
**ASSESSMENT OF INTERSTATE
STREAMS IN THE
SUSQUEHANNA RIVER BASIN**

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Introduction

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 near Cooperstown, N.Y. From there the river flows 444 miles through New York, Pennsylvania, and Maryland before emptying into the Chesapeake Bay at Havre de Grace, Md. Eighty-three streams cross state lines in the basin. Several streams traverse the state borders at multiple points, contributing to 91 total crossings. Of those 91 crossings, 45 streams flow from New York into Pennsylvania, 22 from Pennsylvania into New York, 15 from Pennsylvania into Maryland, and nine from Maryland into Pennsylvania. Many streams are small, and 32 are unnamed.

The Susquehanna River Basin Commission (SRBC) reviews projects that may have interstate impacts on water resources in the Susquehanna River Basin. Established in 1986, SRBC's Interstate Streams Monitoring Program provides data from border streams that are not routinely assessed by state agencies in New York, Maryland, and Pennsylvania. Currently, the state agencies do not monitor 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 (USEPA).

The interstate water quality monitoring program includes periodic collection of water and biological samples from interstate streams, as well as assessments of physical habitat. 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 Integrated List purposes and possible Total Maximum Daily Load (TMDL) development, and (6) identify areas for restoration and protection. Biological conditions are assessed using representative benthic macroinvertebrate and fish populations, which provide an indication of the biological health of a stream and serve as indicators of water quality.

SRBC's interstate monitoring program began in April 1986. For the first five years, results were reported based on water-year (from October to the following September). In 1991, SRBC changed the reporting periods to correspond with its fiscal year (from July to the following June). In 2008, SRBC transitioned to a reporting period based on the calendar year (from January to that December). Reports are typically completed the summer of the year following the collection period. Therefore, this report includes data collected between January 1 and December 31, 2011. Beginning in 2007, a web-based format was initiated to provide a more user-friendly product that is easily accessible to government agencies as well as any individuals or groups that may be interested in the condition of these streams and rivers. Recent reports are available on SRBC's web site at <http://www.srbc.net/programs/monitoringprotection.htm>.

Methods

Field and Laboratory Methods

Sampling Frequency

In 1989, SRBC divided the interstate streams 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 groups remain consistent and are described below.

Group 1

Streams with impaired water quality or those judged to have a high potential for degradation due to large drainage areas or historical pollution have been assigned to Group 1, which includes 13 sites along the Pennsylvania-New York border and eight sites along the Pennsylvania-Maryland border. Group 1 streams were sampled four times per year, once in each of the following months: February, May, July/August, and October. Water quality samples and field chemistry measurements were taken at each Group 1 site during these months. Macroinvertebrate collections were taken, and habitat assessments were made during the July/August sampling period. Following a new fish community sampling protocol initiated in 2009, all Group 1 and Group 2 sites are to be sampled during the May sampling period during alternate years. The large river sites CHEM 12.0, COWN 1.0, COWN 2.2, SUSQ 10, SUSQ 44.5, SUSQ 289.1, SUSQ 340.0, SUSQ 365.0, and TIOG 10.8 were excluded from fish sampling due to sampling difficulties associated with large size.

Group 2

Streams judged to have a moderate potential for impacts have been assigned to Group 2, which includes eight sites along the Pennsylvania-New York border and three sites along the Pennsylvania-Maryland border. Water quality samples, field chemistry parameters, benthic macroinvertebrate samples, and physical habitat information were obtained from Group 2 sites once per year, during base flow conditions in the summer months of July or August. All Group 2 sites are sampled for fish in alternating years, following the new fish community sampling protocol previously mentioned.

Group 3

Streams judged to have a low potential for impacts have been assigned to Group 3, which includes 22 sites along the Pennsylvania-New York border. No Group 3 sites are located along the Pennsylvania-Maryland border. In May of each year, macroinvertebrates, field chemistry parameters, and habitat conditions were assessed at Group 3 sites.

Stream Discharge

Stream discharge was measured at all sites unless high streamflows made access hazardous or impossible. Several sites are located near U.S. Geological Survey (USGS) stream gages. The sites include the following: the Susquehanna River at Windsor, N.Y. (SUSQ 365.0), the Susquehanna River at Kirkwood, N.Y. (SUSQ 340.0), the Susquehanna River at Sayre, Pa. (SUSQ 289.1), the Susquehanna River at Marietta, Pa. (SUSQ 44.5), the Susquehanna River at Conowingo, Md. (SUSQ 10.0), the Chemung River at Chemung, N.Y. (CHEM 12.0), the Tioga River near Lindley, N.Y. (TIOG 10.8), the Cowanesque River at Lawrenceville, Pa. (COWN 1.0 & COWN 2.2), and Octoraro Creek near Richardsmere, Md. (OCTO 6.6). For these sites, recorded stages from USGS gaging stations and ratings curves were used to determine instantaneous discharges measured in cubic feet per second (cfs). Instantaneous discharges for sites not located near USGS gaging stations were measured at the time of sampling, using standard USGS procedures (Buchanan and Somers, 1969) and a FlowTracker.

Water Samples

Water samples were collected at each of the Group 1 and Group 2 streams to measure nutrient and metal concentrations. Water samples were collected using a depth-integrated sampler. Composite samples were obtained by collecting several depth-integrated samples across the stream channel and combining them in a churn splitter that was previously rinsed with stream water. Water samples were mixed thoroughly in the churn splitter and collected in one 500-ml bottle, two 250-ml bottles, and two 40-ml vials. The 500-ml sample bottle was used for a raw sample. Each of the 250-ml bottles consisted of a whole water sample, one fixed with 10-percent nitric acid (HNO_3) for metal analysis, and one fixed with 10-percent sulfuric acid (H_2SO_4) for nutrient analysis. The two 40-ml vials were pre-cleaned and fixed with sulfuric acid (H_2SO_4). The vials were filled with sample water and were used to measure total organic carbon (TOC). The samples were chilled on ice and sent to ALS Environmental in Middletown, Pa., within 24 hours of collection.

Field Chemistry

Temperature, dissolved oxygen, conductivity, and pH were measured in the field for all stations. In addition to the parameters listed above, alkalinity and acidity were also measured in the field for all Group 3 stations. Temperature, dissolved oxygen, conductivity, and pH were measured using a YSI model 6820 V2 multiparameter water quality sonde. Dissolved oxygen and pH probes were calibrated each day prior to sampling. The conductivity probe was calibrated at the beginning of each week. When alkalinity and acidity were to be measured at Group 3 stations, pH was determined by using a Cole-Parmer Model 5996 meter that was calibrated at the beginning of each day. Alkalinity was then determined by titrating a known volume of sample 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

Macroinvertebrate samples were collected from Group 1 and Group 2 stations in July and August, while Group 3 stations were sampled in May. The benthic macroinvertebrate community was sampled and assessed to provide an indication of the biological condition of the stream. Macroinvertebrates were defined as aquatic insects and other invertebrates too large to pass through a No. 30 sieve.

Benthic macroinvertebrate samples were analyzed according to field and laboratory methods described in Rapid Bioassessment Protocol for Use in Streams and Rivers by Barbour et al. (1999). 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 95-percent ethyl alcohol for later laboratory identification and analysis.

In the laboratory, composite samples were sorted into 200-organism subsamples using a gridded pan and a random numbers table. Organisms within the subsample were identified to genus (except Chironomidae and Oligochaeta) and enumerated using taxonomic keys developed by Merrit and Cummins (1996), Peckarsky et al. (1990), and Pennak (1989). Each taxon was assigned an organic pollution tolerance value and a functional feeding category (Chalfant, 2007).

Physical habitat conditions at each station were assessed using a slightly modified version of the habitat assessment procedure outlined by Barbour et al. (1999). Eleven habitat parameters were field-evaluated at each site and used to calculate a site-specific habitat assessment score. Habitat parameters were evaluated on a scale of 0 to 20 and were based on instream composition, channel morphology, and riparian zone and bank conditions. Some of the parameters to be evaluated varied based on whether the stream was characterized by riffles and runs or by glides and pools.

Fish Sampling

Fish community assessments were adapted from the RBP manual (Barbour et al., 1999) and from the Maryland Biological Stream Survey (Roth et al., 1998). Electrofishing at 25 wadeable Group 1 and 2 interstate stream stations occurred in alternate years, beginning in 2009. Eighteen stations were initially sampled in 2009, and five were sampled in 2010. The remaining nine Group 1 and 2 streams were too large to be effectively sampled using current protocols. Conditions at the time of sampling had to be conducive to electrofishing operations. Specifically, flows had to be manageable and allow the electrofishing team to traverse the entire width of the stream. Water clarity also had to be sufficient to allow visual detection of immobilized fish at all depths. Every possible effort was made prior to departure for sampling activities to ensure that ideal conditions were realized.

Electrofishing at each site consisted of two passes on a 75-meter segment containing best available habitat. Efforts were made to locate the upstream point at a natural cutoff (e.g., impassible riffles, falls, head of a pool) that could deter fish from moving out of the sample

reach. If a natural cutoff was not present, block nets were deployed to keep fish within the reach. After placing a piece of flagging tape in a visible location at the downstream point, staff measured five wetted channel widths, in meters, with a tape or rangefinder while walking to the upstream limit of the reach. Sample reach distance was adjusted if a natural cutoff occurred within ± 5 meters of the 75-meter mark. If there was no natural cutoff at the upstream margin of the reach, block nets were used.

GPS coordinates for the upstream and downstream limits of the sample reach were recorded on the field data sheet. Sampling teams consisted of three or four members, depending on stream size. Backpack (battery-powered electrical-generated) or towed barge electrofishing units with two handheld probes were used. Electrofishing consisted of a two-pass coverage of the entire width and length of the selected stream segment. Beginning at the downstream limit of the sample reach, the sampling team proceeded upstream, covering the entire stream width and using a sinuous pattern when necessary. Each team member made every effort to capture all fish sighted that were more than 25mm in length so that a representative sample was collected. Start and stop times, as well as accumulated electrofishing time (shock time), were recorded on the field data sheet.

Nets and holding cages with 0.25-inch mesh were used to prevent escape. All fish were identified to species in the field, when possible. Fish that could not be readily identified in the field were preserved in 10-percent formalin and returned to the laboratory for identification. Digital photographs were taken of all unknown specimens, as were voucher (reference) photographs of each species. After processing fish from the first pass, all individuals were returned to the stream at a point downstream of the reach, where fish could not travel back into the sample reach. All data were entered into SRBC's Access database.

Data Synthesis Methods

Chemical water quality

Results of laboratory analysis for chemical parameters were compared to New York, Pennsylvania, and Maryland state water quality standards. Additionally, a simple water quality index (WQI) was calculated using procedures established by McMorran (1988). 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 three groups. One group contains stations along the New York-Pennsylvania border (14 stations), another contains stations along the Pennsylvania-Maryland border (nine stations), and the remaining group compares large river stations (nine stations). The data in each group were sorted by parameter and ranked by increasing order of magnitude, with several exceptions. Dissolved oxygen was ranked by decreasing order of magnitude, while pH, alkalinity, acidity, calcium, and magnesium were not included in the WQI analysis. The values of each chemical analysis were divided by the highest ranking value in the group to obtain a percentile. The WQI score was calculated by averaging all percentile ranks for each sample. WQI scores ranged from 1 to 100, with high WQI scores indicating poor water quality.

Biological and physical habitat conditions

Benthic macroinvertebrate samples were assessed using procedures described by Barbour et al. (1999), Klemm et al. (1990), and Plafkin et al. (1989). Using these methods, staff calculated a series of biological indices for a stream and compared them to a reference station in the same region to determine the degree of impairment. The metrics used in the survey are summarized in the Appendix. The calculation of the Shannon Diversity Index followed the methods described in Klemm et al. (1990), and all other metrics were taken from Barbour et al. (1999).

The 200-organism subsample data were used to generate scores for each of the seven metrics. Scores for metrics 1-4 were converted to a biological condition score, based on the percent similarity of the metric score, relative to the metric score of the reference site. Scores for metrics 5-7 were based on set scoring criteria developed for the percentages (Plafkin et al., 1989; Ohio Environmental Protection Agency, 1987b). The sum of the biological condition scores constituted the total biological score for the sample site, and total biological score was used to assign each site to a biological condition category of nonimpaired, slightly impaired, moderately impaired, or severely impaired. Habitat assessment scores of sample sites were compared to those of reference sites to classify each sample into a habitat condition category of excellent, supporting, partially supporting, or nonsupporting.

Fish data were analyzed using an adapted version of the Maryland Biological Stream Survey (MBSS) Fish Index of Biological Integrity (IBI) (Roth et al., 1998; Roth et al., 2000; Southerland et al., 2005). Two versions of the Fish IBI were used depending on the location of the stream. All Pennsylvania-Maryland border streams were assessed using the Eastern Piedmont version while Pennsylvania-New York streams were assessed using the Highlands version. The Eastern Piedmont version used contains the following eight metrics: number of native species, number of benthic species, number of intolerant species, percent tolerant fish, percent abundance of dominant species, percent generalists, omnivores and invertivores, percent lithophilic spawners, and number of individuals per square meter. The metric biomass per square meter was omitted from the analysis as biomass data were not available at the time of sampling. The Highlands version used contains the following six metrics: number of benthic species, number of intolerant species, percent tolerant fish, percent generalists, omnivores and invertivores, percent insectivores, and percent lithophilic spawners. Each metric received a score of 1, 3, or 5 based on scoring criteria for each ecoregion (Roth et al., 2000). Metric scores were then averaged and the fish community received a classification of good, fair, poor, or very poor according to the table listed in the Appendix.

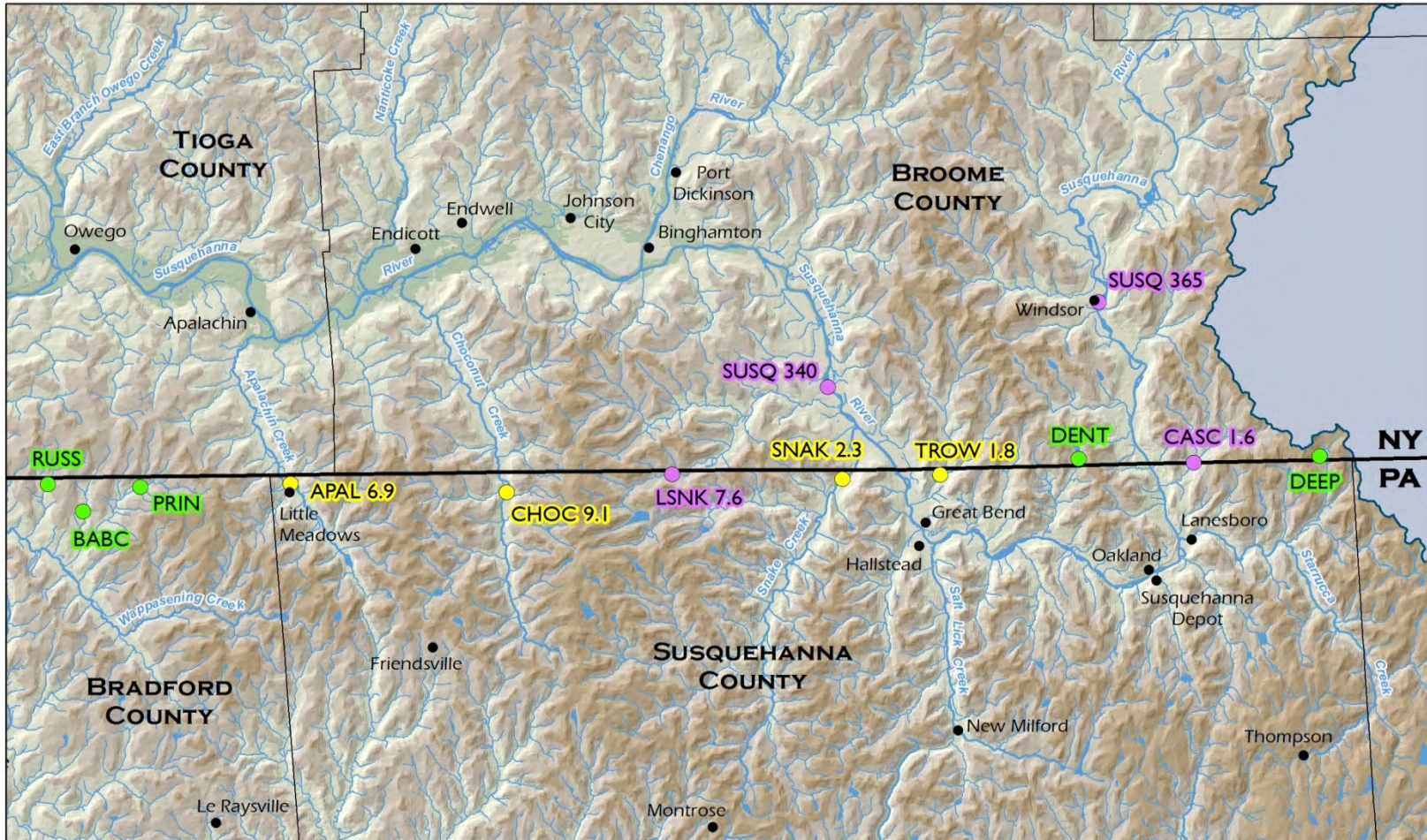
List of New York-Pennsylvania Interstate Streams

Station	Stream and Location	Monitoring Group	Rationale
APAL 6.9*	Apalachin Creek, Little Meadows, PA	2	Monitor for potential water quality impacts
BABC	Babcock Run, Cadis, PA	3	Monitor for potential impacts
BILL	Bill Hess Creek, Nelson, PA	3	Monitor for potential impacts
BIRD	Bird Creek, Webb Mills, NY	3	Monitor for potential impacts
BISC	Biscuit Hollow, Austinburg, PA	3	Monitor for potential impacts
BNTY 0.9	Bentley Creek, Wellsburg, NY	1	Monitor for potential water quality impacts
BRIG	Briggs Hollow, Nichols, NY	3	Monitor for potential impacts
BULK	Bulkley Brook, Knoxville, PA	3	Monitor for potential impacts
CAMP	Camp Brook, Osceola, PA	3	Monitor for potential impacts
CASC 1.6	Cascade Creek, Lanesboro, PA	1	Monitor for potential water quality impacts
CAYT 1.7	Cayuta Creek, Waverly, NY	1	Municipal discharge from Waverly, NY
CHEM 12.0	Chemung River, Chemung, NY	1	Municipal and industrial discharges from Elmira, NY
CHOC 9.1	Choconut Creek, Vestal Center, NY	2	Monitor for potential water quality impacts
COOK	Cook Hollow, Austinburg, PA	3	Monitor for potential impacts
COWN 2.2	Cowanesque River, Lawrenceville, PA	1	Impacts from flood control reservoir
COWN 1.0	Cowanesque River, Lawrenceville, PA	1	Recovery zone from upstream flood control reservoir
DEEP	Deep Hollow Brook, Danville, NY	3	Monitor for potential impacts
DENT	Denton Creek, Hickory Grove, PA	3	Monitor for potential impacts
DRYB	Dry Brook, Waverly, NY	3	Monitor for potential impacts
HLDN 3.5	Holden Creek, Woodhull, NY	2	Monitor for potential water quality impacts
LSNK 7.6	Little Snake Creek, Brackney, PA	1	Monitor for potential water quality impacts
LWAP	Little Wappasening Creek, Nichols, NY	3	Monitor for potential impacts
NFCR 7.6	North Fork Cowanesque River, North Fork, PA	2	Monitor for potential water quality impacts
PARK	Parks Creek, Litchfield, NY	3	Monitor for potential impacts
PRIN	Prince Hollow Run, Cadis, PA	3	Monitor for potential impacts
REDH	Redhouse Run, Osceola, PA (formerly Beagle Hollow Run)	3	Monitor for potential impacts
RUSS	Russell Run, Windham, PA	3	Monitor for potential impacts
SACK	Sackett Creek, Nichols, NY	3	Monitor for potential impacts
SEEL 10.3	Seeley Creek, Seeley Creek, NY	1	Monitor for potential water quality impacts
SMIT	Unnamed tributary to Smith Creek, East Lawrence, PA	3	Monitor for potential impacts
SNAK 2.3	Snake Creek, Brookdale, PA	2	Monitor for potential water quality impacts
SOUT 7.8	South Creek, Fassett, PA	2	Monitor for potential water quality impacts
STRA	Strait Creek, Nelson, PA	3	Monitor for potential impacts
SUSQ 365.0	Susquehanna River, Windsor, NY	1	Large drainage area (1,882 sq. mi.); municipal discharges from Cooperstown, Sidney, Bainbridge, and Oneonta
SUSQ 340.0	Susquehanna River, Kirkwood, NY	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
TIOG 10.8	Tioga River, Lindley, NY	1	Pollution from abandoned mine discharges and impacts from flood control reservoirs
TRUP 4.5	Troups Creek, Austinburg, PA	1	High turbidity and moderately impaired macroinvertebrate populations
TROW 1.8	Trowbridge Creek, Great Bend, PA	2	Monitor for potential water quality impacts
WAPP 2.6	Wappasening Creek, Nichols, NY	2	Monitor for potential water quality impacts
WBCO	White Branch Cowanesque River, North Fork, PA	3	Monitor for potential impacts
WHIT	White Hollow, Wellsburg, NY	3	Monitor for potential impacts

List of Pennsylvania-Maryland Interstate Streams

Station	Stream and Location	Monitoring Group	Rationale
BBDC 4.1	Big Branch Deer Creek, Fawn Grove, PA	2	Monitor for potential water quality impacts
CNWG 4.4	Conowingo Creek, Pleasant Grove, PA	1	High nutrient loads and other agricultural runoff; 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
EBAU 1.5	Ebaughs Creek, Stewartstown, PA	1	Municipal discharge from Stewartstown, PA; nonpoint runoff to Chesapeake Bay
FBDC 4.1	Falling Branch Deer Creek, Fawn Grove, PA	2	Monitor for potential water quality impacts
LNGA 2.5	Long Arm Creek, Bandanna, PA	1	Monitor for potential water quality impacts
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
SBCC 20.4	South Branch Conewago Creek, Bandanna, PA	2	Monitor for potential water quality impacts
SCTT 3.0	Scott Creek, Delta, PA	1	Historical pollution due to untreated sewage
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

*denotes no macroinvertebrates were collected in 2011



**INTERSTATE STREAM MONITORING SITES
ALONG THE NEW YORK AND PENNSYLVANIA BORDER**

- Monitoring Site**
- Group 1
 - Group 2
 - Group 3

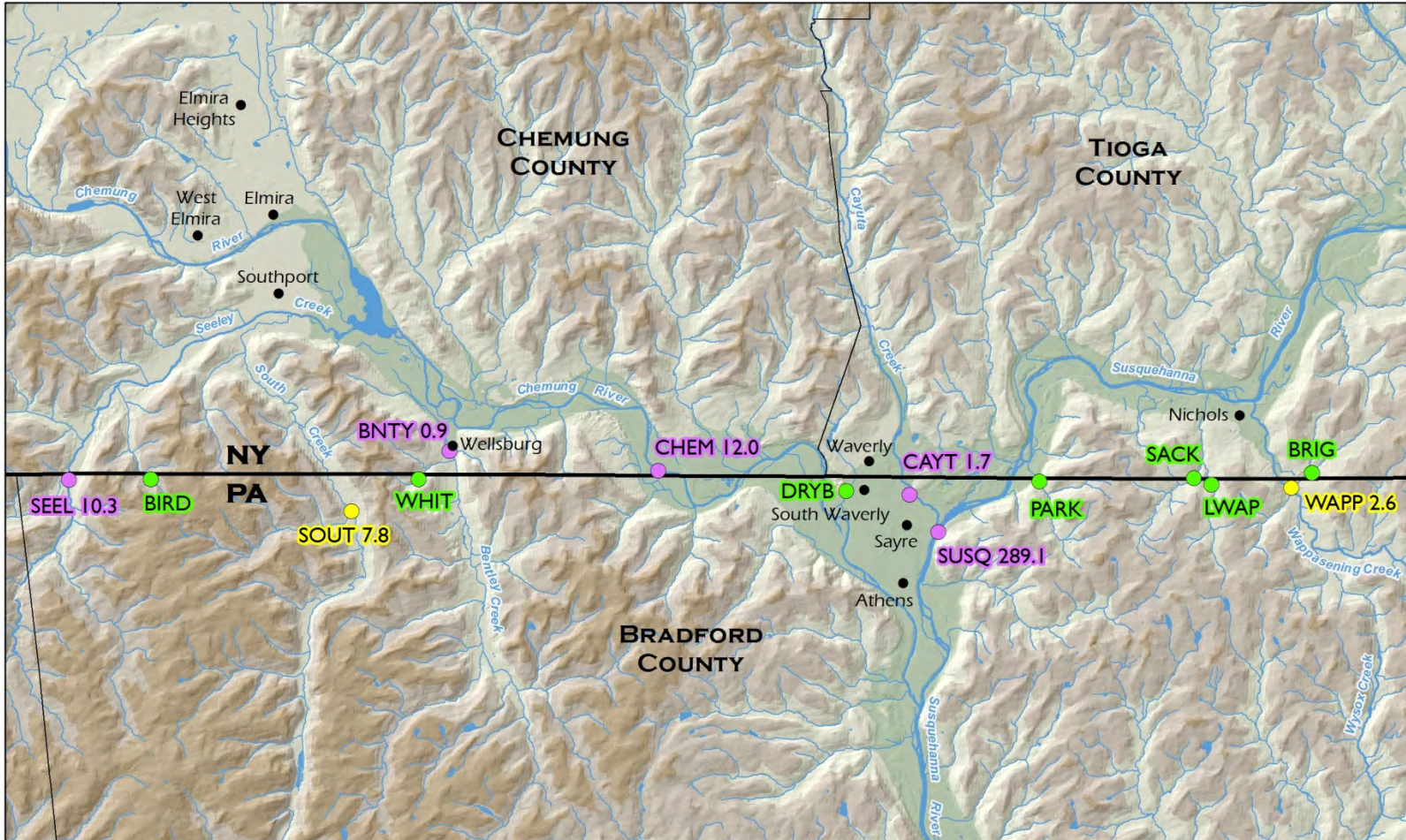
- City/Town
- River/Stream
- Waterbody

- County Boundary
- State Boundary
- Susquehanna River Basin

Background Colors Denote Elevation

DISCLAIMER: Intended for Educational Display Purposes Only; SRBC (1302a) 08-01-2012





**INTERSTATE STREAM MONITORING SITES
ALONG THE NEW YORK AND PENNSYLVANIA BORDER**

Monitoring Site

- Group 1
- Group 2
- Group 3

● City/Town

River/Stream

Waterbody

County Boundary

State Boundary

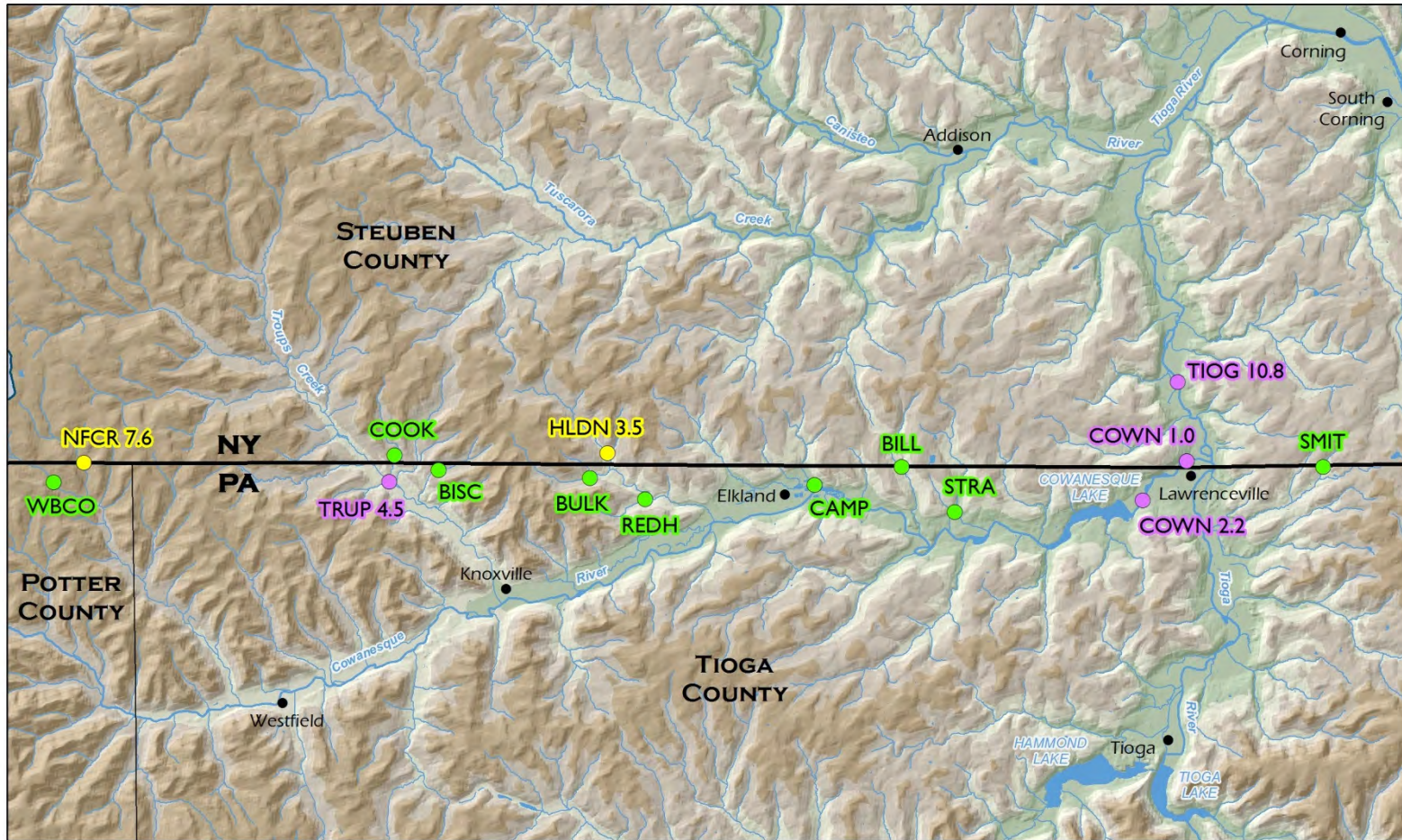
Susquehanna River Basin

Background Colors Denote Elevation

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INTERSTATE STREAM MONITORING SITES ALONG THE NEW YORK AND PENNSYLVANIA BORDER

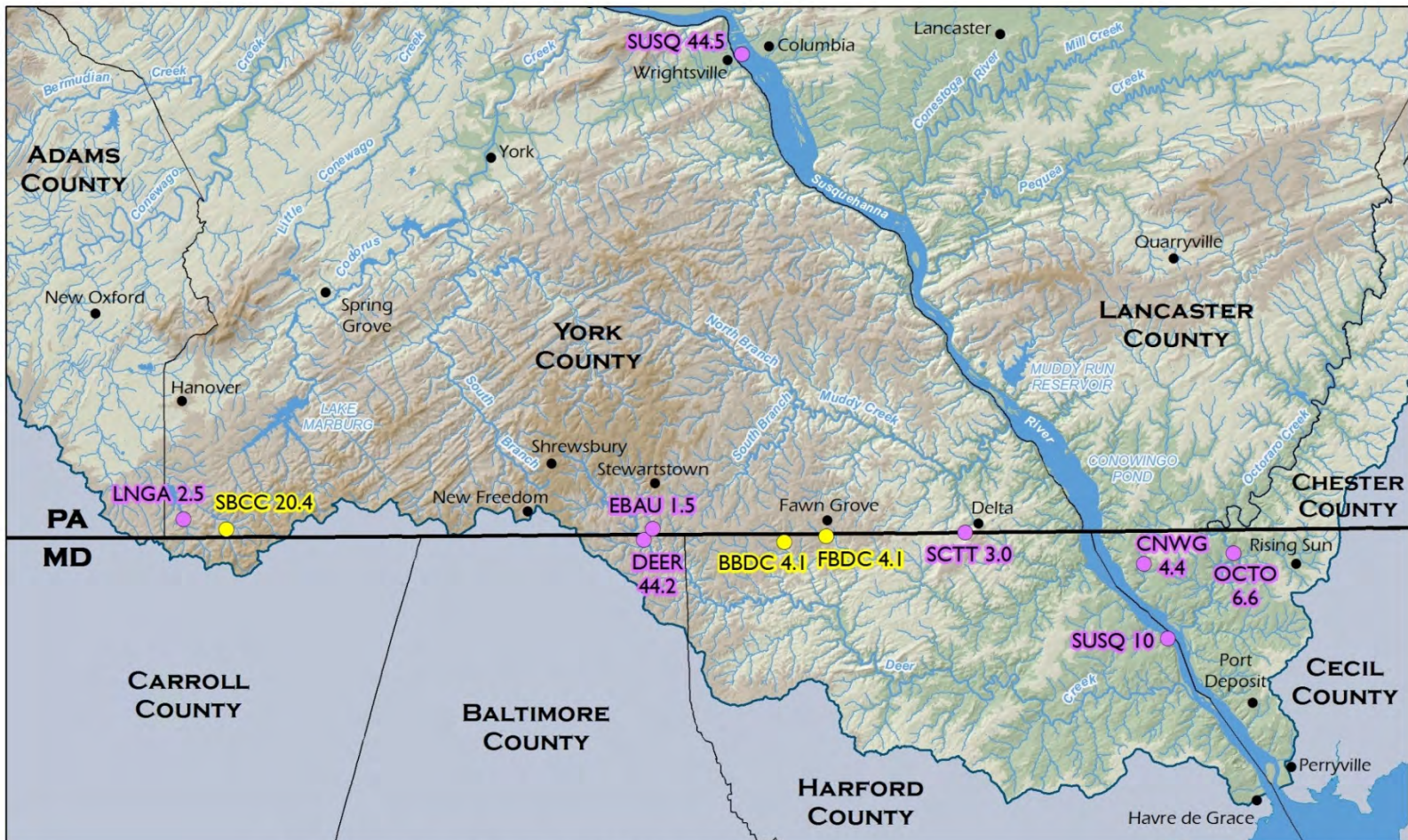
- Monitoring Site**
- Group 1
 - Group 2
 - Group 3
- Legend:**
- City/Town
 - River/Stream
 - Waterbody
 - County Boundary
 - State Boundary
 - Susquehanna River Basin

Background Colors Denote Elevation

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**INTERSTATE STREAM MONITORING SITES
ALONG THE MARYLAND AND PENNSYLVANIA BORDER**

- Monitoring Site**
- Group 1
 - Group 2
 - Group 3

- City/Town
- River/Stream
- Waterbody

- County Boundary
- State Boundary
- Susquehanna River Basin

Background Colors Denote Elevation

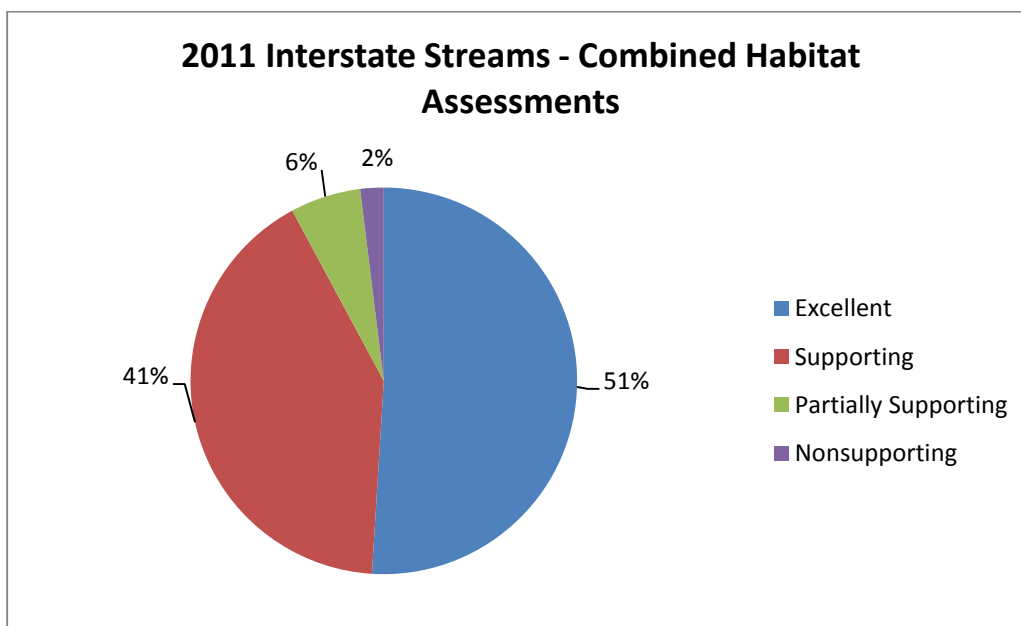
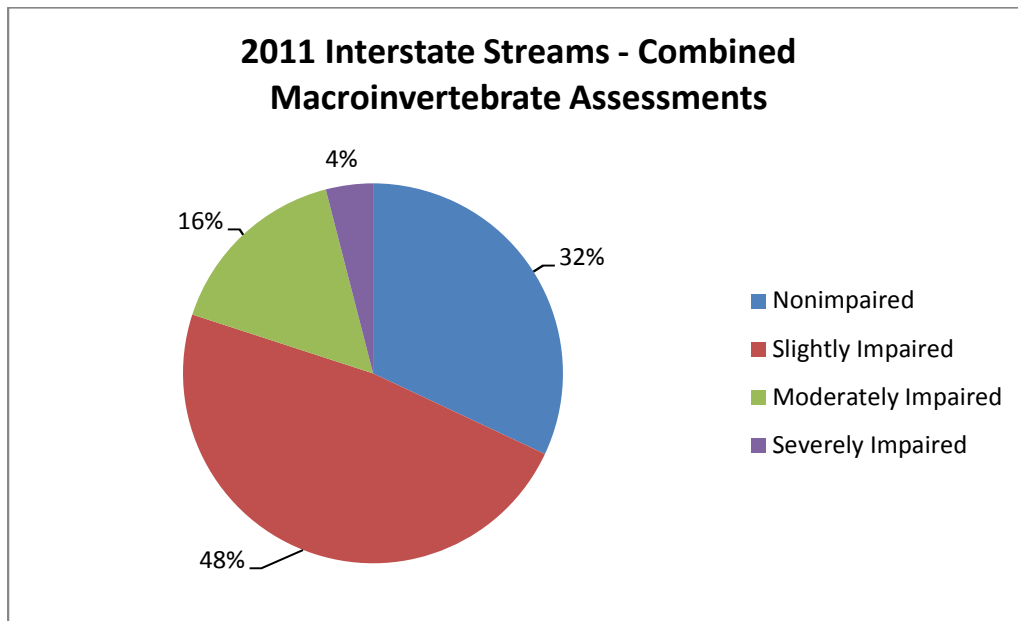
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Overall Results

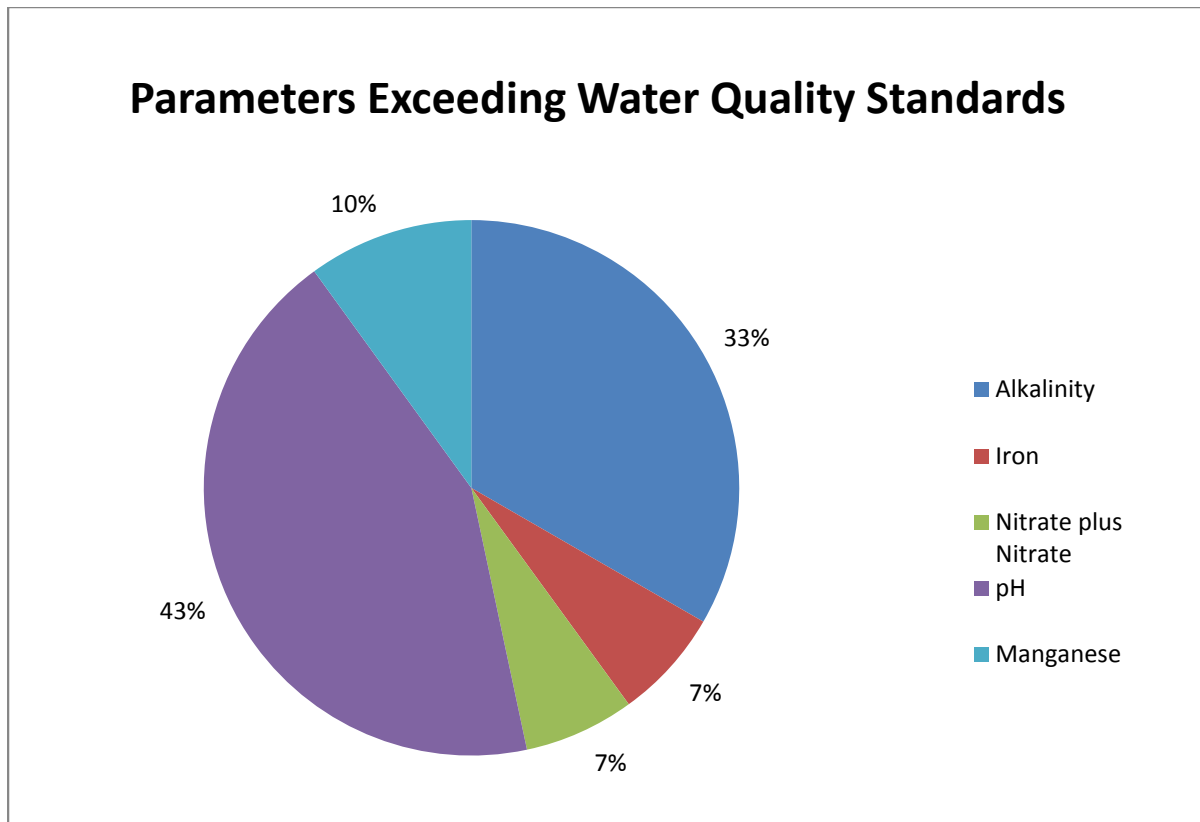
Macroinvertebrates & Habitat

In 2011, 80 percent of the interstate streams assessed had a biological community deemed nonimpaired or slightly impaired. Nonimpaired biological communities were present at 16 of 50 streams assessed (32 percent), while two were considered severely impaired. Physical habitat was rated as being excellent or supporting for 92 percent of the streams evaluated. Of the 51 total sites where physical habitat was assessed, 26 sites were rated as excellent while only one was nonsupporting.



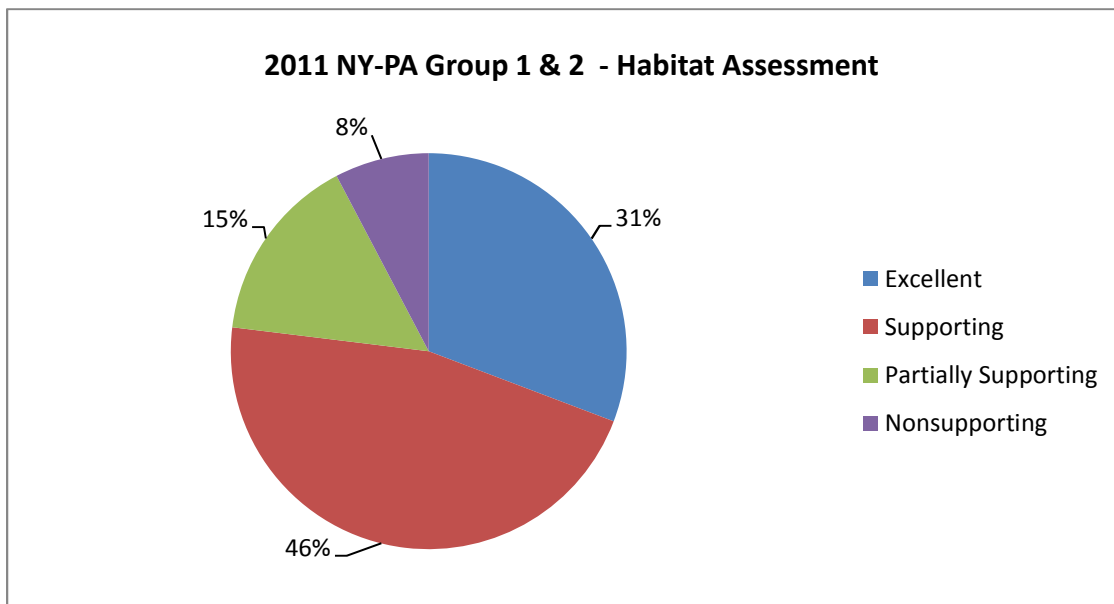
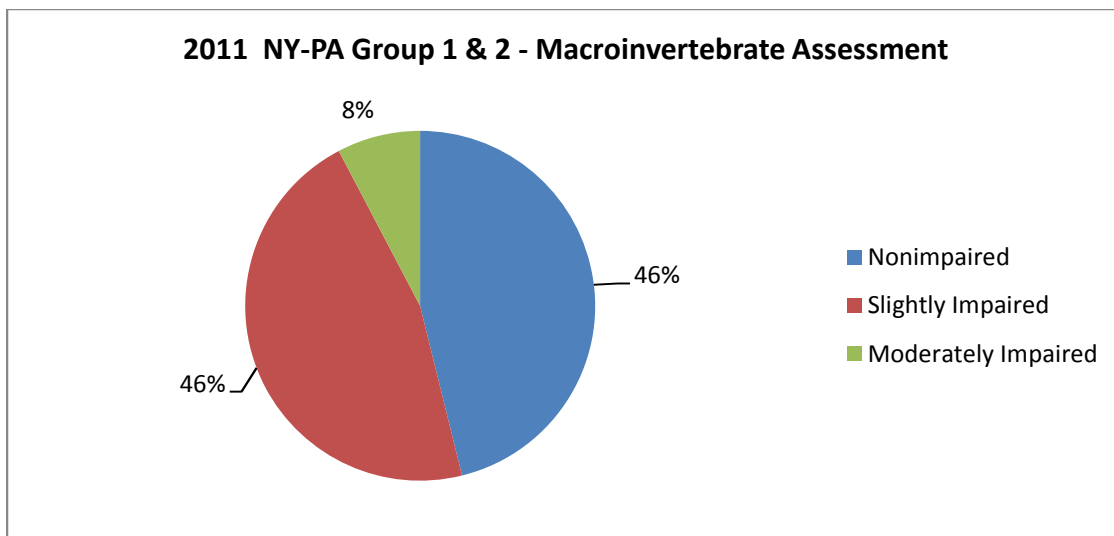
Water Quality

Parameter	Standard	Standard Value	Number of Observations	Number Exceeding Standards
Alkalinity	PA aquatic life	20 mg/L	123	10
Total Aluminum	NY aquatic (chronic)	100 µg/L	102	0
Total Iron	NY aquatic (chronic) PA aquatic life	300 µg/L 1500 µg/L	102	2
Nitrate plus Nitrite	PA public water supply	10 mg/L	102	2
pH	NY general MD aquatic life PA aquatic life	6.5-8.5 6.5-8.5 6.0-9.0	123	13
Total Manganese	NY aquatic (chronic)	300 µg/L	102	3
Turbidity	MD aquatic life	150 NTU	102	0
Dissolved Oxygen	PA aquatic life	5.0 mg/L	123	0

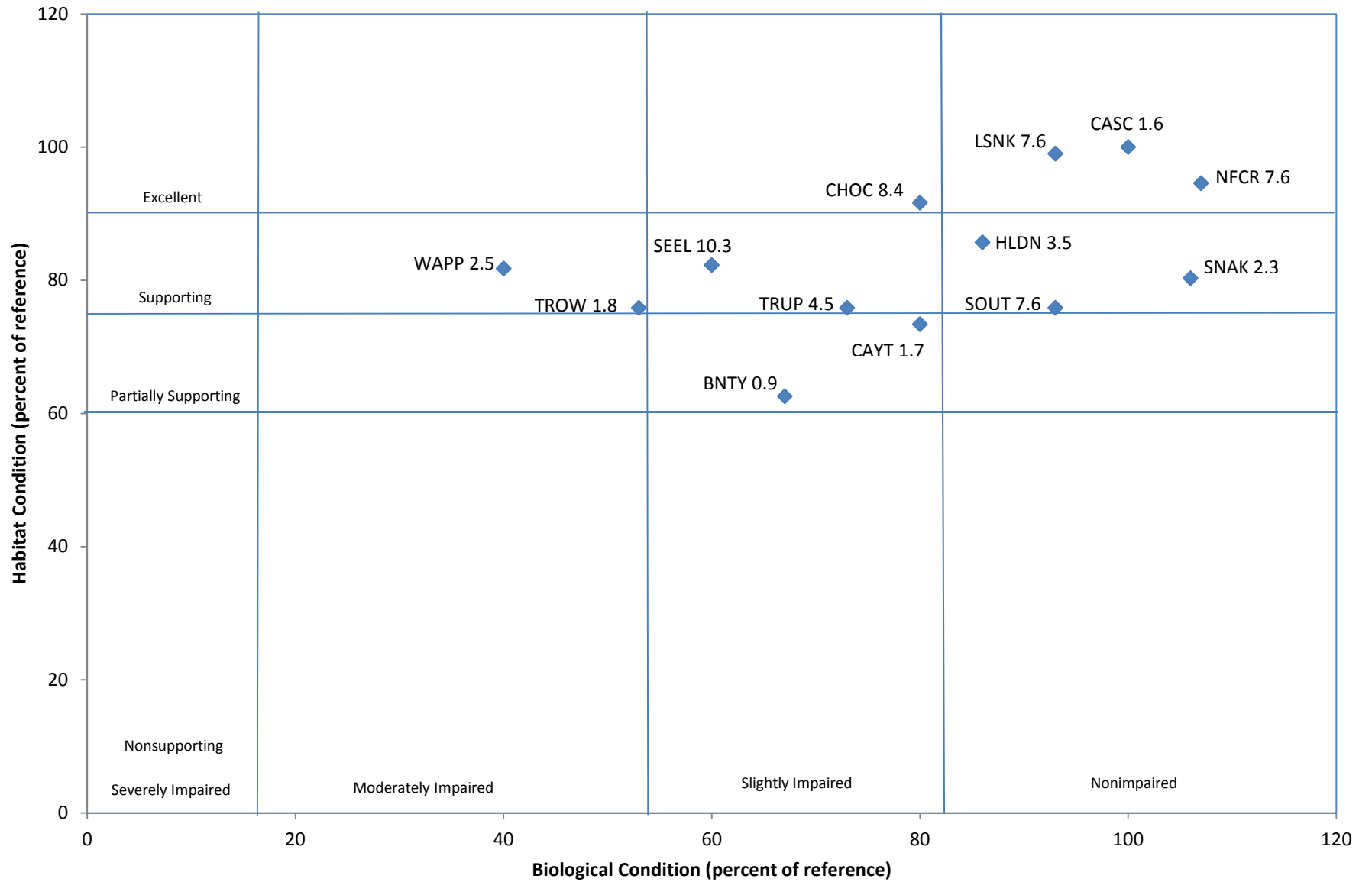


Results for 2011 New York-Pennsylvania Group 1 & 2 Stream Assessments

Sites that represent the best available combination of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2011, Cascade Creek near Lanesboro, Pa (CASC 1.6), served as the reference stream to which all other New York-Pennsylvania Group 1 and 2 streams were compared. Cascade Creek possessed the highest rated available habitat and the second highest macroinvertebrate assessment score of all streams within the group. Computed water quality indices (WQI) were also consistently among the best in group during 2011. The macroinvertebrate community was not assessed at Apalachin Creek (APAL 6.9) in 2011. Of the 13 Group 1 and 2 streams where biological communities were evaluated, six were rated as “nonimpaired,” and six were rated as “slightly impaired.” Available physical habitat was rated as “excellent” or “supporting” at 10 Group 1 and 2 streams assessed.

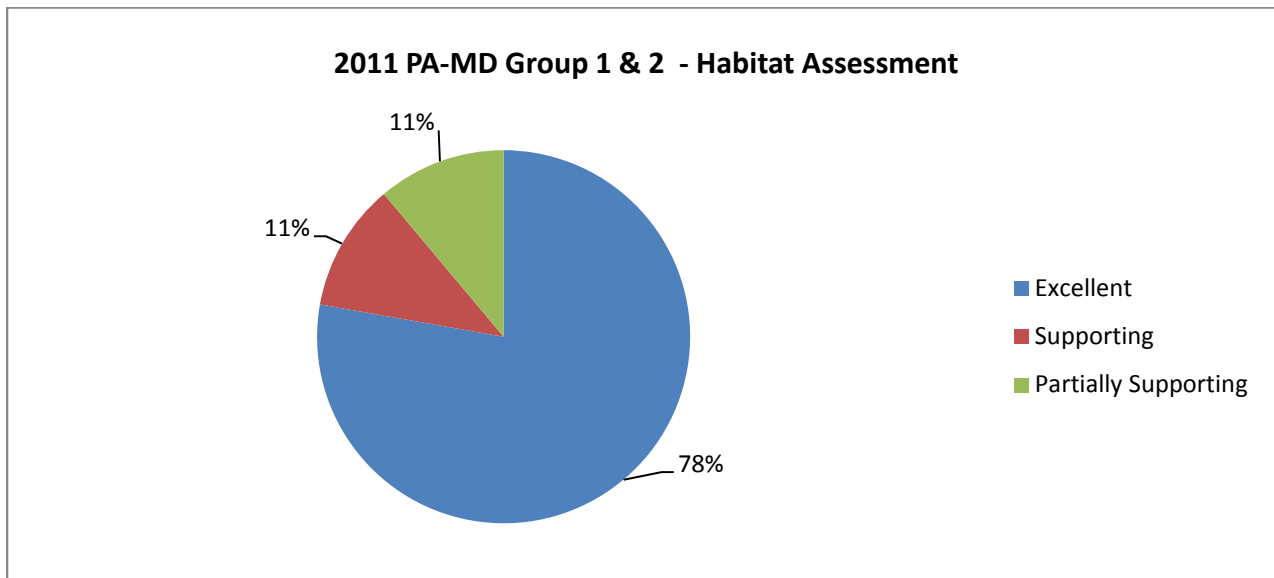
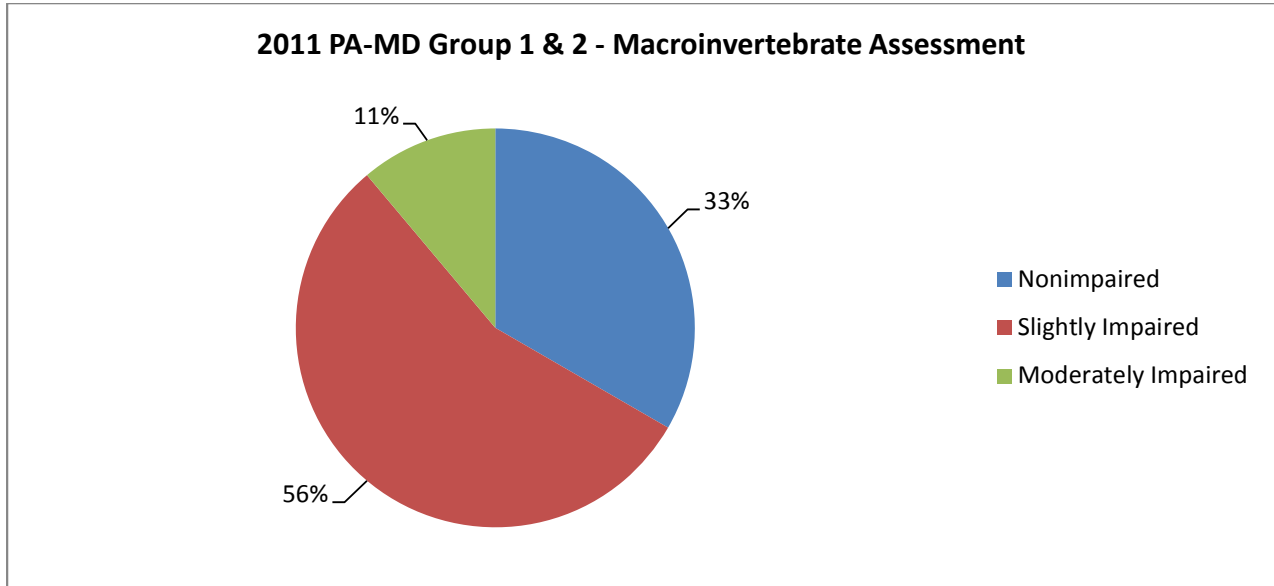


New York -Pennsylvania Group 1 & 2 Streams

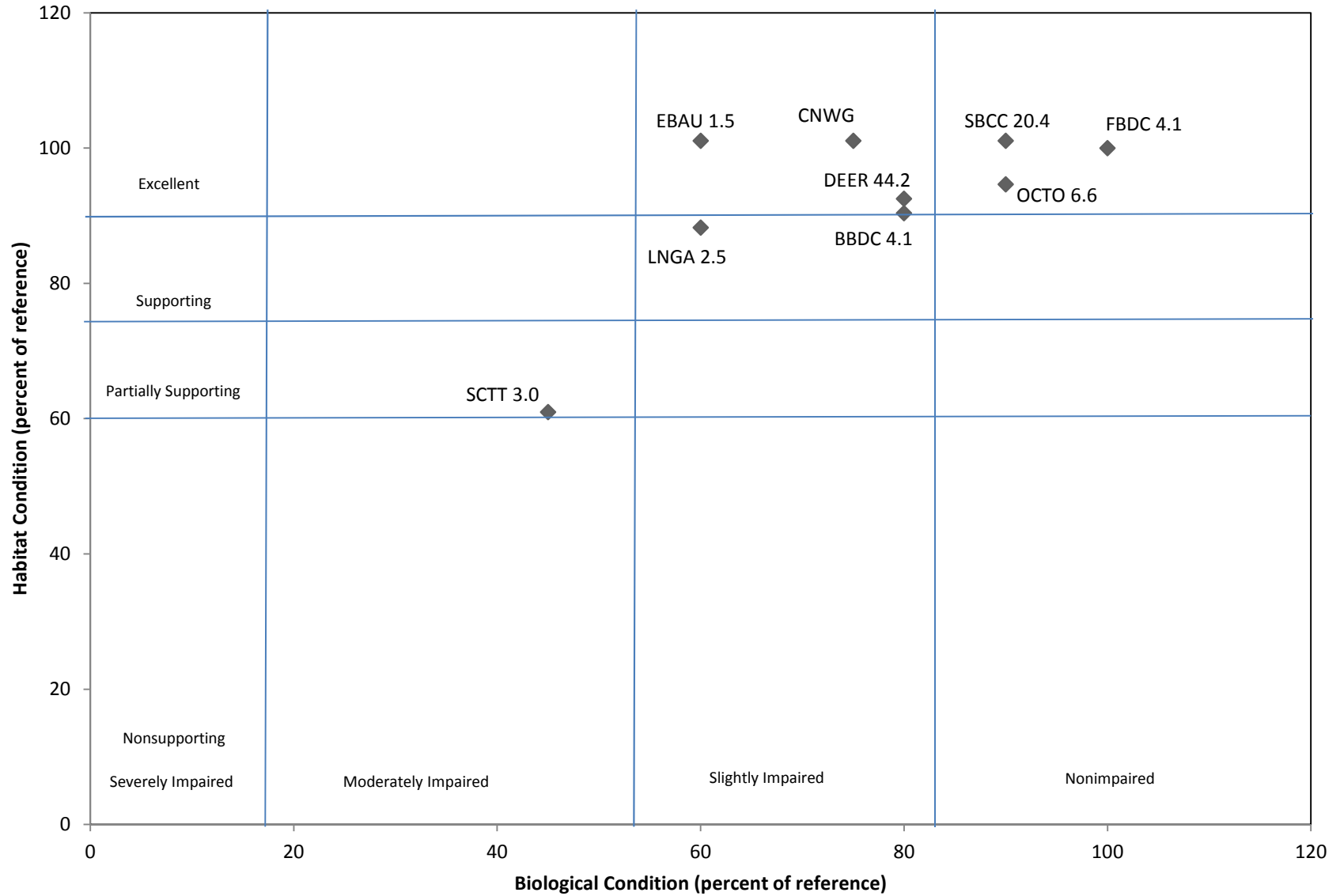


Results for 2011 Maryland-Pennsylvania Stream Assessments

Sites that represent the best available combination of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2011, Falling Branch of Deer Creek (FBDC 4.1) received the designation as reference site after receiving the highest macroinvertebrate assessment score and second highest available habitat score. Overall this grouping of streams rated very highly with only one stream, Scotts Creek (SCTT 3.0), receiving moderately impaired and partially supporting macroinvertebrate and habitat assessments, respectively.

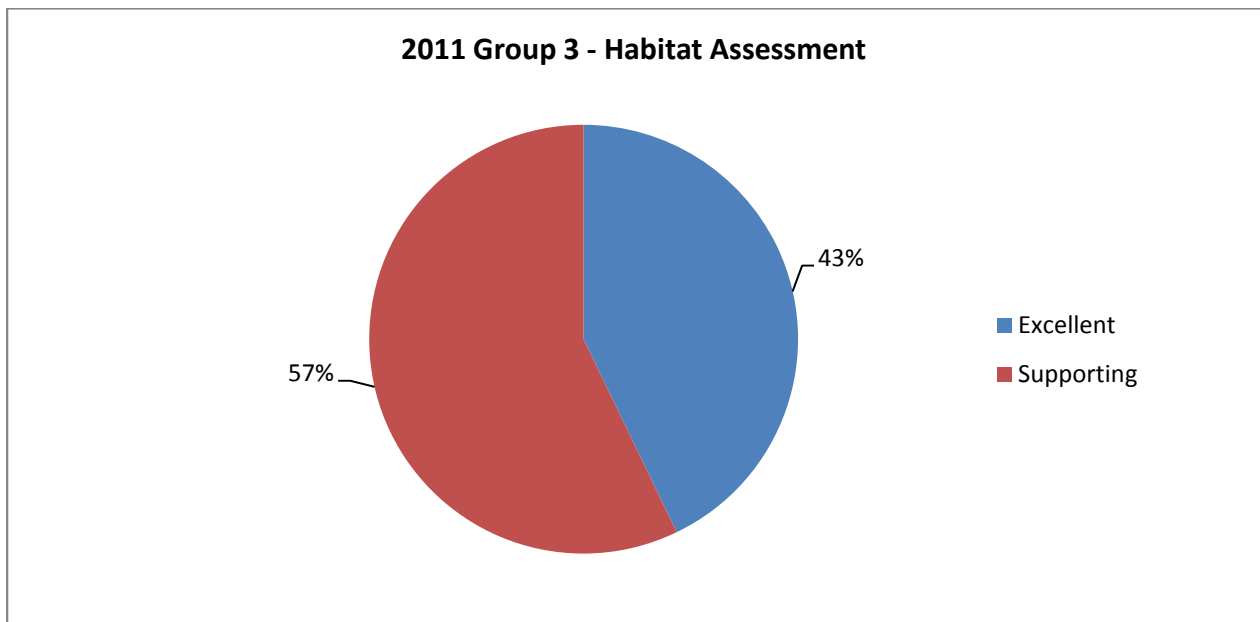
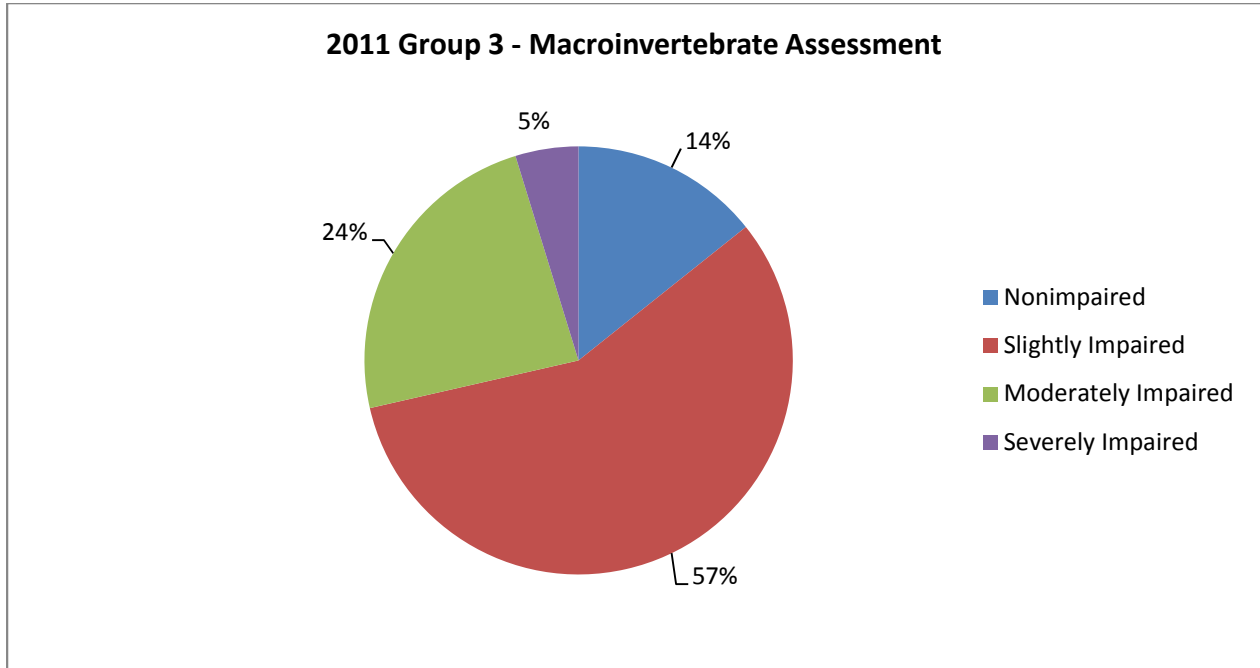


Maryland-Pennsylvania Group 1 & 2 Streams

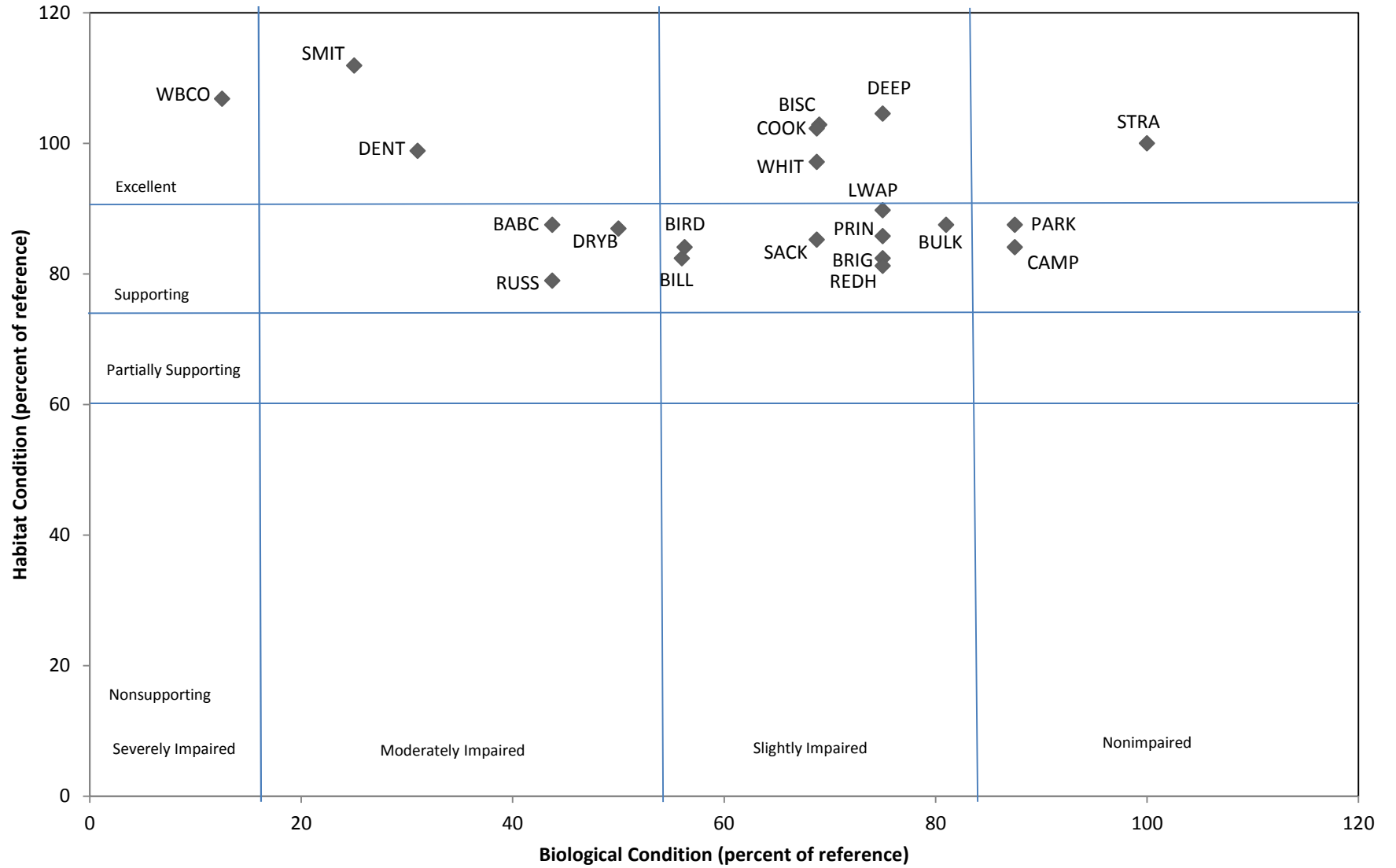


Results for 2011 New York–Pennsylvania Group 3 Stream Assessments

Sites that represent the best available combination of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2011, Strait Creek near Nelson, Pa. (STRA), was designated as the reference stream to which all other Group 3 streams were compared. Strait Creek possessed excellent available physical habitat and a nonimpaired macroinvertebrate community assessment. All Group 3 streams possessed habitat characteristics rated as excellent or supporting. Only one site, West Branch Cowanesque, received a macroinvertebrate assessment of severely impaired.

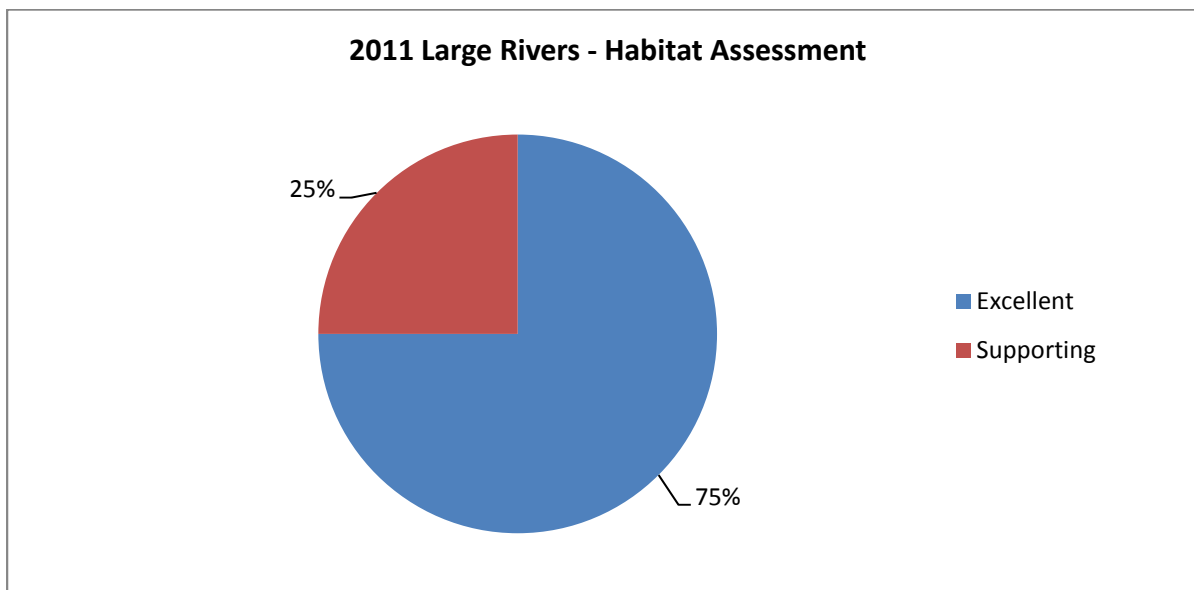
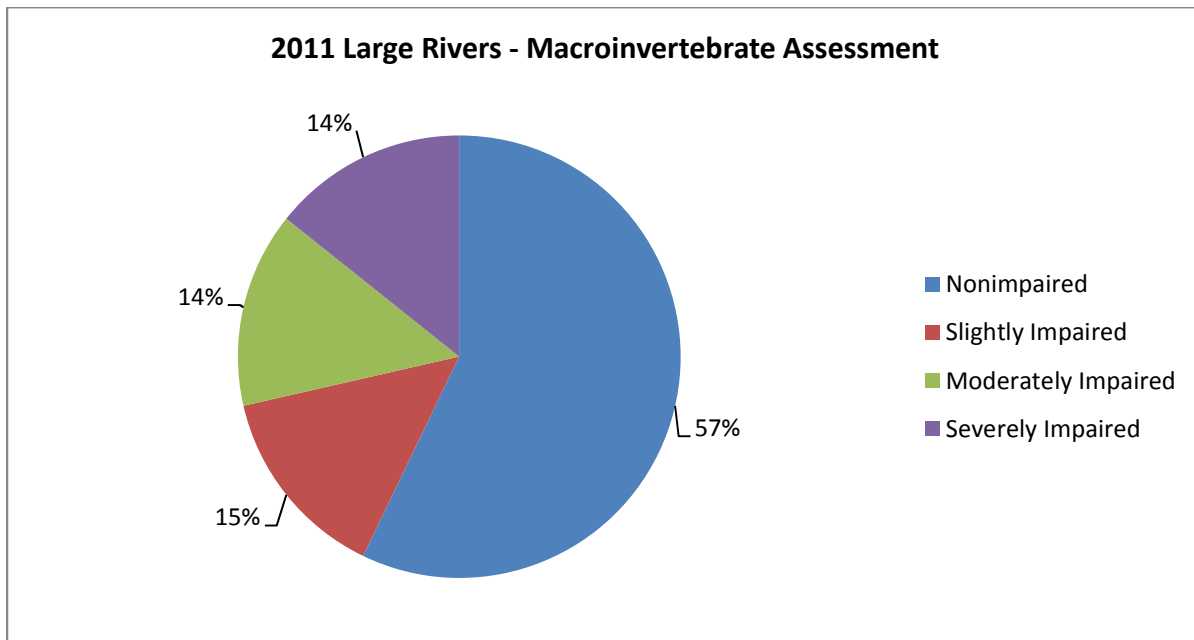


Group 3 Streams

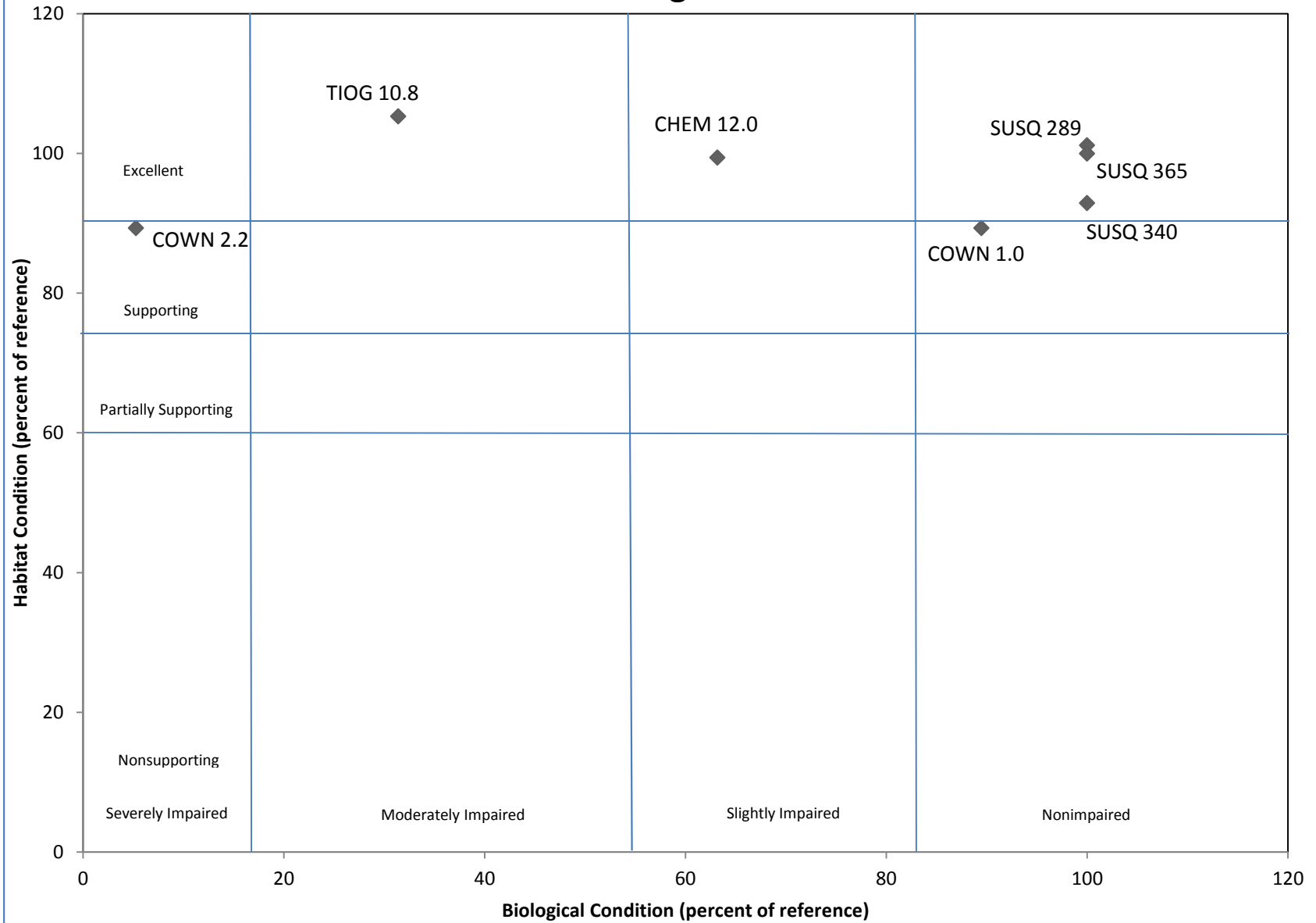


Results for 2011 Large Rivers Assessment

Sites that represent the best available combination of conditions, in terms of biological community, water quality, and physical habitat for each group of stream sites are designated as reference sites. In 2011, the Susquehanna River at Conklin, NY (SUSQ 340) was designated as the reference site to which all other large river sites were compared. SUSQ 340 possessed available physical habitat assessed as excellent and a nonimpaired macroinvertebrate community. Additionally, water quality indicia values were consistently favorable across all four sampling periods.



Large Rivers



Site Results for Large River Interstate Sites

Chemung River at Chemung, NY (CHEM 12.0)

Group 1

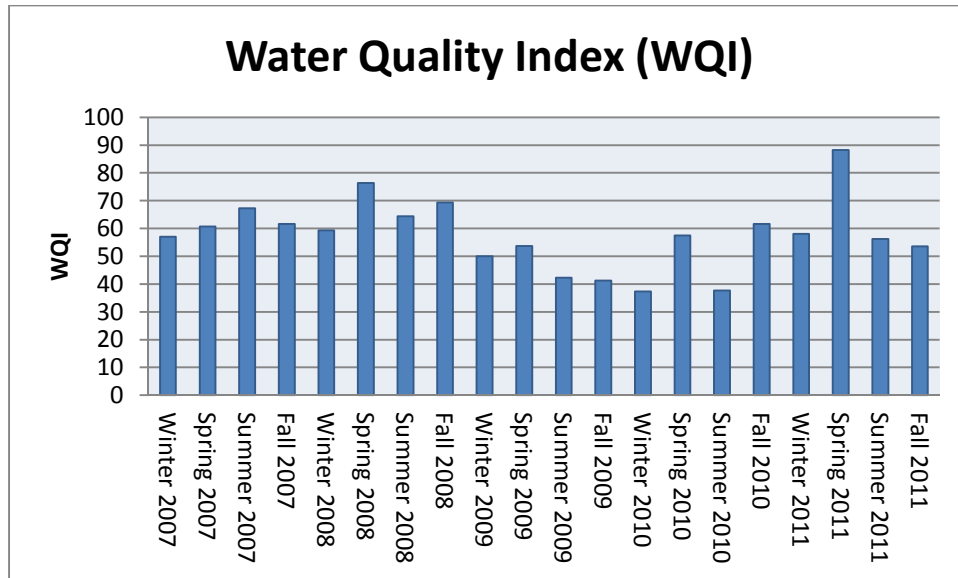


Habitat Condition:

Physical habitat was rated as excellent at CHEM 12.0. The site scored 168 out of a possible 220. Staff noted optimal channel flow status and bank conditions.

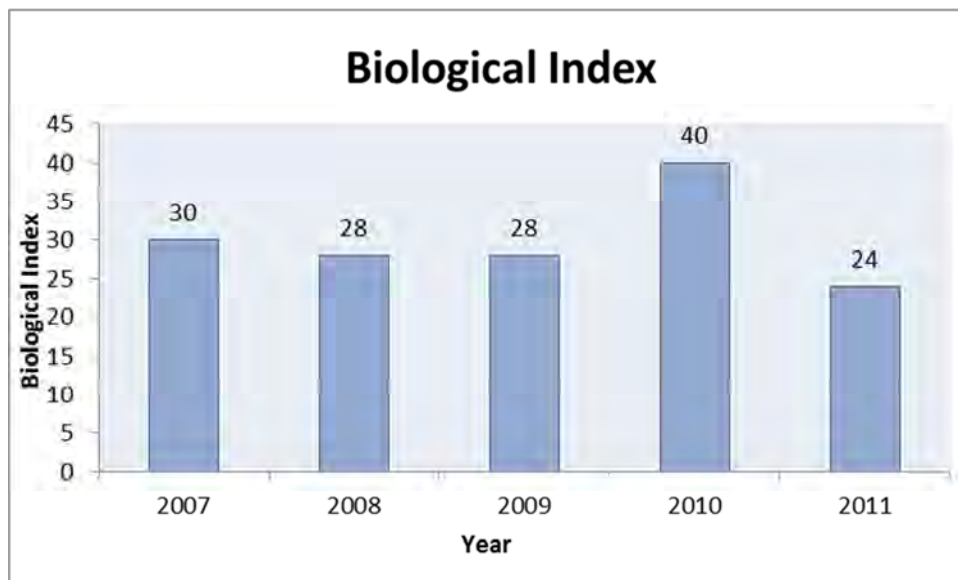
Water Quality:

pH measurements exceeding 8.5 units were recorded at this site.



Biological Condition: CHEM 12.0 received a biological condition designation of slightly impaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	30	Slightly Impaired
2008	28	Nonimpaired
2009	28	Slightly Impaired
2010	40	Nonimpaired
2011	24	Slightly Impaired



Cowanesque River at Lawrenceville, PA (COWN 1.0)

Group 1

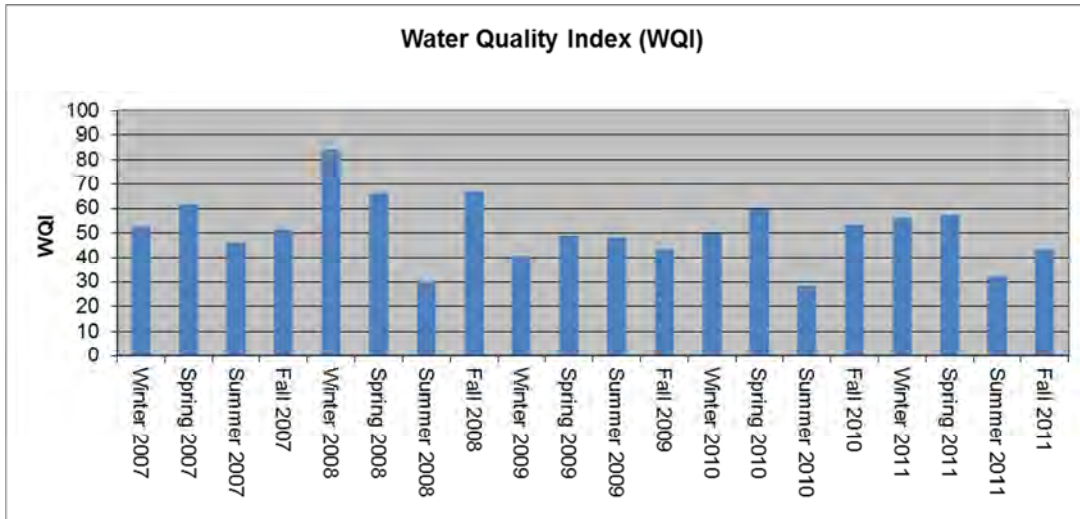


Habitat Condition:

Physical habitat was classified as supporting. The site scored 151 out of a possible 220. Bank conditions were negatively impacted from road development adjacent to the river.

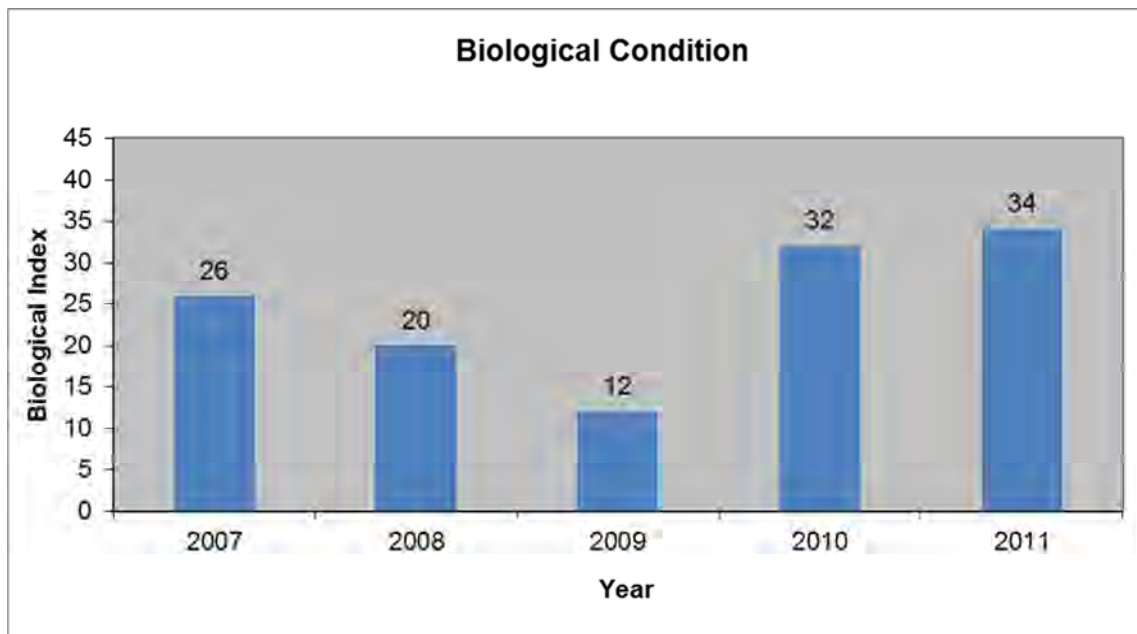
Water Quality:

All measured water quality parameters tested within acceptable limits.



Biological Condition: The biological community was classified as nonimpaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	26	Slightly Impaired
2008	20	Slightly Impaired
2009	12	Moderately Impaired
2010	32	Nonimpaired
2011	34	Nonimpaired



Cowanesque River at Lawrenceville, PA (COWN 2.2)

Group 1

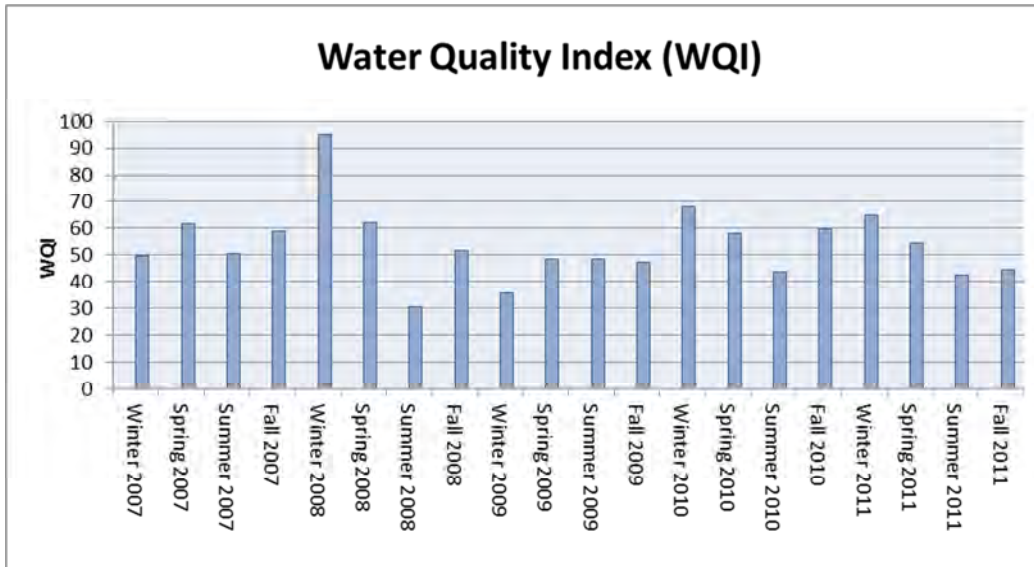


Habitat Condition:

Located directly below a large reservoir, physical habitat was designated as supporting. The site scored 151 out of a possible 220 points. A heavily altered channel and a streambed devoid of cover were factors limiting the available habitat.

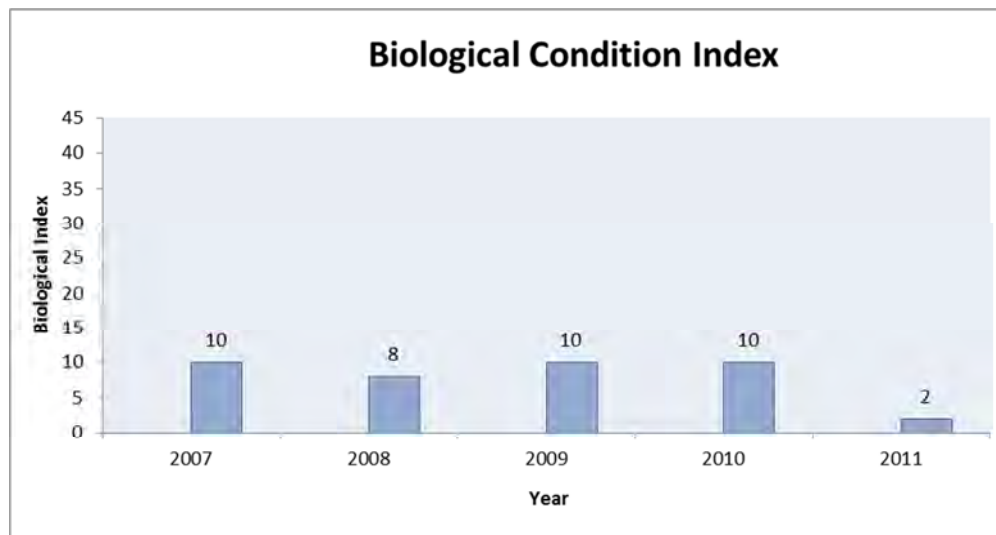
Water Quality:

Manganese concentrations were determined to be outside of accepted limits.



Biological Condition: The biological community at COWN 2.2 was classified as severely impaired. The station received the lowest biological condition score of all streams monitored in the project.

Biological Condition		
Year	Score	Rating
2007	10	Moderately Impaired
2008	8	Moderately Impaired
2009	10	Moderately Impaired
2010	10	Moderately Impaired
2011	2	Severely Impaired



Susquehanna River at Conowingo, MD (SUSQ 10.0)

Group 1

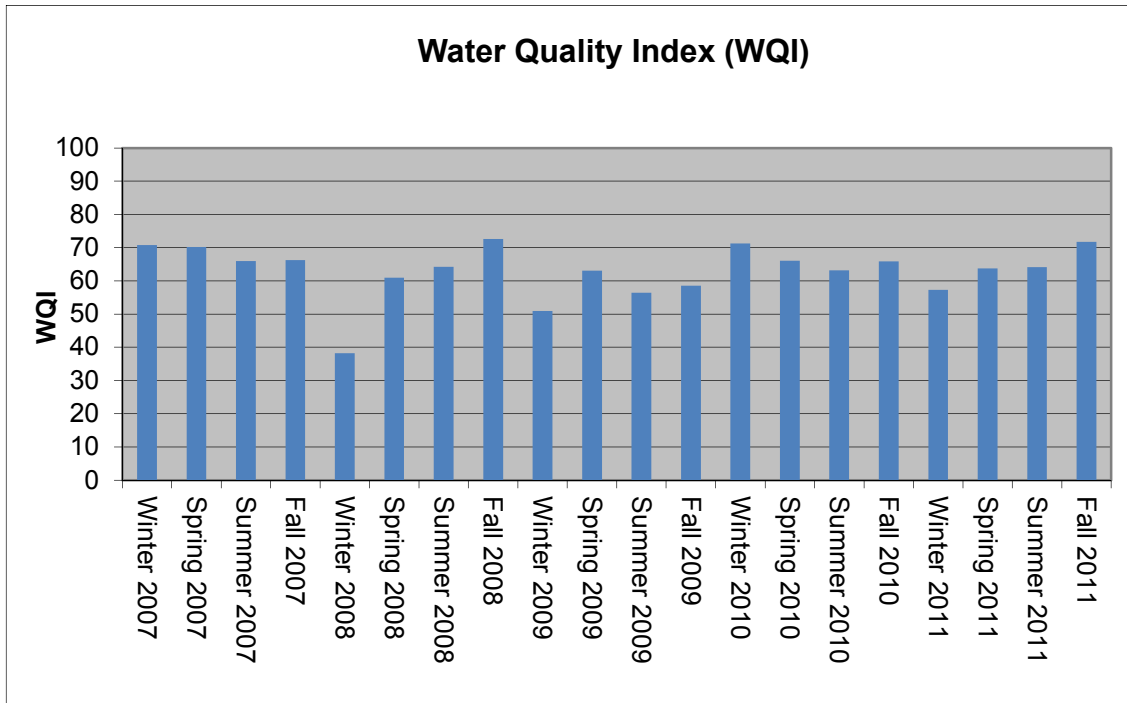


Habitat Condition:

Due to the location of this sampling station, physical habitat is not assessed. The sampling point is directly downstream of the Conowingo Hydroelectric dam and is subject to frequent disturbances in flow due to plant operations.

Water Quality:

All measured water quality parameters tested within acceptable limits.



Biological Condition:

The macroinvertebrate community was not assessed at the sampling location.

Susquehanna River at Marietta, PA (SUSQ 44.5)

Group 1

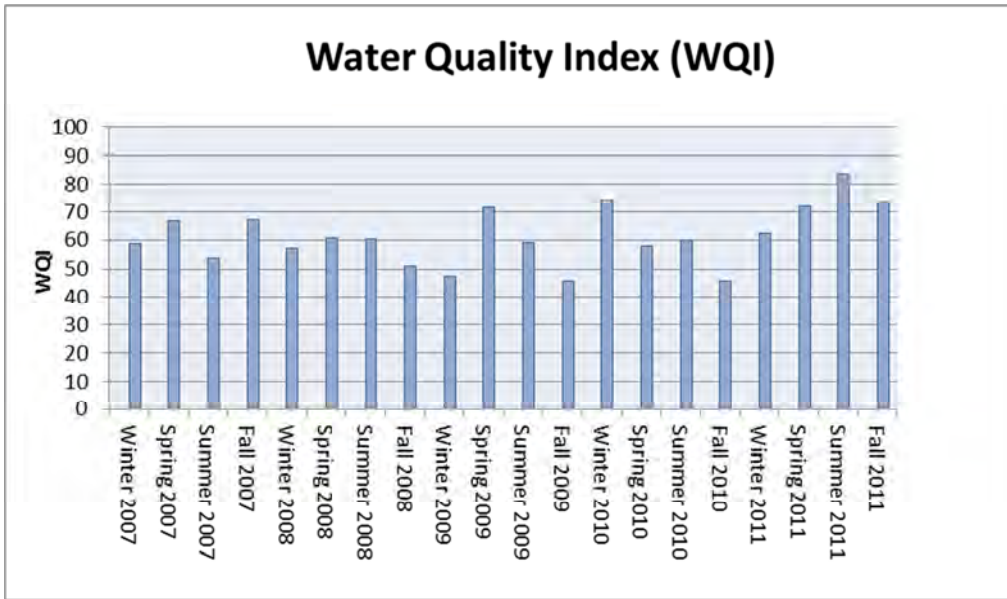


Habitat Condition:

Physical habitat was designated as excellent when assessed in 2011, scoring 154 out of a possible 220. SRBC staff noted a lack of instream cover and pool variability at the site.

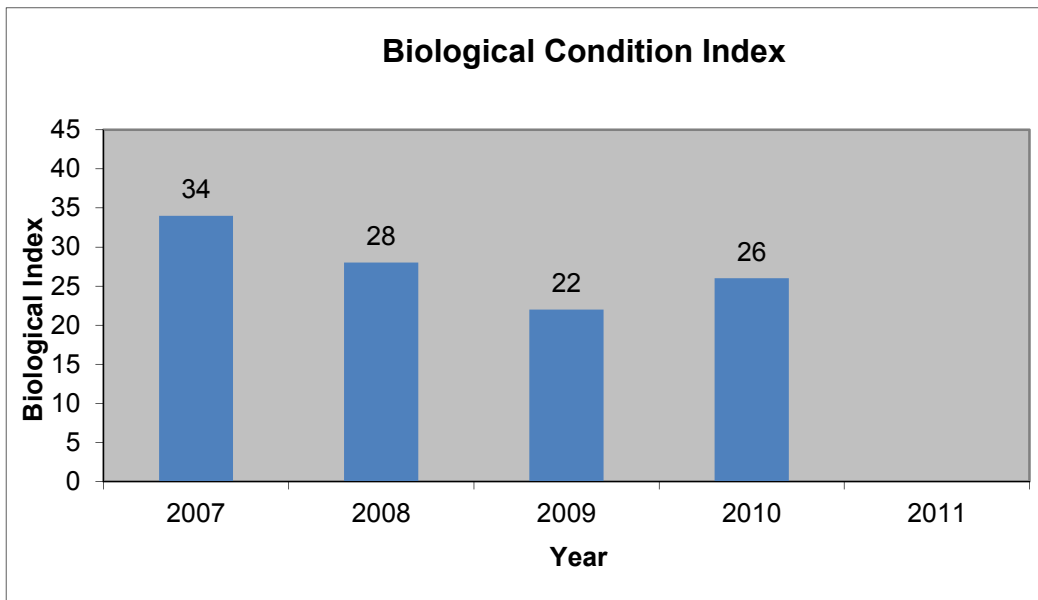
Water Quality:

All measured water quality parameters tested within acceptable limits.



Biological Condition: Due to high flows during the summer sampling period, the biological community at SUSQ 44.5 was not assessed in 2011.

Biological Condition		
Year	Score	Rating
2007	34	Nonimpaired
2008	28	Nonimpaired
2009	22	Slightly Impaired
2010	26	Slightly Impaired
2011	NA	NA



Susquehanna River at Sayre, PA (SUSQ 289.1)

Group 1

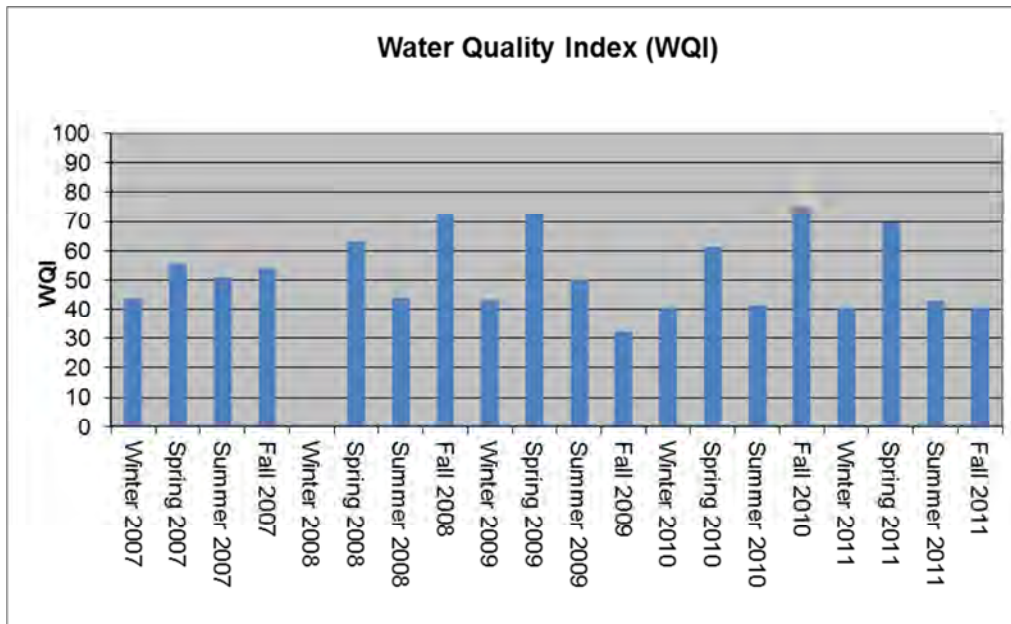


Habitat Condition:

Available physical habitat was classified as excellent in 2011. SUSQ 289.1 scored 171 out of a possible 220 points. SRBC staff noted minimal embeddedness and sediment deposition.

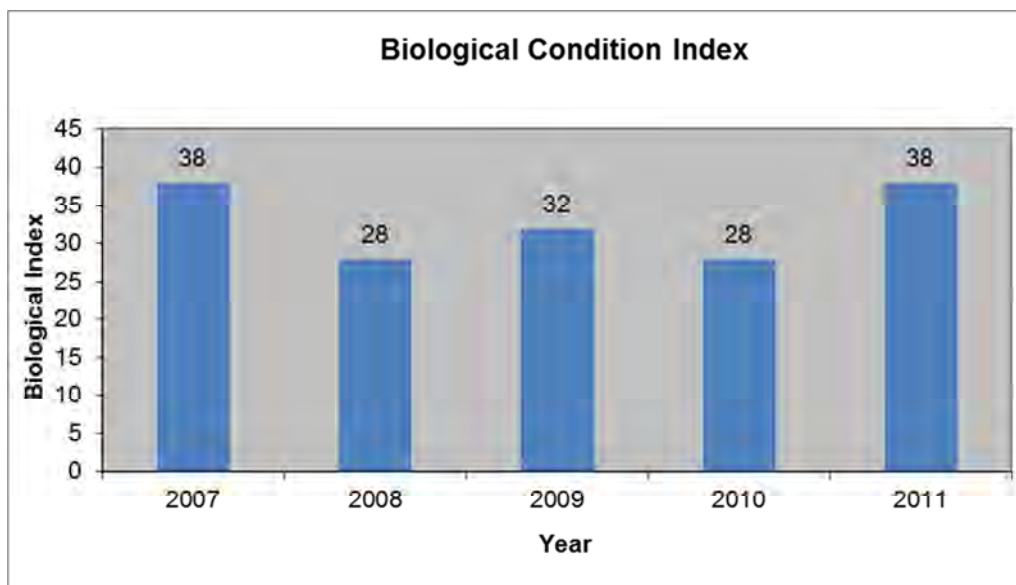
Water Quality:

A pH value of 9.01 was recorded during the summer of 2011, exceeding both the New York and Pennsylvania water quality standards criteria.



Biological Condition: The biological community at SUSQ 289.1 was classified as nonimpaired in 2011.

Biological Condition		
Year	Score	Rating
2007	38	Nonimpaired
2008	28	Nonimpaired
2009	32	Nonimpaired
2010	28	Slightly Impaired
2011	38	Nonimpaired



Susquehanna River at Kirkwood, NY (SUSQ 340.0)

Group 1

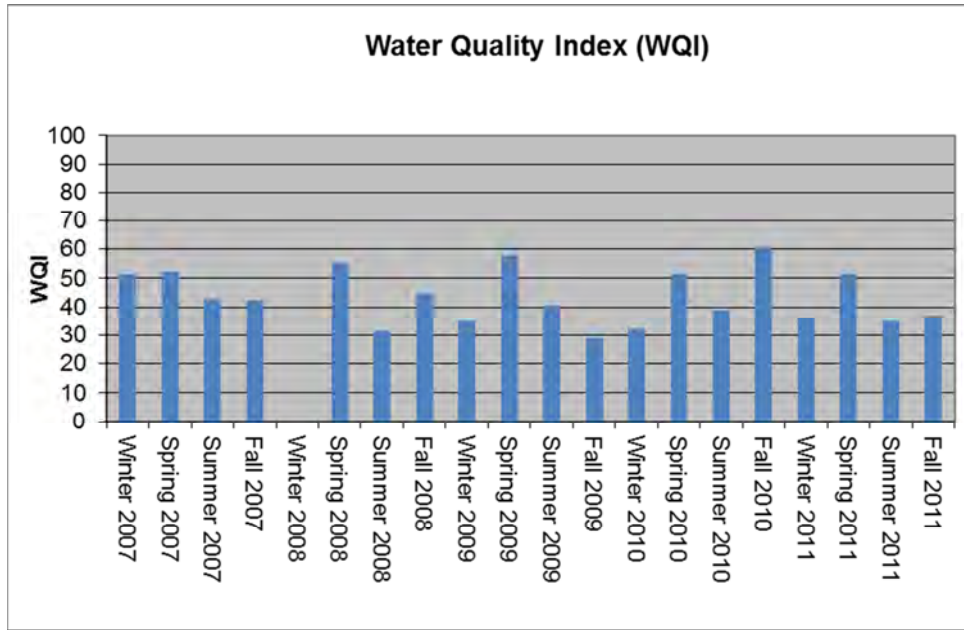


Habitat Condition:

Scoring 157 out of a possible 220, physical habitat conditions were considered excellent in 2011.

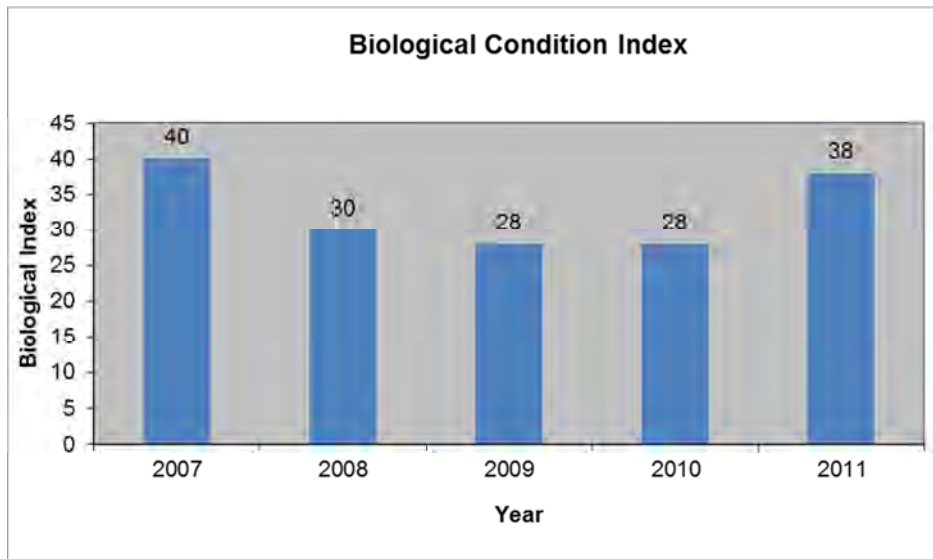
Water Quality:

All measured water quality parameters tested within accepted limits.



Biological Condition: The biological community at SUSQ 340.0 was rated as nonimpaired when sampled in 2011. The site served as the reference site to which all other large river sites were compared.

Biological Condition		
Year	Score	Rating
2007	40	Nonimpaired
2008	30	Nonimpaired
2009	28	Slightly Impaired
2010	28	Slightly Impaired
2011	38	Nonimpaired



Susquehanna River at Windsor, NY (SUSQ 365.0)

Group 1

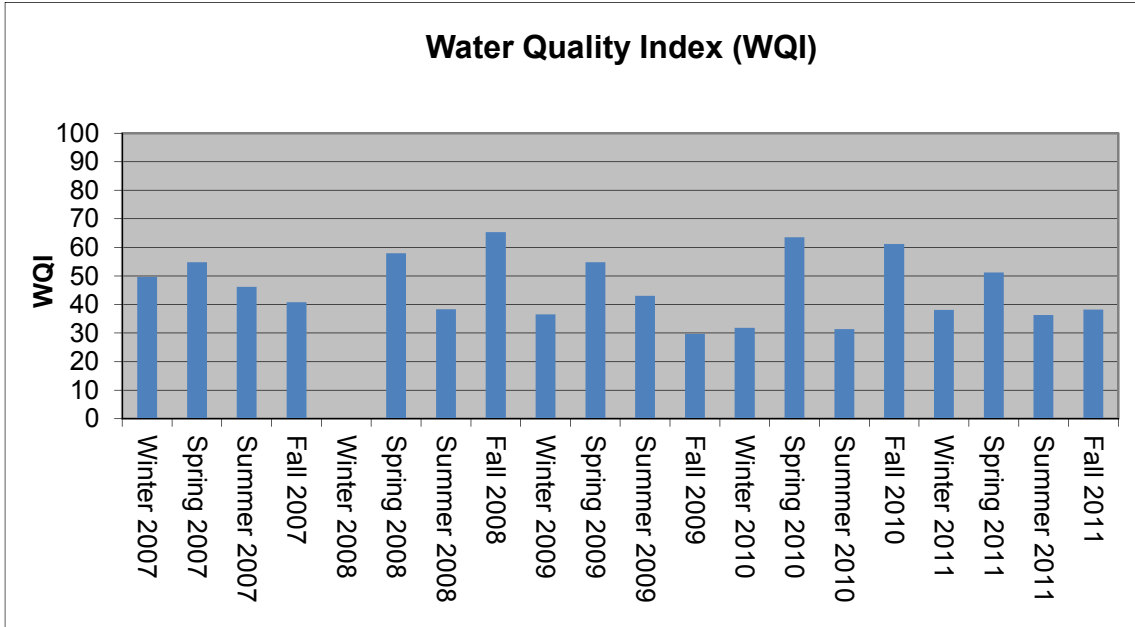


Habitat Condition:

Available physical habitat was classified as excellent in 2011. Scoring 171 out of a possible 220, SUSQ 365.0 possessed the second highest habitat score of all large river sites evaluated in 2011.

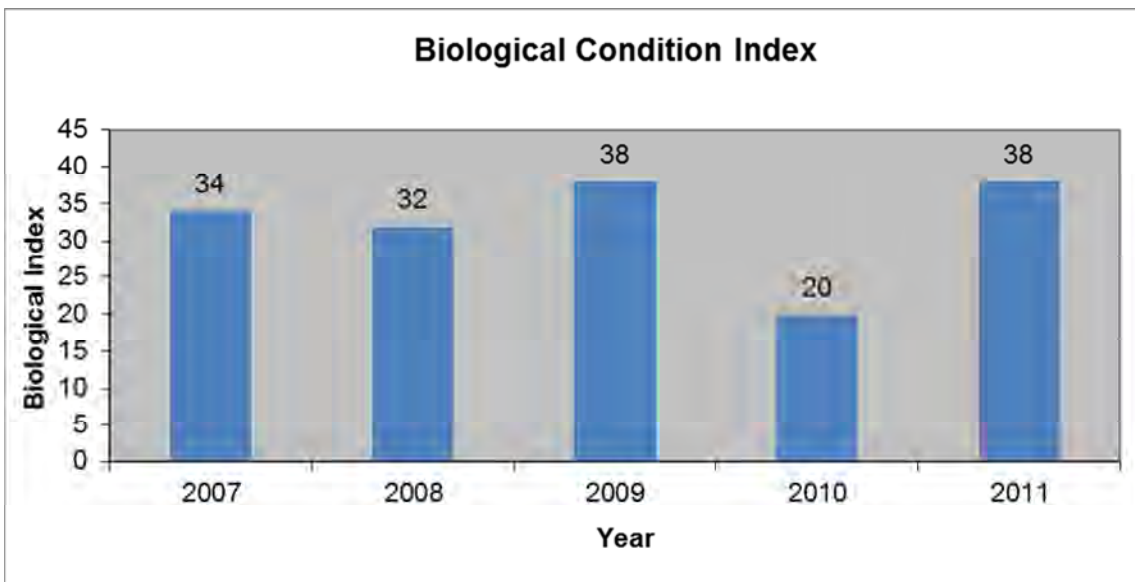
Water Quality:

A recorded pH value in excess of the New York state water quality criteria was recorded in 2011.



Biological Condition: The biological condition of SUSQ 365.0 was designated as nonimpaired when assessed in 2011.

Biological Condition		
Year	Score	Rating
2007	34	Nonimpaired
2008	32	Nonimpaired
2009	38	Nonimpaired
2010	20	Slightly Impaired
2011	38	Nonimpaired



Tioga River at Lindley, PA (TIOG 10.8)

Group 1

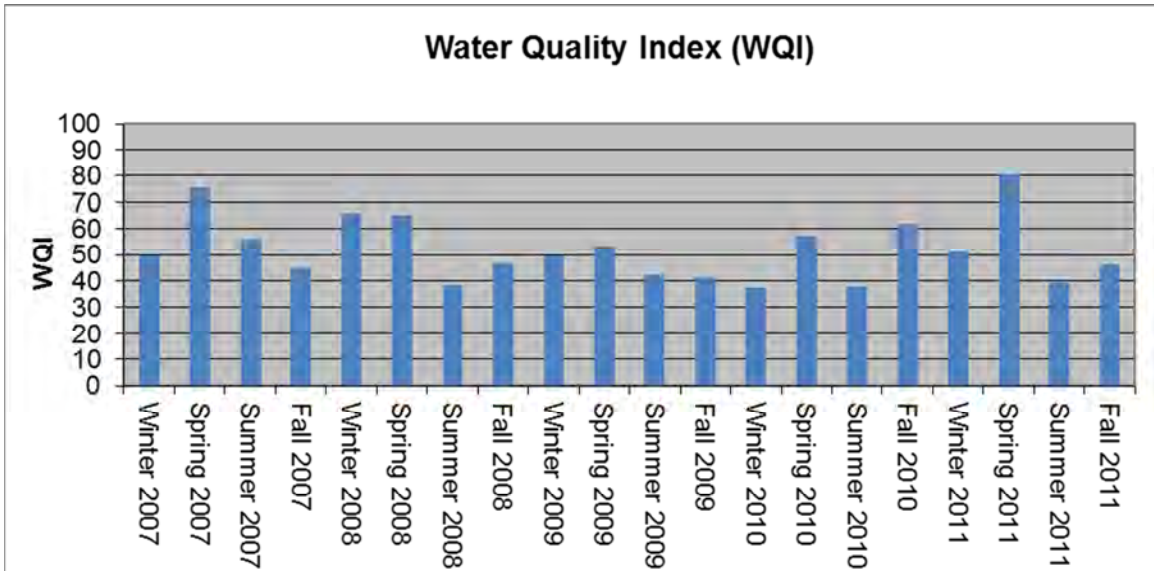


Habitat Condition:

Scoring 178 out of a possible 220, TIOG 10.8 received the highest habitat condition score of all large river sites assessed in 2011.

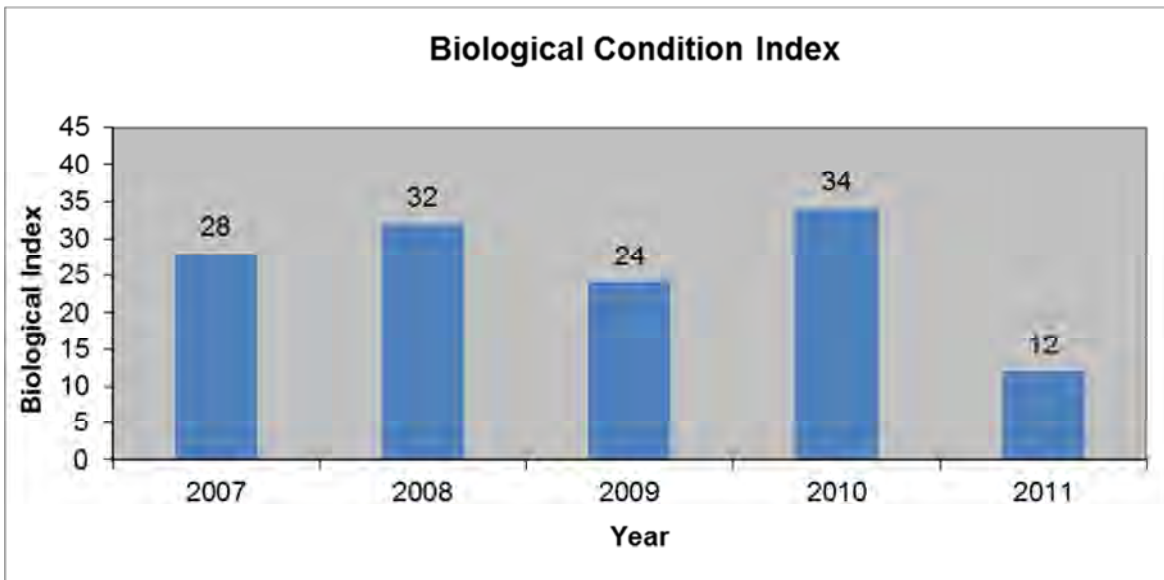
Water Quality:

Manganese concentrations were determined to be outside of accepted limits.



Biological Condition: The biological condition of TIOG 10.8 was determined to be moderately impaired, marking a significant departure from the nonimpaired status attained in 2010.

Biological Condition		
Year	Score	Rating
2007	28	Slightly Impaired
2008	32	Nonimpaired
2009	24	Slightly Impaired
2010	34	Nonimpaired
2011	12	Moderately Impaired



Site Results for Pennsylvania-Maryland Border Sites
Big Branch Deer Creek at Fawn Grove, PA (BBDC 4.1)

Group 2

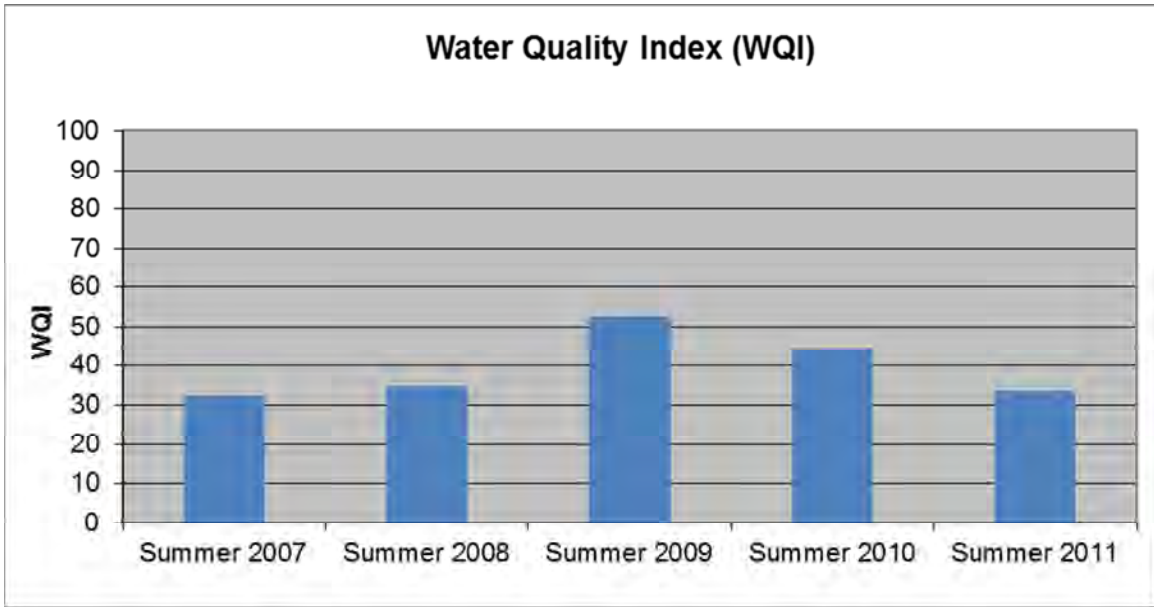


Habitat Condition:

Physical habitat was rated as excellent at the station in 2011. Scoring 169 out of a possible 220 points, BBDC 4.1 possessed optimal conditions in nearly all parameters measured. Sediment deposition remained atypically high relative to previous observations.

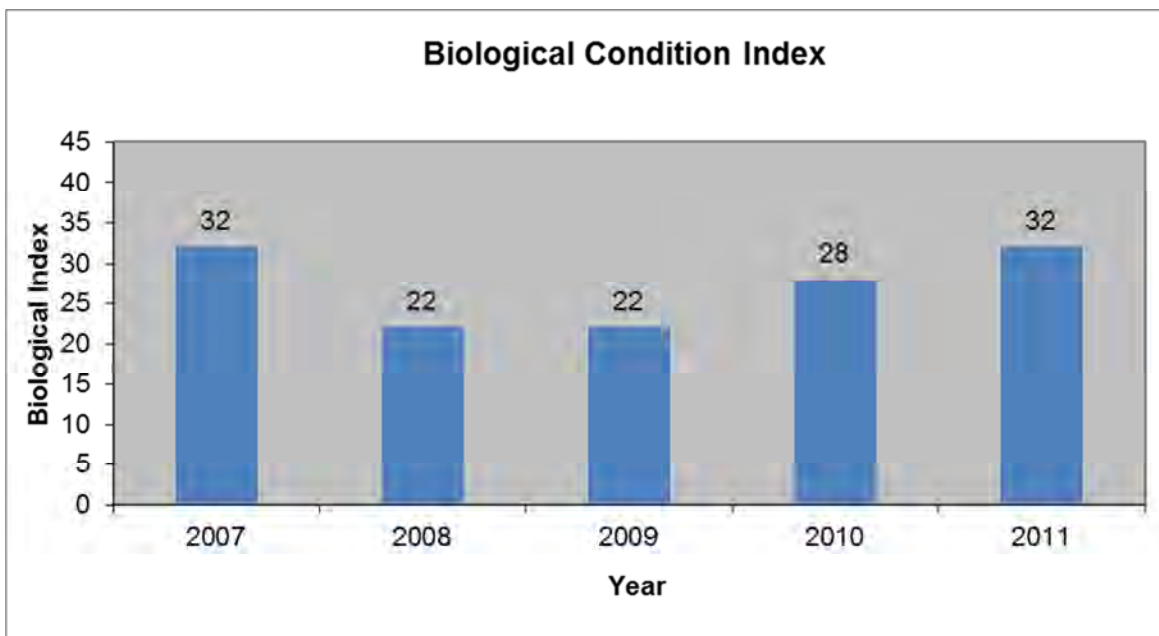
Water Quality:

All measured water quality parameters were within accepted limits at the time of testing.



Biological Condition: The biological community at BBDC 4.1 was rated as slightly impaired in 2011.

Biological Condition		
Year	Score	Rating
2007	32	Nonimpaired
2008	22	Slightly Impaired
2009	22	Slightly Impaired
2010	28	Slightly Impaired
2011	32	Slightly Impaired



Conowingo Creek at Pleasant Grove, PA (CNWG 4.4)

Group 1

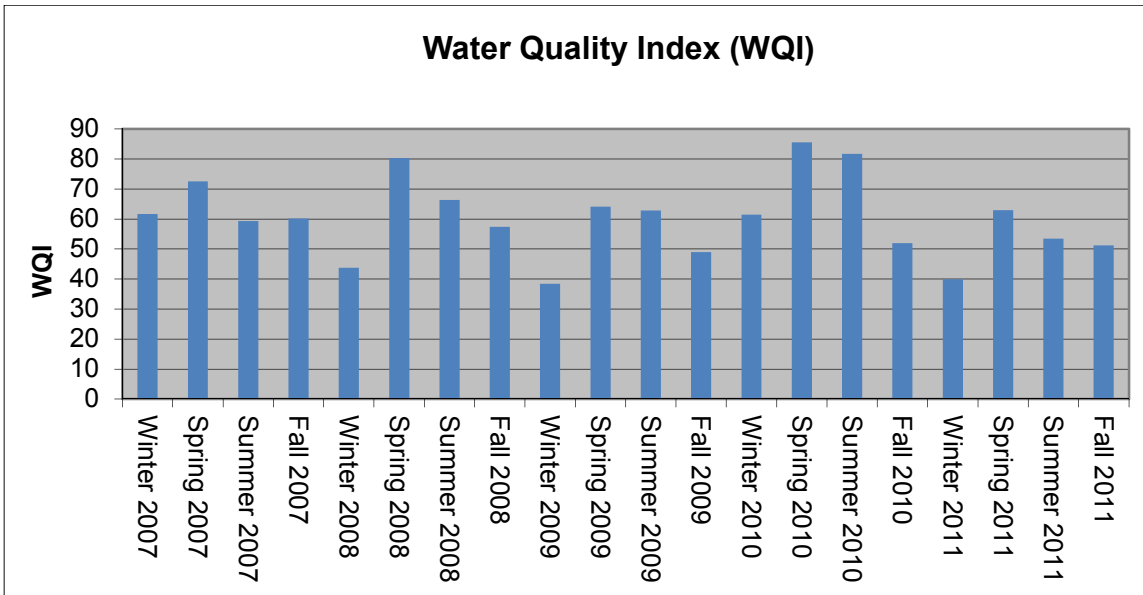


Habitat Condition:

Scoring 189 out of a possible 220, available physical habitat was classified as excellent in 2011. CNWG 4.4 was one of three sites sharing the highest habitat score in the MD-PA monitoring group.

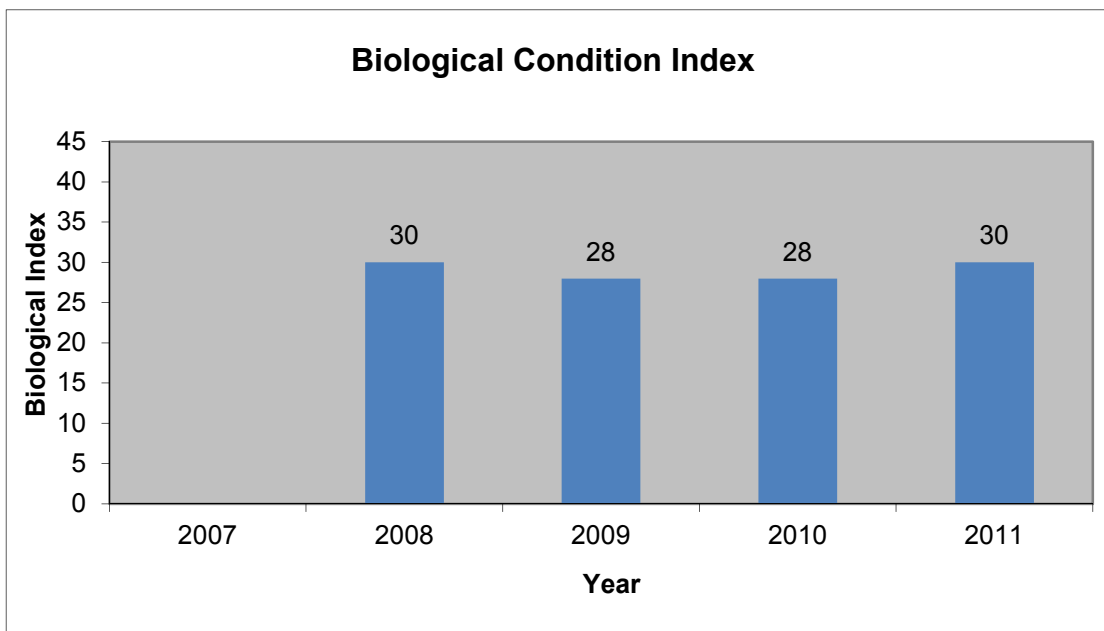
Water Quality:

Nitrate plus nitrite concentrations were above accepted limits. Elevated concentrations were detected across all sampling periods.



Biological Condition: The macroinvertebrate community was rated as slightly impaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	NA	NA
2008	30	Nonimpaired
2009	28	Nonimpaired
2010	28	Slightly Impaired
2011	30	Slightly Impaired



Deer Creek at Gorsuch Mills, PA (DEER 44.2)

Group 1

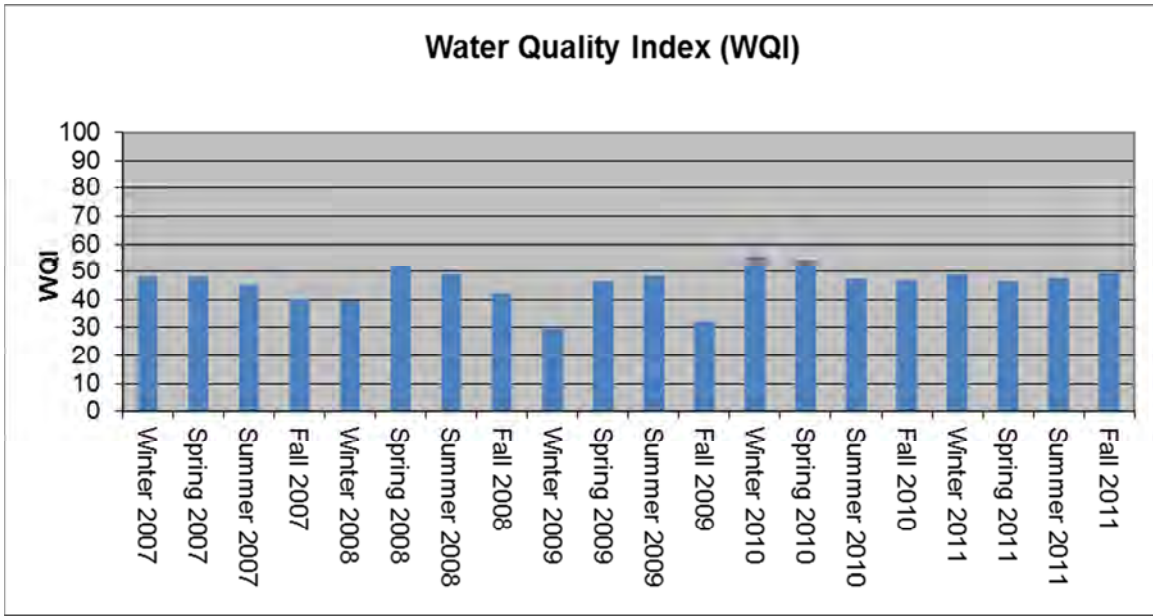


Habitat Condition:

DEER 44.2 possessed excellent habitat conditions as rated by SRBC staff in 2011. Bank erosion and stability were identified as potential areas of concern.

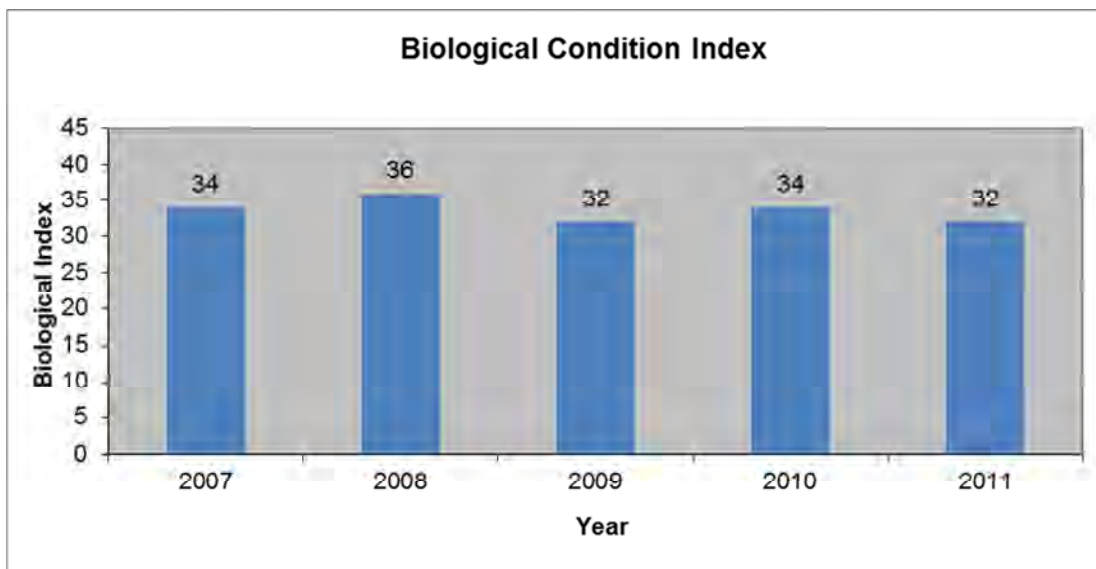
Water Quality:

All measured water quality parameters were within accepted limits at the time of testing.



Biological Condition: Deer Creek possessed a slightly impaired biological community in 2011. Although the rating declined from previous years' nonimpaired classification, conditions remained favorable at the station.

Biological Condition		
Year	Score	Rating
2007	34	Nonimpaired
2008	36	Nonimpaired
2009	32	Nonimpaired
2010	34	Nonimpaired
2011	32	Slightly Impaired



Ebaughs Creek at Stewartstown, PA (EBAU 1.5)

Group 1

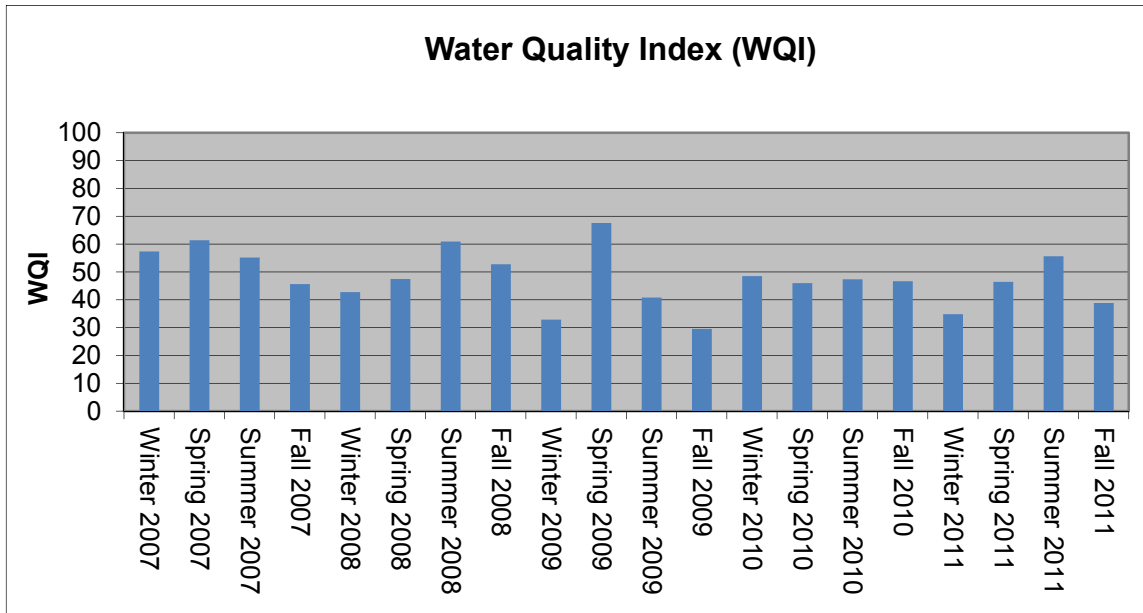


Habitat Condition:

Available physical habitat was rated as excellent in 2011. EBAU 1.5 was one of three sites sharing the highest habitat score in the MD-PA monitoring group.

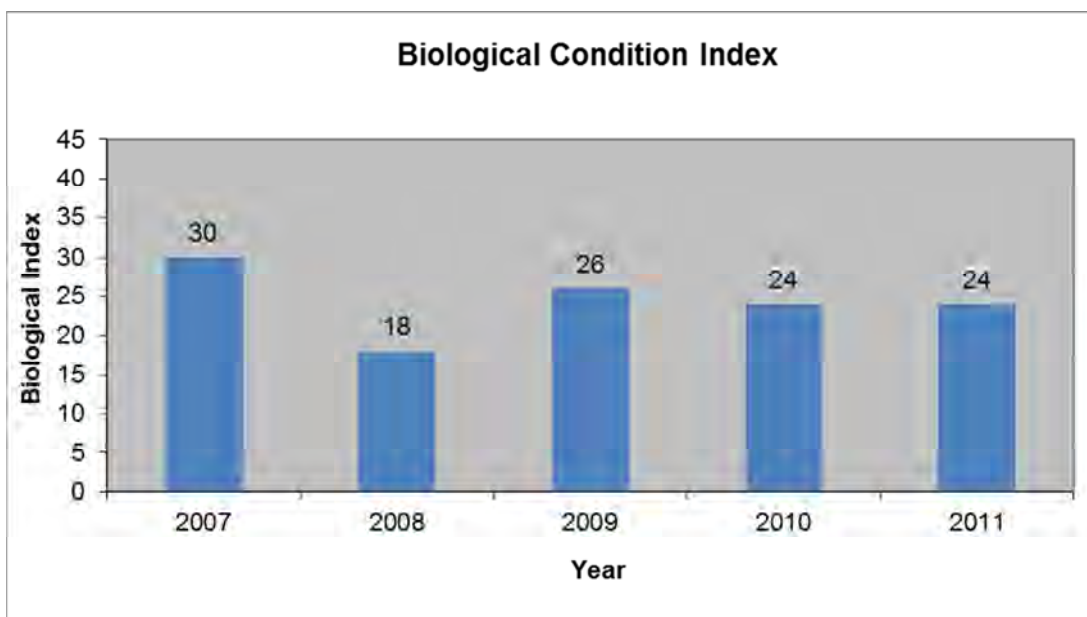
Water Quality:

All measured water quality parameters were within accepted limits when tested in 2011.



Biological Condition: The biological condition at EBAU 1.5 was rated as slightly impaired for the third consecutive year.

Biological Condition		
Year	Score	Rating
2007	30	Nonimpaired
2008	18	Moderately Impaired
2009	26	Slightly Impaired
2010	24	Slightly Impaired
2011	24	Slightly Impaired



Falling Branch Deer Creek at Fawn Grove, PA (FBDC 4.1)

Group 2

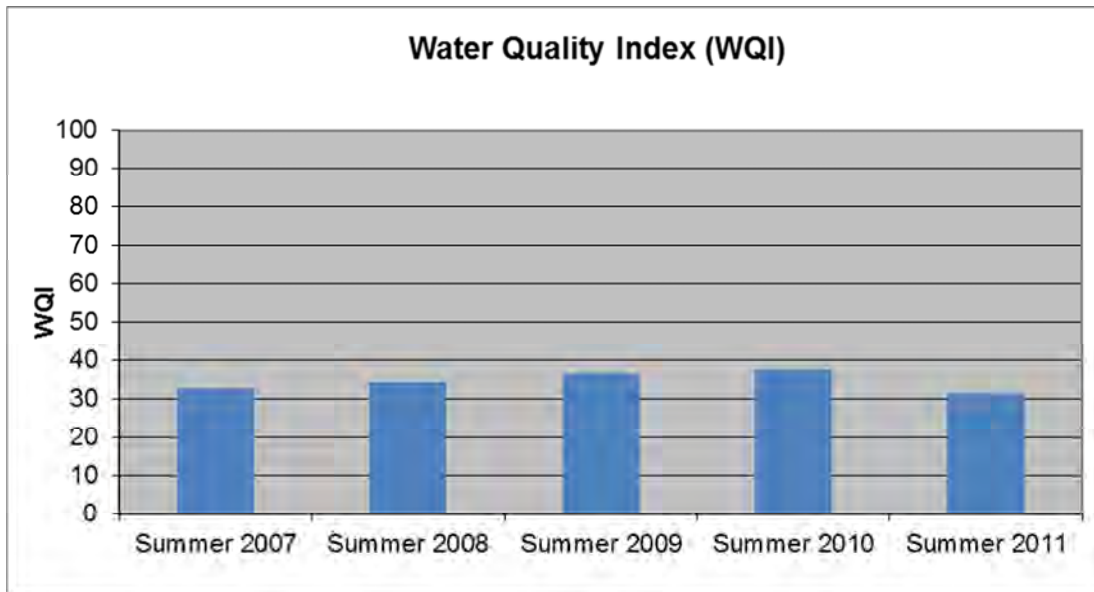


Habitat Condition:

Scoring 187 out of a possible 220 points, the available physical habitat at FBDC 4.1 was classified as excellent in 2011. Habitat conditions have remained stable and favorable at this site.

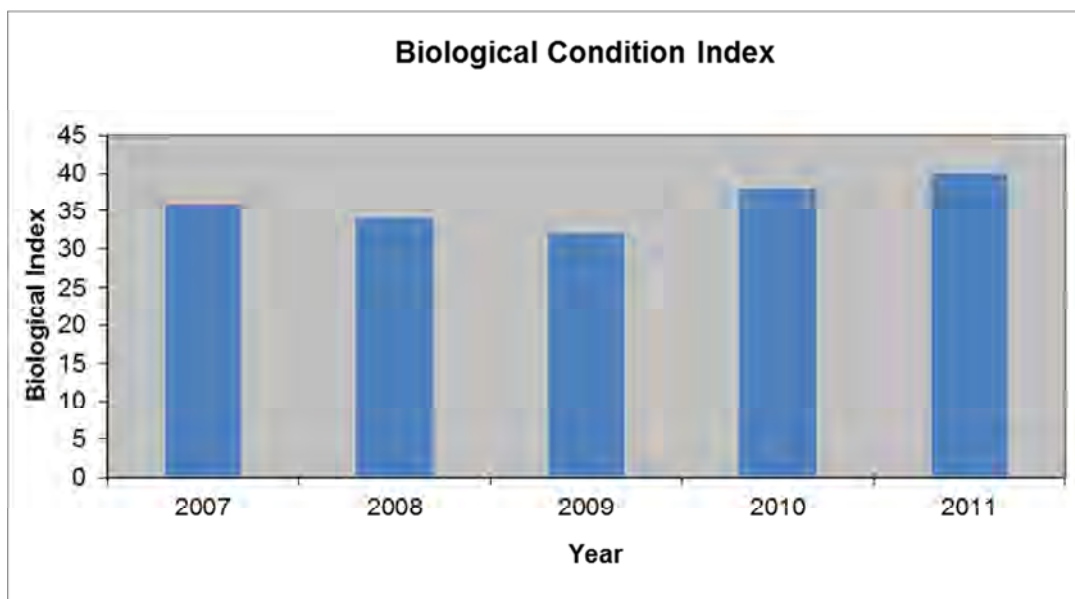
Water Quality:

All measured water quality parameters were within accepted limits when tested in 2011.



Biological Condition: FBDC 4.1 was chosen as the reference site to which all other MD-PA interstate sites were compared in 2011. The biological condition at this site was rated as nonimpaired.

Biological Condition		
Year	Score	Rating
2007	36	Nonimpaired
2008	34	Nonimpaired
2009	32	Nonimpaired
2010	38	Nonimpaired
2011	40	Nonimpaired



Long Arm Creek at Bandanna, PA (LNGA 2.5)

Group 1

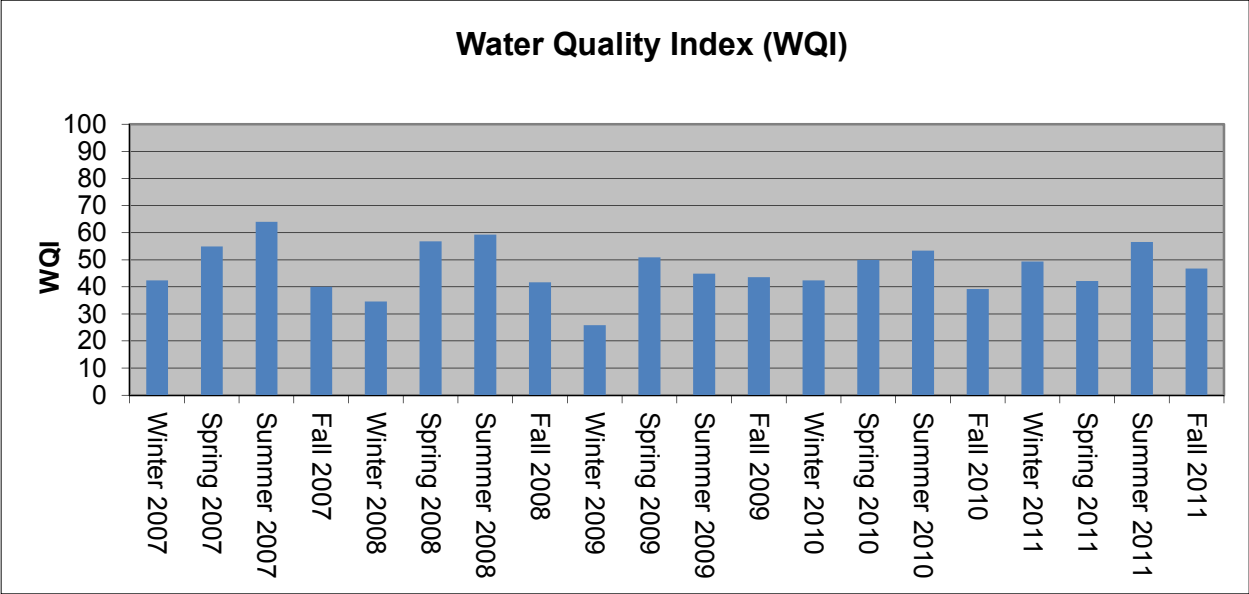


Habitat Condition:

Receiving a score of 189 out of a possible 220 points, Long Arm Creek's physical habitat was classified as excellent.

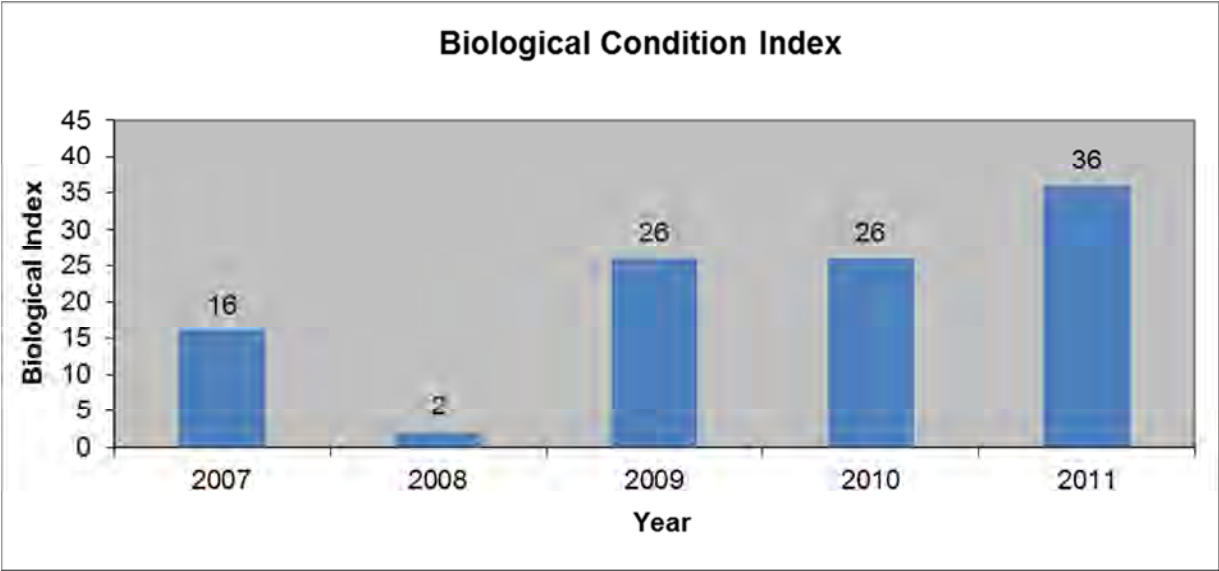
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: LNGA 2.5 received a biological condition classification of nonimpaired in 2011, marking a significant improvement from previous years' assessments.

Biological Condition		
Year	Score	Rating
2007	16	Moderately Impaired
2008	2	Severely Impaired
2009	26	Slightly Impaired
2010	26	Slightly Impaired
2011	36	Nonimpaired



Octoraro Creek at Rising Sun, MD (OCTO 6.6)

Group 1

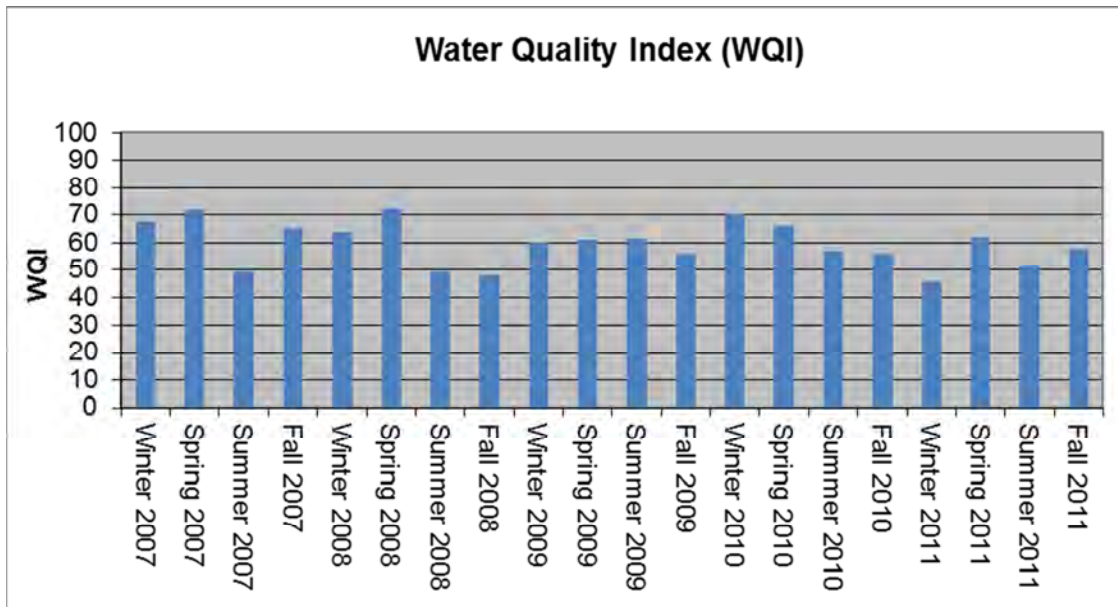


Habitat Condition:

Physical habitat was rated as excellent, scoring 177 out of a possible 220. Optimal amounts of instream cover and minimal channel alteration contributed to this classification.

Water Quality:

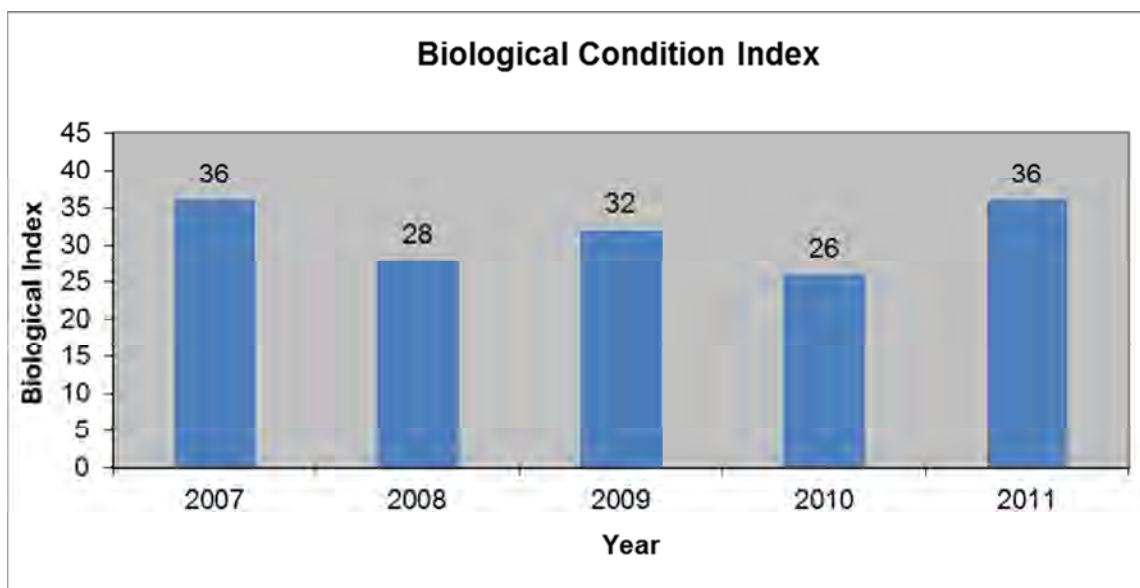
All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition:

The macroinvertebrate community was classified as nonimpaired in 2011.

Biological Condition		
Year	Score	Rating
2007	36	Nonimpaired
2008	28	Slightly Impaired
2009	32	Nonimpaired
2010	26	Slightly Impaired
2011	36	Nonimpaired



South Branch Conewago Creek at Bandanna, PA (SBCC 20.4)

Group 2

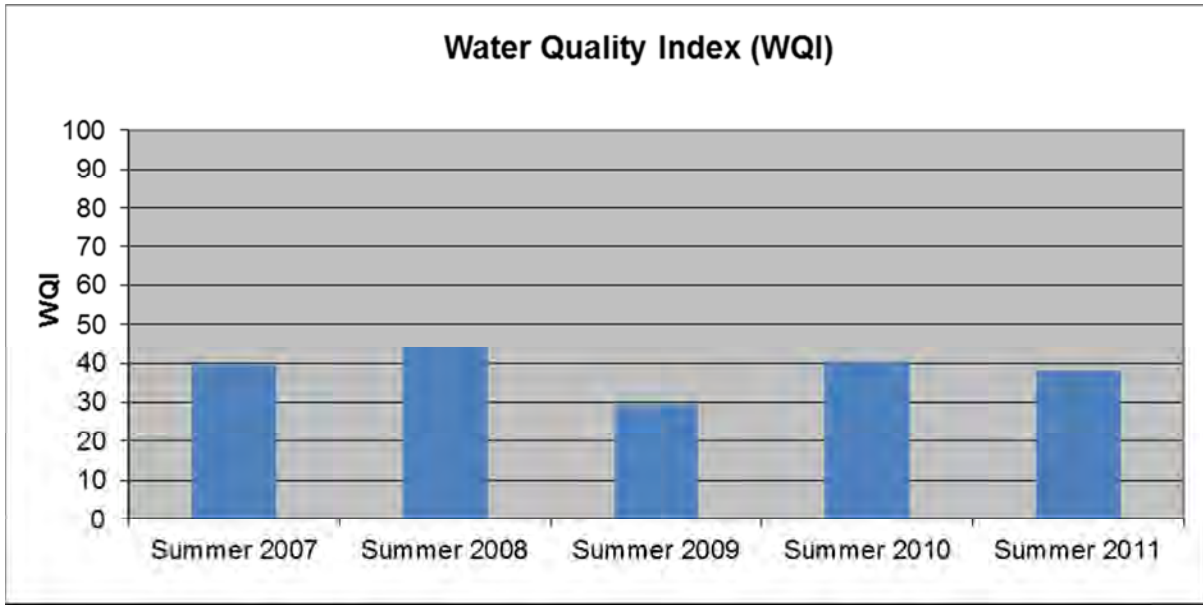


Habitat Condition:

Located in a primarily forested watershed, the South Branch Conewago Creek site received a habitat classification of excellent in 2011. The site scored 189 out of a possible 220.

Water Quality:

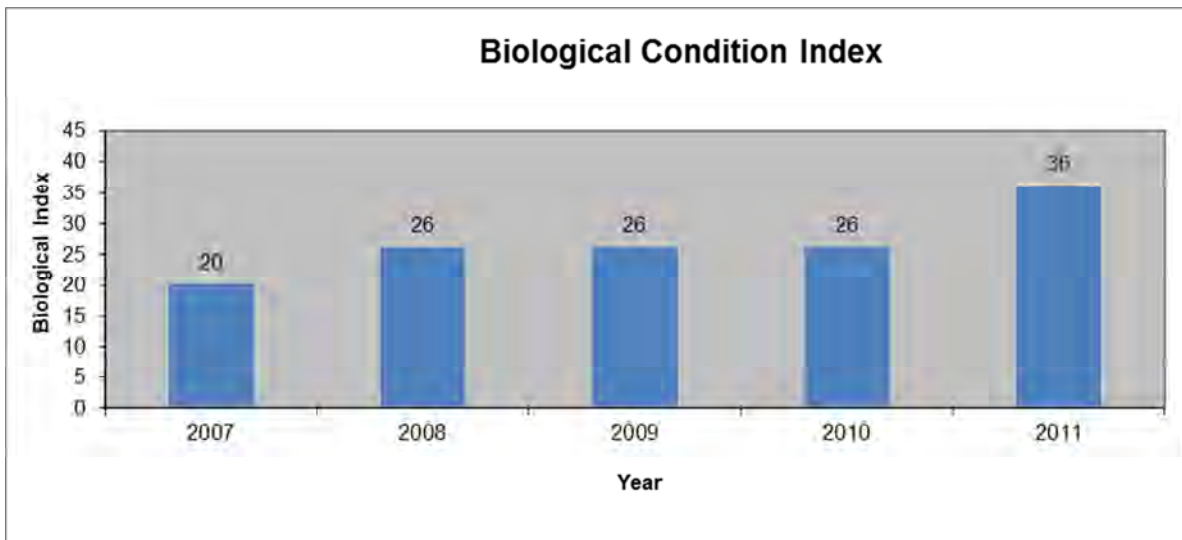
All measured water quality parameters were within accepted limits when tested in 2011.



Biological Condition:

SBCC 20.4 received a biological condition rating of nonimpaired in 2011. This represents an improvement over prior years' classifications of slightly impaired.

Biological Condition		
Year	Score	Rating
2007	20	Slightly Impaired
2008	26	Slightly Impaired
2009	26	Slightly Impaired
2010	26	Slightly Impaired
2011	36	Nonimpaired



Scott Creek at Delta, PA (SCTT 3.0)

Group 1

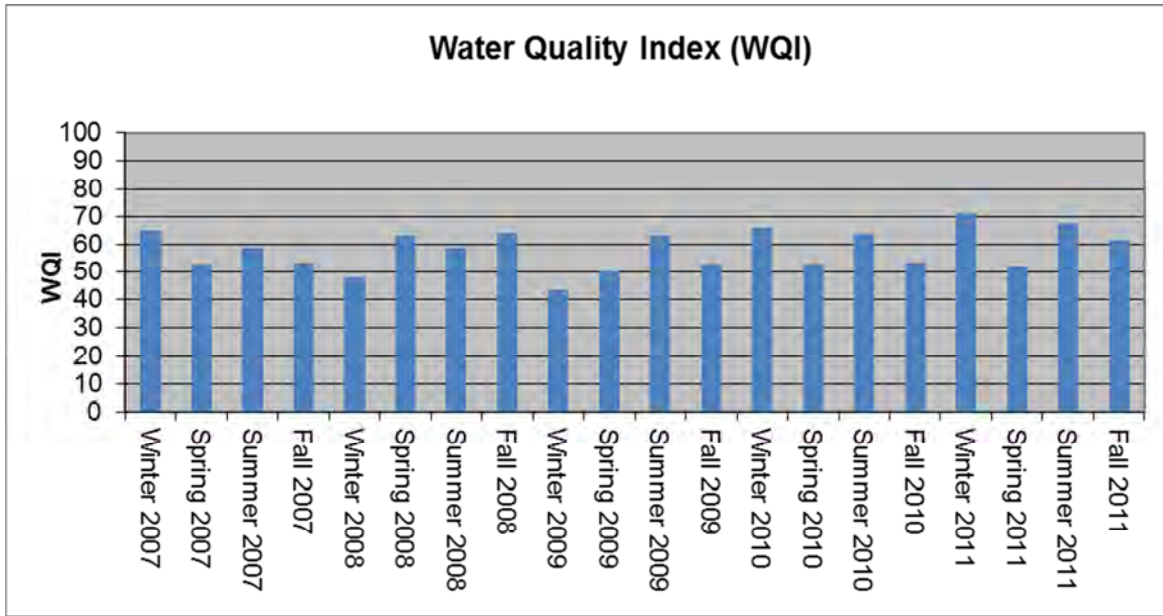


Habitat Condition:

Scoring 114 out of a possible 220 points, available physical habitat was deemed partially supporting in 2011. Highly eroded banks lacking sufficient vegetative protective cover reduced the score at this station.

Water Quality:

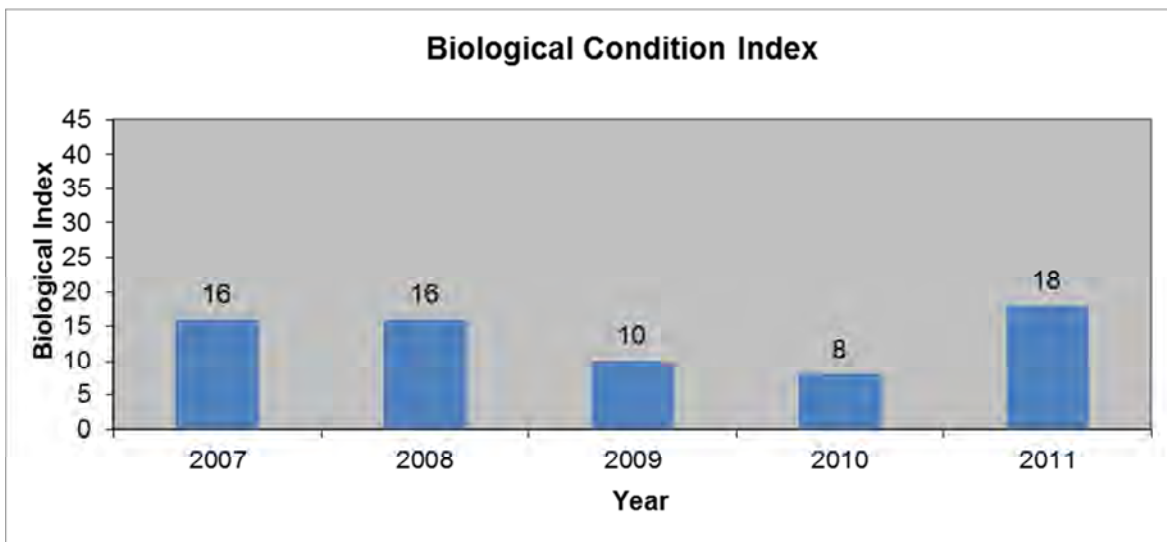
All measured water quality parameters were within accepted limits when tested in 2011, though consistently high WQI values suggested lesser quality water at this station relative to other MD-PA interstate sites.



Biological Condition:

SCTT 3.0 received a biological classification of moderately impaired in 2011. Scott Creek was the lone MD-PA interstate site to receive this designation. SCTT 3.0 has consistently scored poorly in biological assessments.

Biological Condition		
Year	Score	Rating
2007	16	Moderately Impaired
2008	16	Moderately Impaired
2009	10	Moderately Impaired
2010	8	Moderately Impaired
2011	18	Moderately Impaired



Site Results for Group 1 and 2 Streams on the New York-Pennsylvania Border

Apalachin Creek at Little Meadows, PA (APAL 6.9)

Group 2

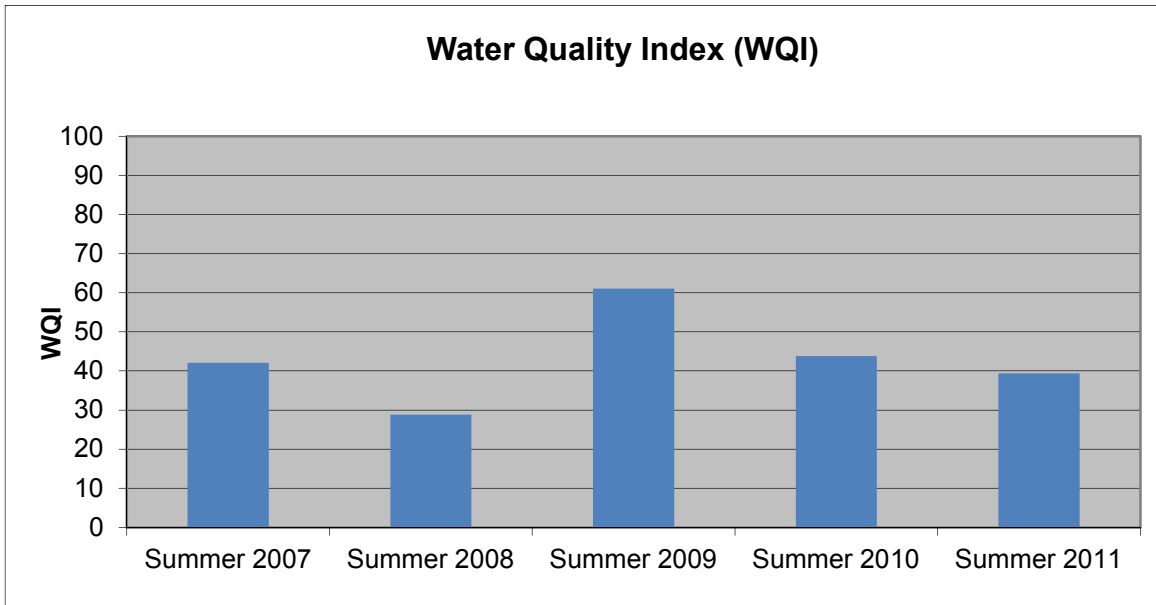


Habitat Condition:

Scoring only 85 points out of a possible 220, physical habitat was classified as nonsupporting at APAL 6.9 in 2011. SRBC staff noted excessive sedimentation and poor velocity/depth regimes contributing to the low rating.

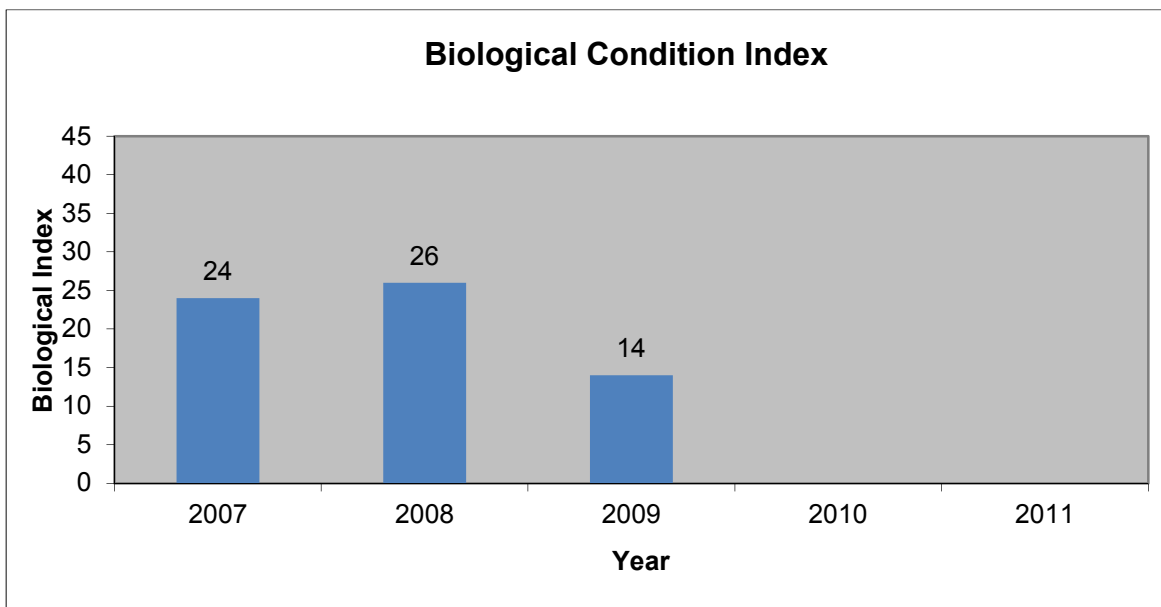
Water Quality:

All measured water quality parameters were within accepted limits when tested in 2011.



Biological Condition: Macroinvertebrates were not collected at this station in 2011 due to anomalous conditions.

Biological Condition		
Year	Score	Rating
2007	24	Slightly Impaired
2008	26	Slightly Impaired
2009	14	Moderately Impaired
2010	NA	NA
2011	NA	NA



Bentley Creek at Wellsburg, NY (BNTY 0.9)

Group 1

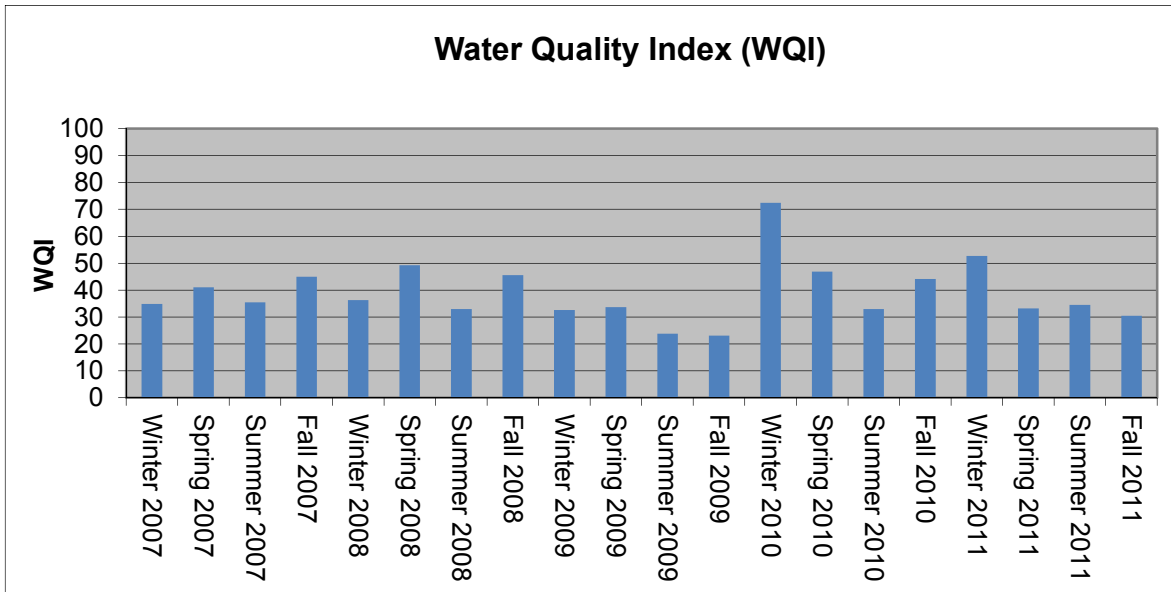


Habitat Condition:

Scoring 127 out of a possible 220, available physical habitat was rated as partially supporting. Considerable bank erosion and a highly mobile stream channel contributed to the low score.

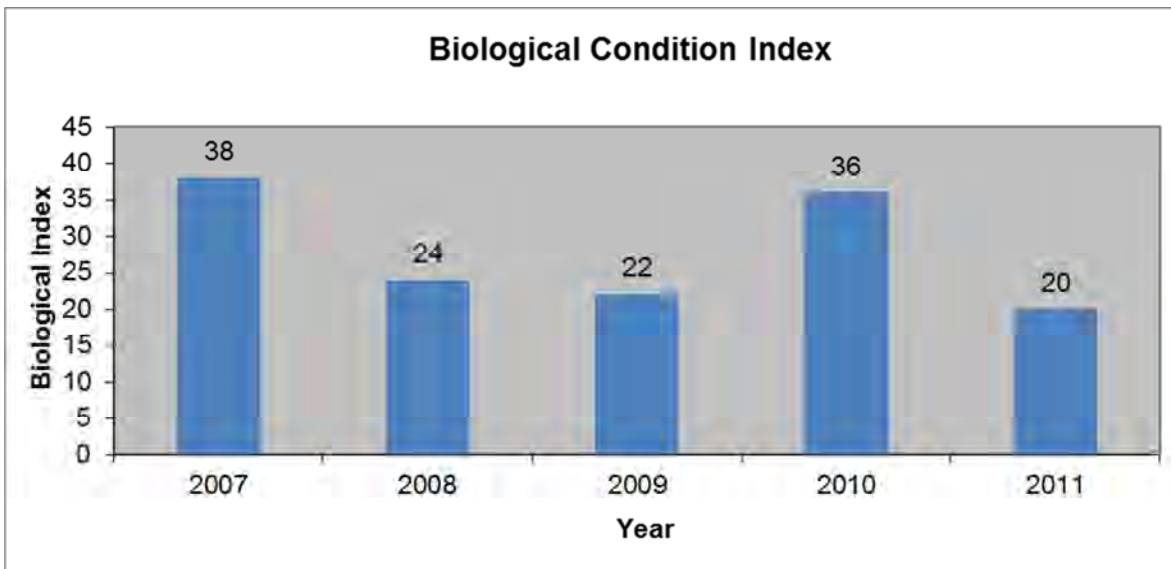
Water Quality:

Elevated pH measurements recorded during the summer sampling period were outside of accepted limits.



Biological Condition: The biological community of BNTY 0.9 was rated as slightly impaired in 2011.

Biological Condition		
Year	Score	Rating
2007	38	Nonimpaired
2008	24	Slightly Impaired
2009	22	Slightly Impaired
2010	36	Nonimpaired
2011	20	Slightly Impaired



Cascade Creek at Lanesboro, PA (CASC 1.6)

Group 1

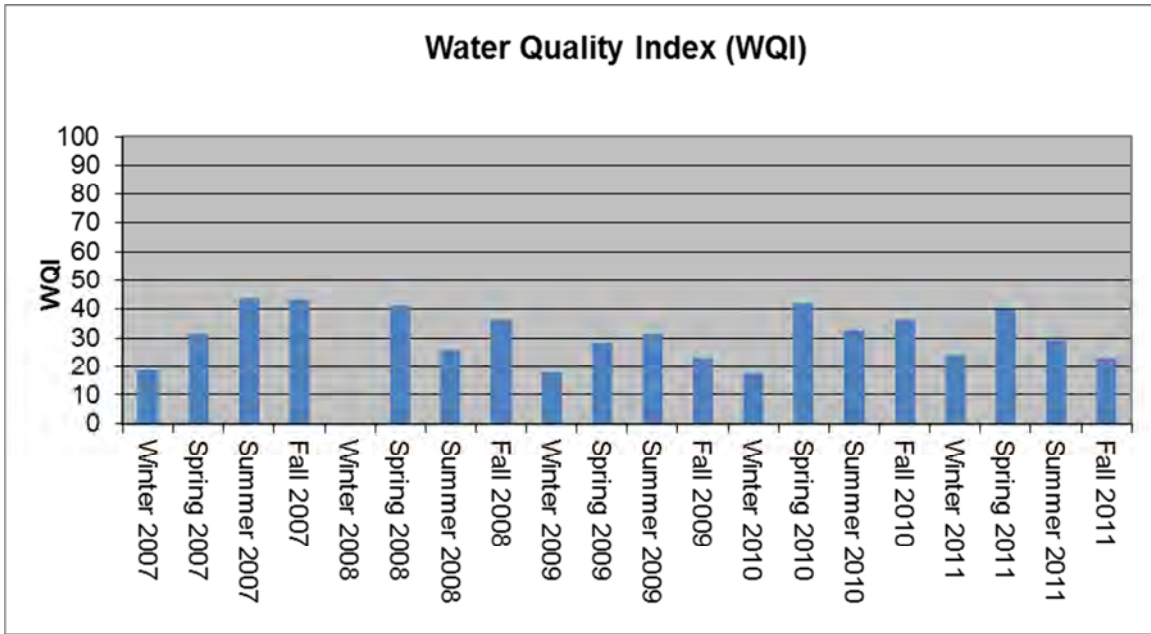


Habitat Condition:

Scoring 203 out of a possible 220, Cascade Creek's physical habitat received a rating of excellent in 2011. The station received the highest habitat condition score of all interstate sites monitored in the project.

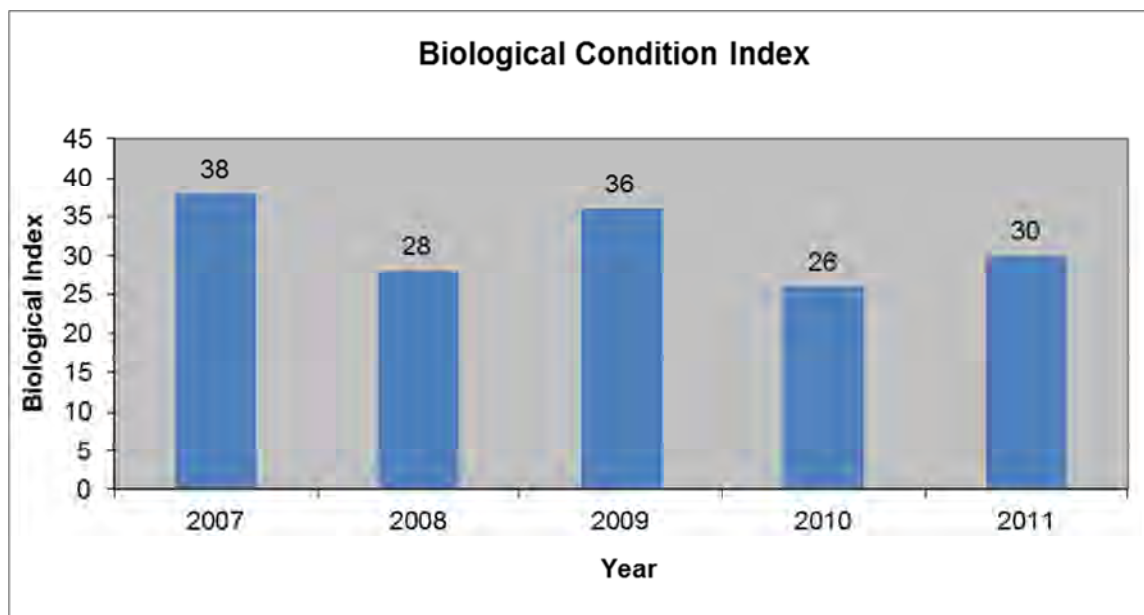
Water Quality:

A pH measurement of 6.11 was recorded in 2011, falling outside of accepted standards.



Biological Condition: CASC 1.6 received a nonimpaired macroinvertebrate community designation in 2011. The station served as the reference site to which all other NY-PA Group 1 and 2 streams were compared.

Biological Condition		
Year	Score	Rating
2007	38	Nonimpaired
2008	28	Slightly Impaired
2009	36	Nonimpaired
2010	26	Slightly Impaired
2011	30	Nonimpaired



Cayuta Creek at Waverly, NY (CAYT 1.7)

Group 1

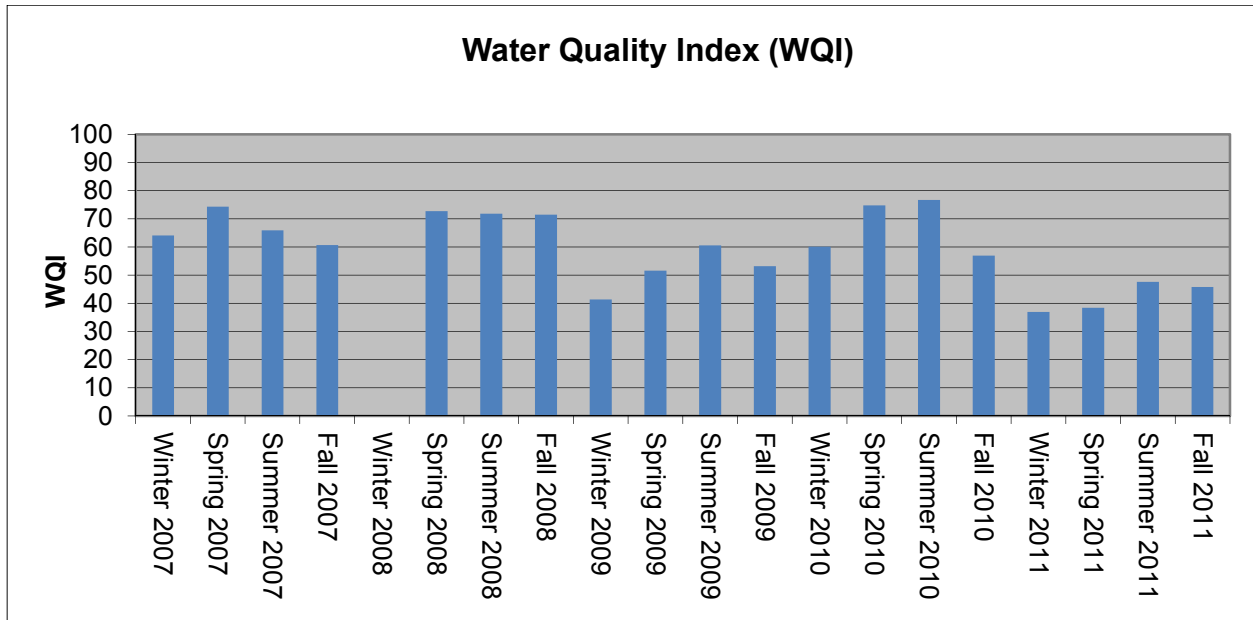


Habitat Condition:

Scoring 149 out of 220, physical habitat was rated as partially supporting. Surrounding industrial land uses contributed negatively to this assessment.

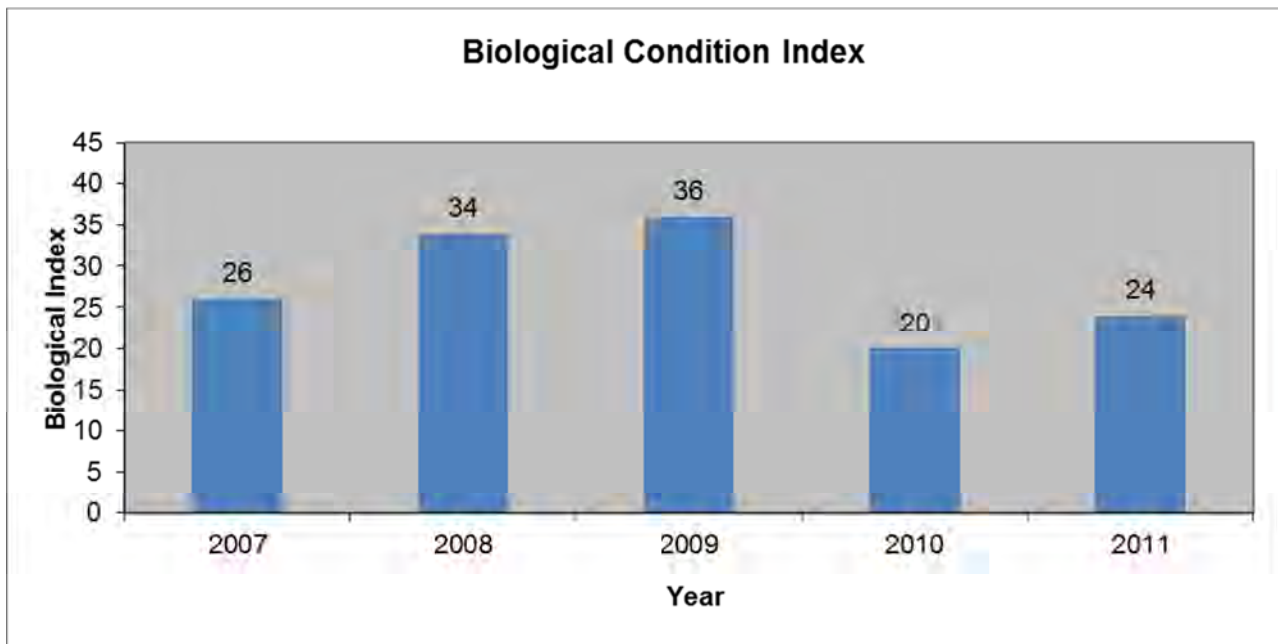
Water Quality:

pH measurements were outside of accepted limits on two of four site visits.



Biological Condition: The biological community was rated as slightly impaired in 2011.

Biological Condition		
Year	Score	Rating
2007	26	Slightly Impaired
2008	34	Nonimpaired
2009	36	Nonimpaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired



Choconut Creek at Vestal Center, NY (CHOC 9.1)

Group 2

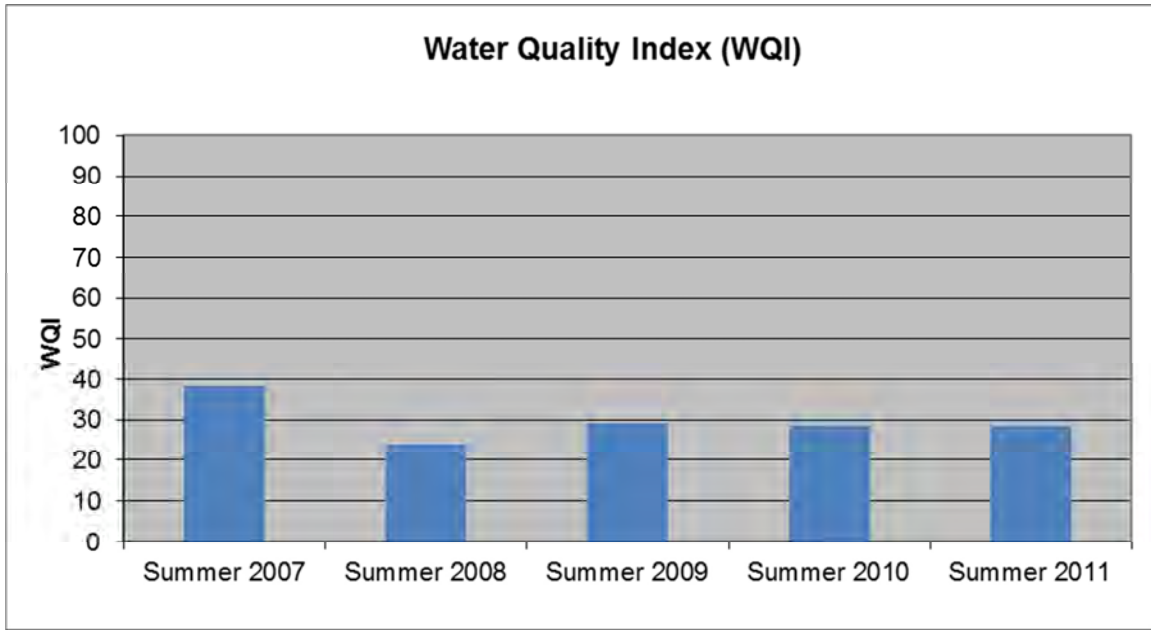


Habitat Condition:

Physical habitat was rated excellent when assessed in 2011. The site scored 186 out of 220 possible points. SRBC staff noted optimal velocity/depth regimes and minimal sediment deposition.

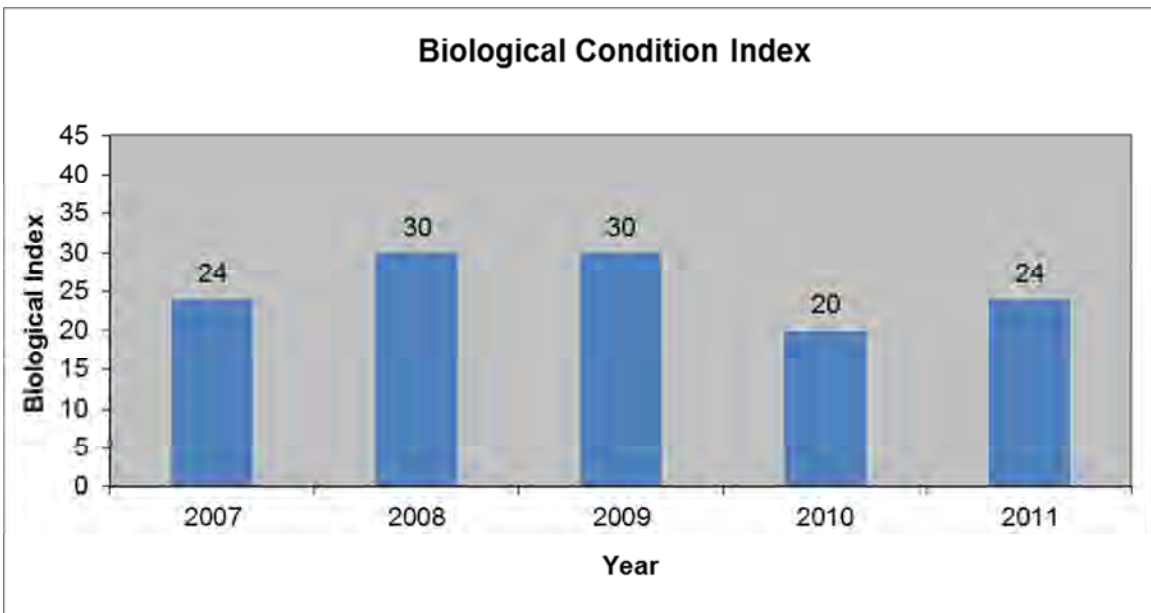
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: CHOC 9.1 received a biological condition rating of slightly impaired for the fifth consecutive year when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	24	Slightly Impaired
2008	30	Slightly Impaired
2009	30	Slightly Impaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired



Holden Creek at Woodhull, NY (HLDN 3.5)

Group 2

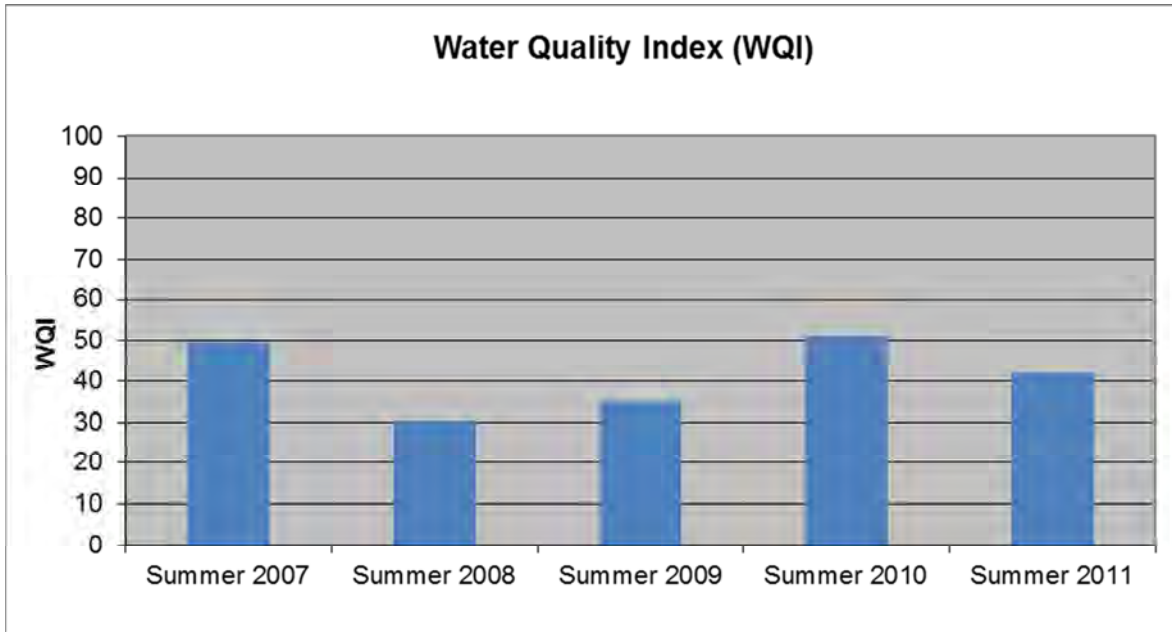


Habitat Condition:

Physical habitat was deemed supporting, receiving a score of 174 out of a possible 220. Low flow conditions were evident at the time of sampling.

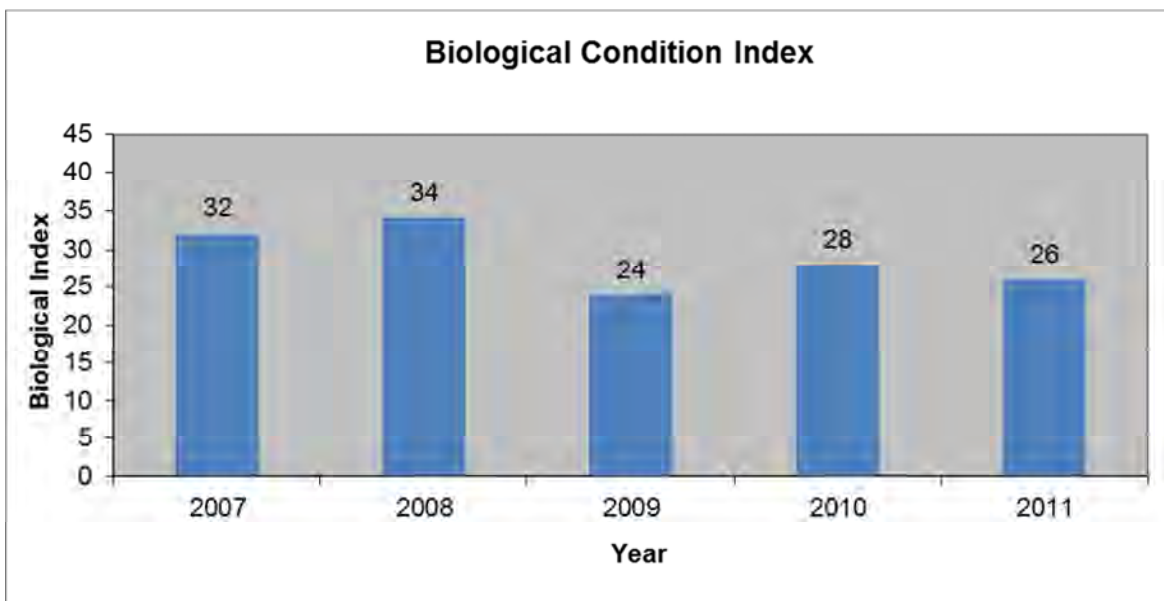
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: The macroinvertebrate community was assessed as being nonimpaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	32	Nonimpaired
2008	34	Nonimpaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	26	Nonimpaired



Little Snake Creek at Brackney, PA (LSNK 7.6)

Group 1

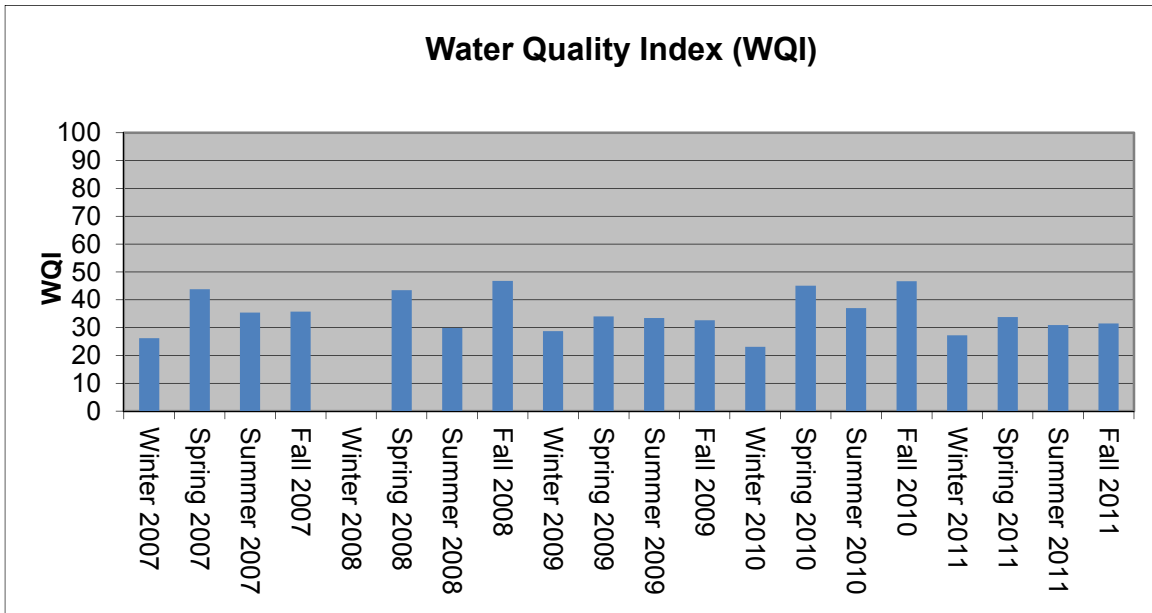


Habitat Condition:

Available physical habitat was rated as excellent in 2011. The station received a habitat score of 201 out of 220, netting the second highest habitat score of all interstate streams sites.

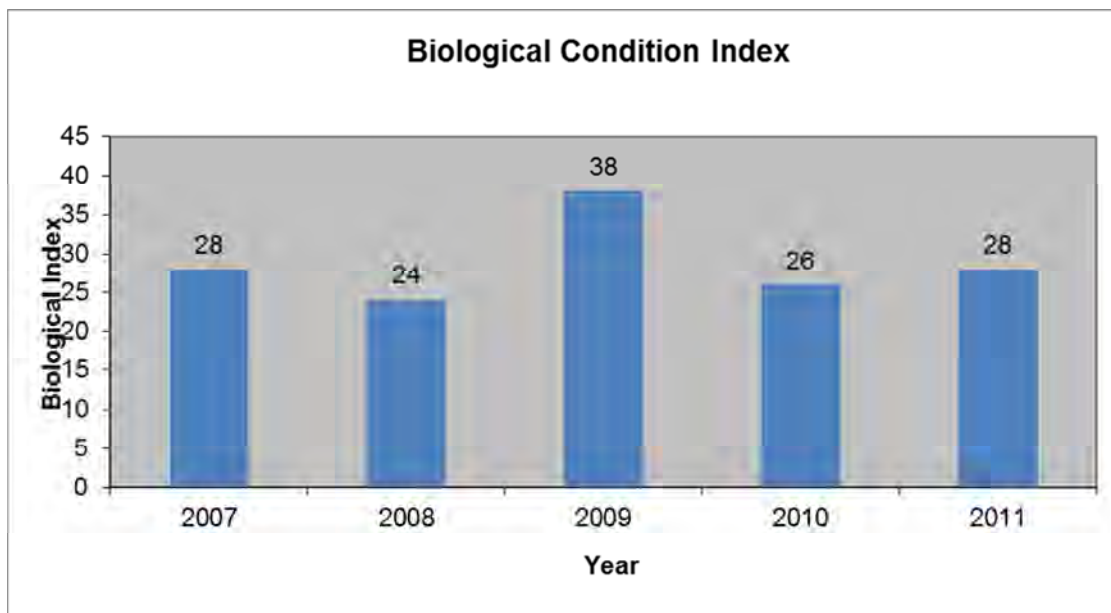
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: Little Snake Creek received a biological condition rating of nonimpaired in 2011.

Biological Condition		
Year	Score	Rating
2007	28	Slightly Impaired
2008	24	Slightly Impaired
2009	38	Nonimpaired
2010	26	Slightly Impaired
2011	28	Nonimpaired



North Fork Cowanesque River at North Fork, PA (NFCR 7.6)

Group 2

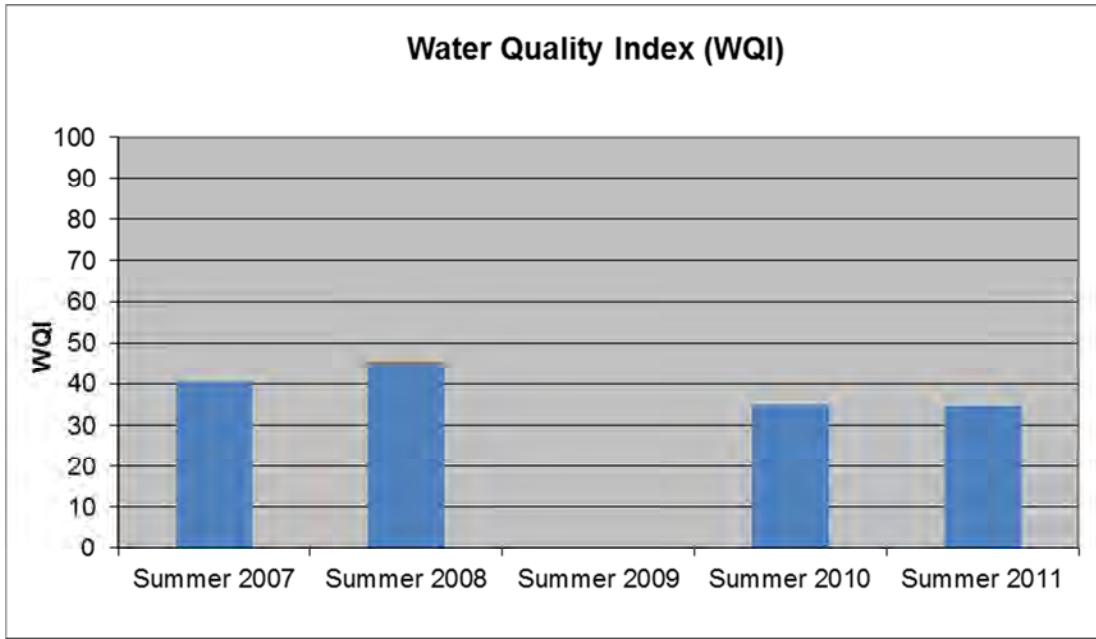


Habitat Condition:

Physical habitat at the site was rated as excellent, receiving a score of 193 out of a possible 220 points. SRBC staff noted wide riparian buffer widths and a mostly undisturbed watershed during the site visit.

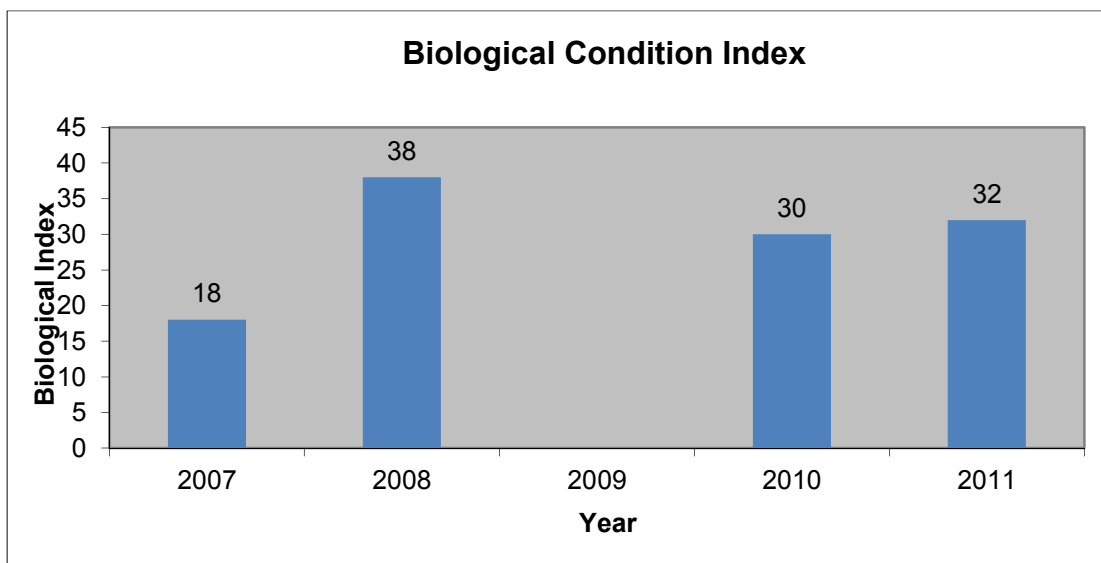
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: NFCR 7.6's macroinvertebrate community received a nonimpaired classification in 2011.

Biological Condition		
Year	Score	Rating
2007	18	Moderately Impaired
2008	38	Nonimpaired
2009	NA	NA
2010	30	Nonimpaired
2011	32	Nonimpaired



Seely Creek at Seely Creek, NY (SEEL 10.8)

Group 1

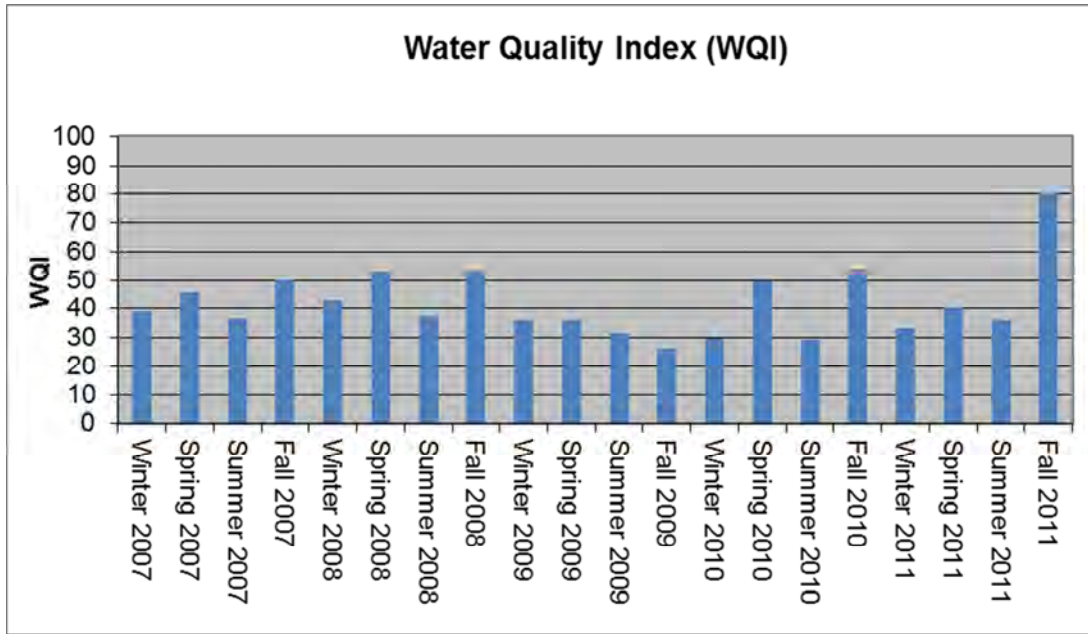


Habitat Condition:

Available physical habitat was classified as supporting in 2011. SRBC staff noted construction activities occurring at the site throughout the duration of the 2011 sampling year. These activities negatively impacted available habitat immediately downstream of the sampling site.

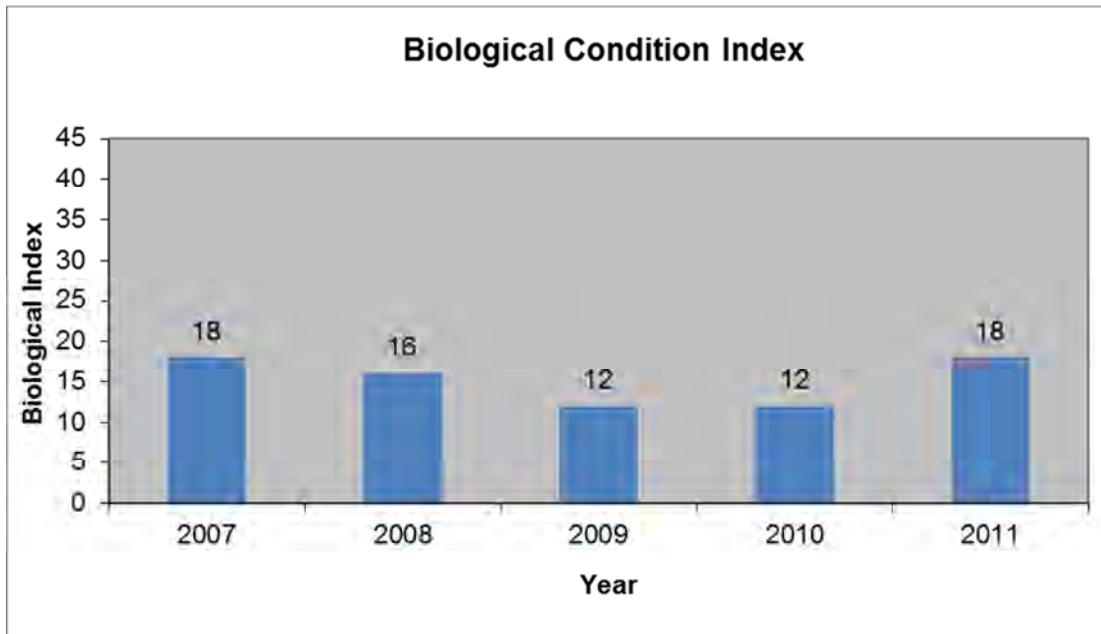
Water Quality:

Total iron concentration was measured to be in excess of accepted water quality criteria.



Biological Condition: SEEL 10.8 received a biological condition rating of slightly impaired in 2011.

Biological Condition		
Year	Score	Rating
2007	18	Moderately Impaired
2008	16	Moderately Impaired
2009	12	Moderately Impaired
2010	12	Moderately Impaired
2011	18	Slightly impaired



Snake Creek at Brookdale, PA (SNAK 2.3)

Group 2

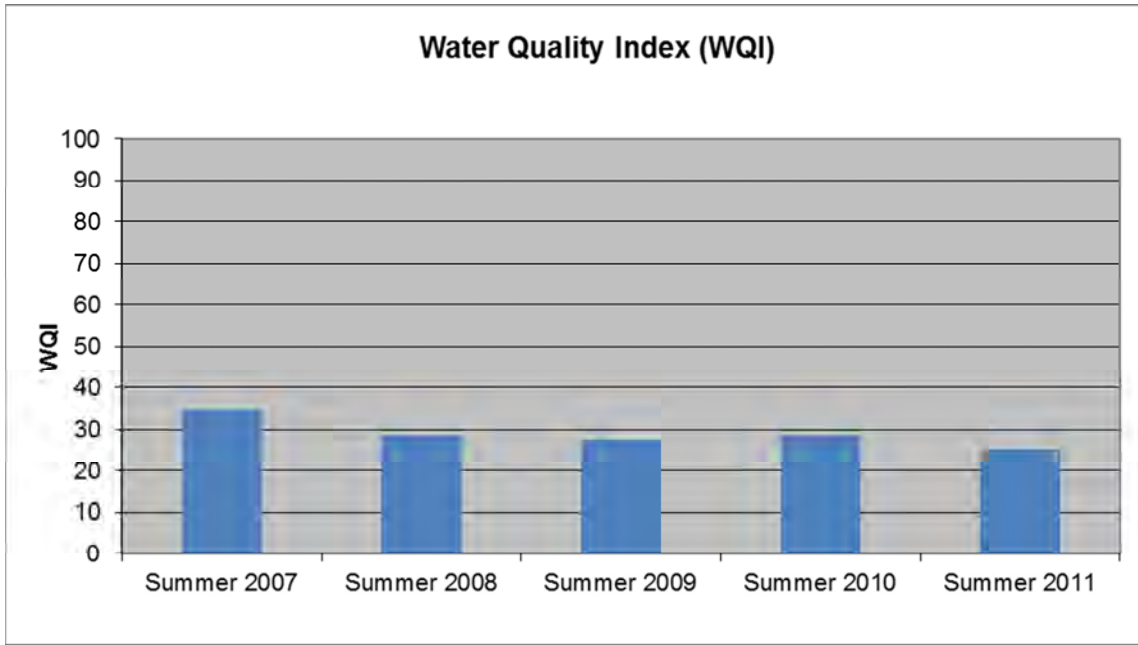


Habitat Condition:

Physical habitat at Snake Creek was rated as supporting in 2011. SRBC staff noted bank instability and residual impacts from recent construction activities at the site.

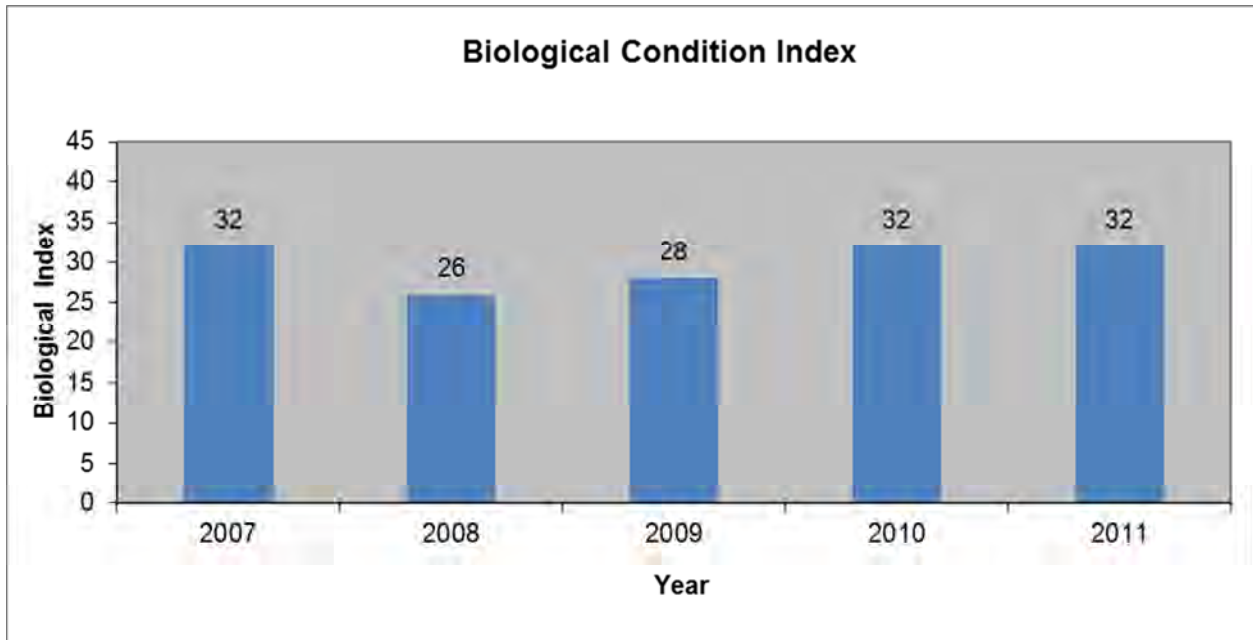
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: The macroinvertebrate community of Snake Creek received a classification of nonimpaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	32	NA
2008	26	Nonimpaired
2009	28	Slightly Impaired
2010	32	Slightly Impaired
2011	32	Nonimpaired



South Creek at Fassett, PA (SOUT 7.6)

Group 2

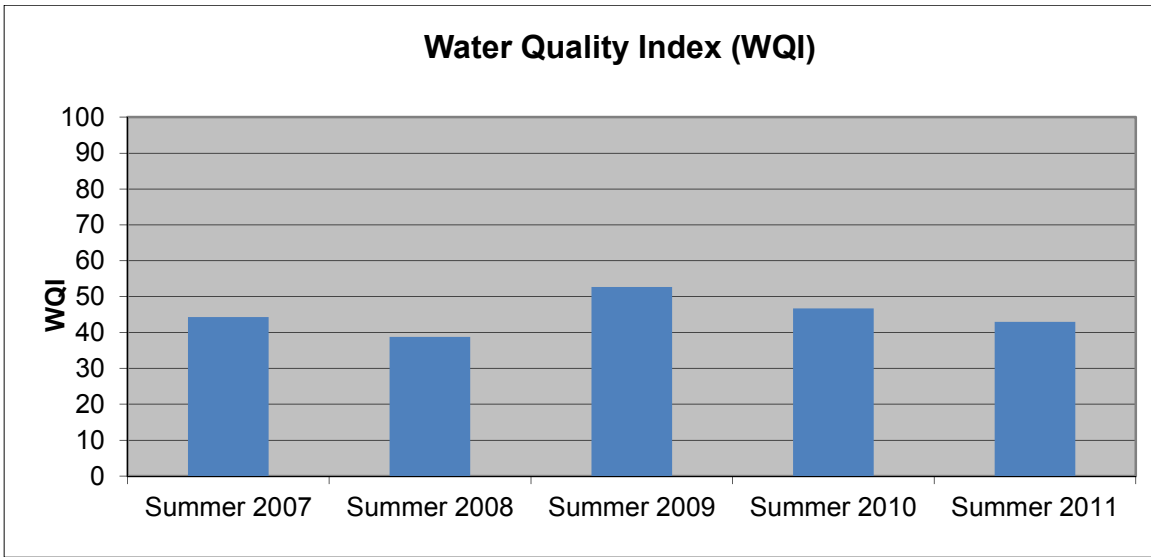


Habitat Condition:

Available physical habitat was rated as supporting. The site possessed good epifaunal substrate and instream cover; however, sedimentation was problematic at the monitoring site.

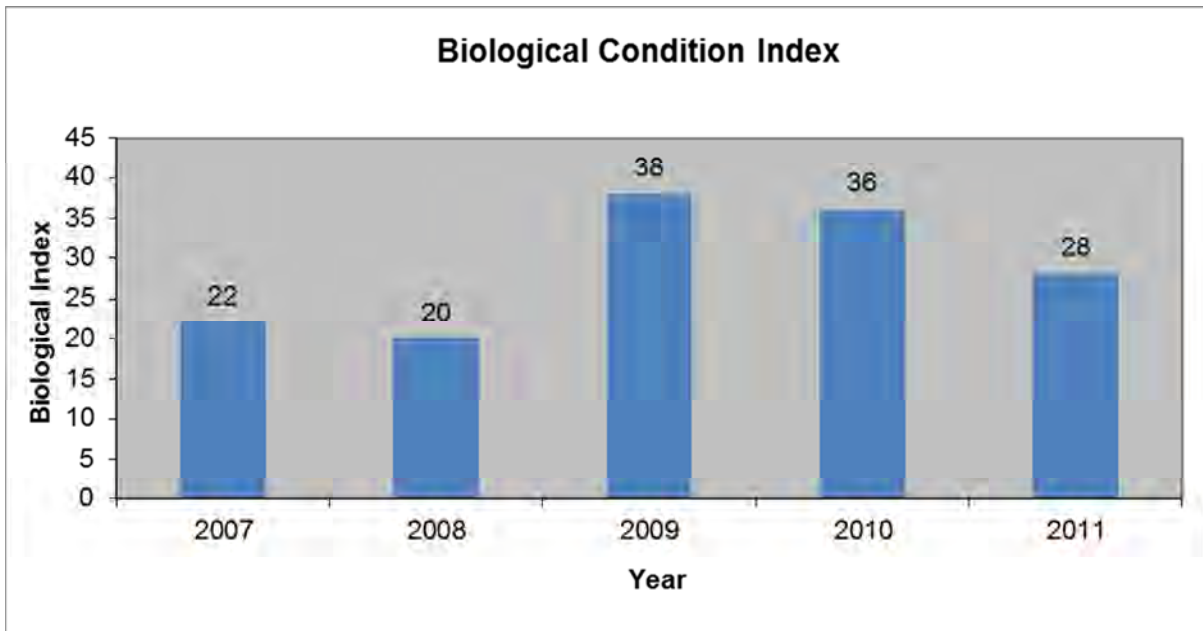
Water Quality:

A pH measurement of 8.98 recorded in summer 2011 fell outside of established water quality criteria.



Biological Condition: South Creek possessed a nonimpaired biological community when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	22	Slightly Impaired
2008	20	Slightly Impaired
2009	38	Nonimpaired
2010	36	Nonimpaired
2011	28	Nonimpaired



Troups Creek at Austinburg, PA (TRUP 4.5)

Group 1

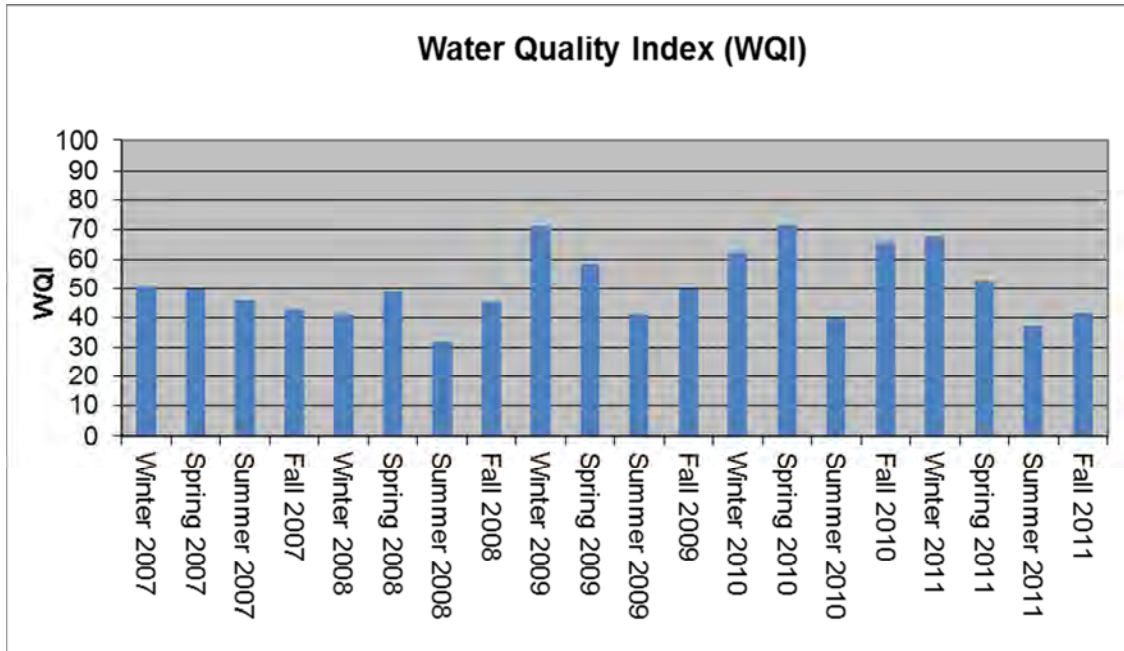


Habitat Condition:

SRBC staff classified available physical habitat at Troups Creek as being supporting. Significant bank erosion continued to impact conditions at the site. Pre-construction activities for bridge repairs were occurring in fall 2011, indicating potential future impacts.

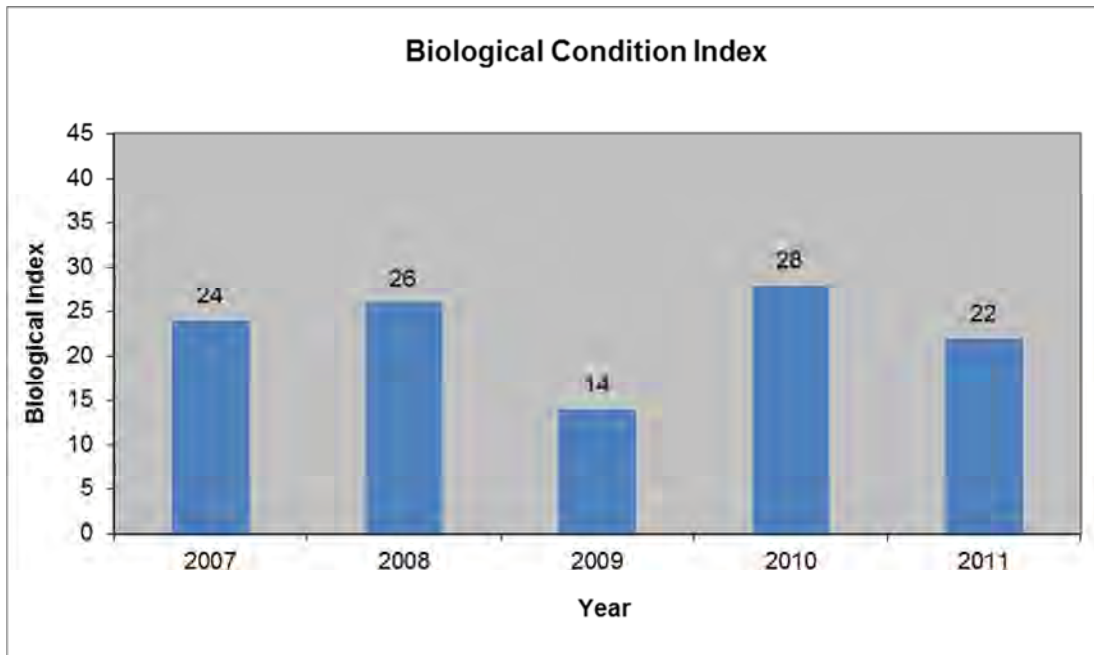
Water Quality:

A pH value of 8.86, falling outside of accepted water quality criteria, was recorded in June 2011.



Biological Condition: The macroinvertebrate community was rated as slightly impaired when sampled in 2011.

Biological Condition		
Year	Score	Rating
2007	24	Slightly Impaired
2008	26	Slightly Impaired
2009	14	Moderately Impaired
2010	28	Slightly Impaired
2011	22	Slightly Impaired



Trowbridge Creek at Great Bend, PA (TROW 1.8)

Group 2

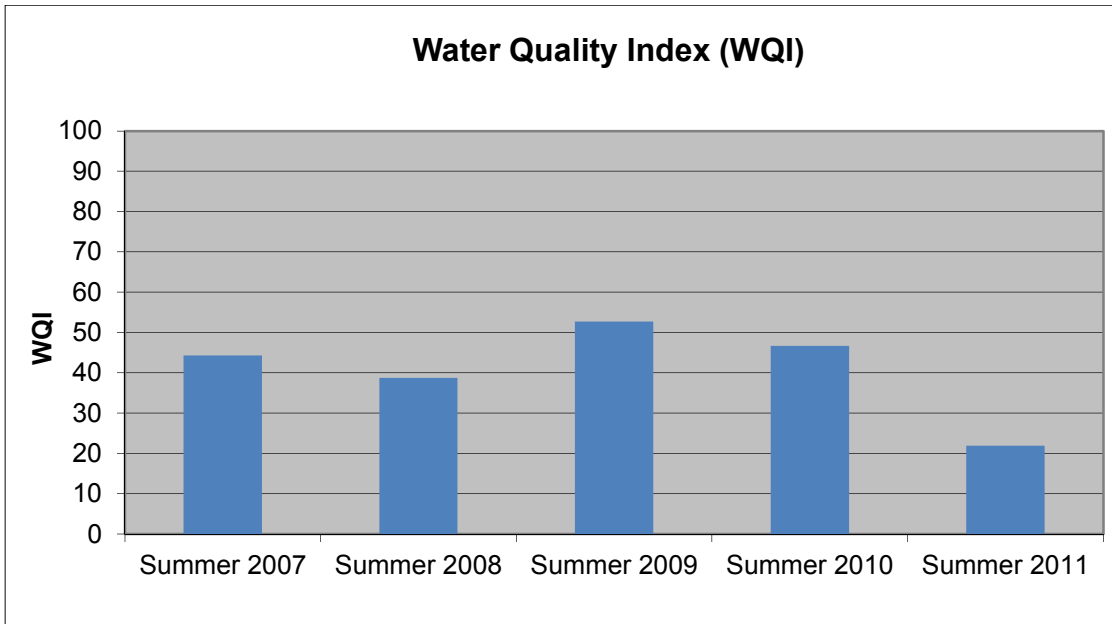


Habitat Condition:

Physical habitat was rated as supporting when assessed in 2011. The site scored 154 out of a possible 220, losing significant points for poor bank conditions.

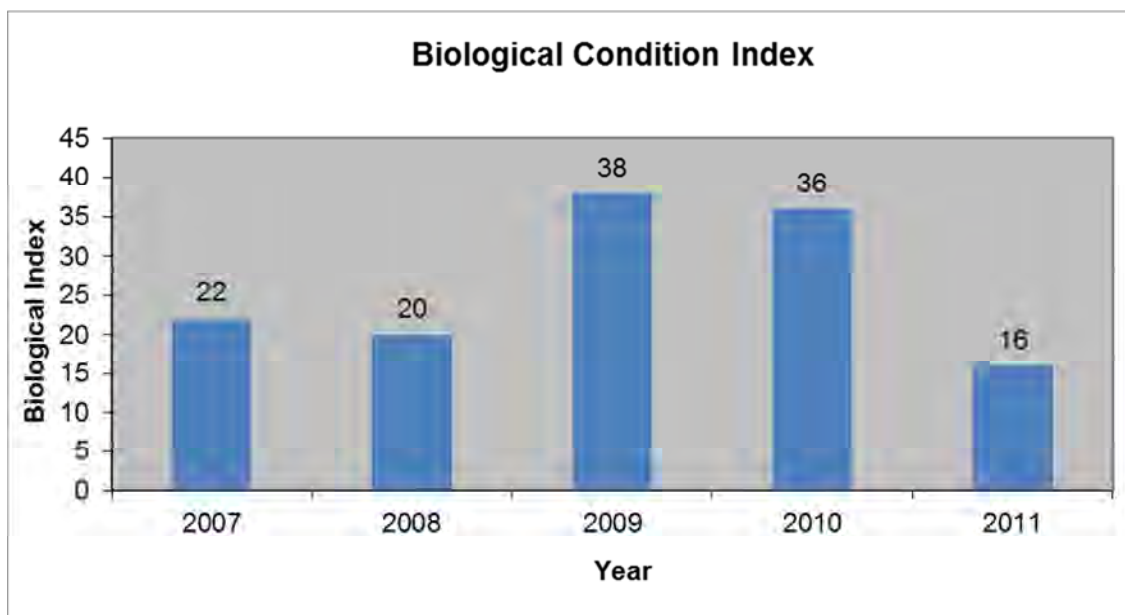
Water Quality:

All measured water quality parameters were within acceptable limits when tested in 2011.



Biological Condition: TROW 1.8 received a macroinvertebrate community designation of slightly impaired in 2011, a departure from prior nonimpaired classifications.

Biological Condition		
Year	Score	Rating
2007	22	Slightly Impaired
2008	20	Slightly Impaired
2009	38	Nonimpaired
2010	36	Nonimpaired
2011	16	Slightly Impaired



Wappasening Creek at Nichols, NY (WAPP 2.6)

Group 2

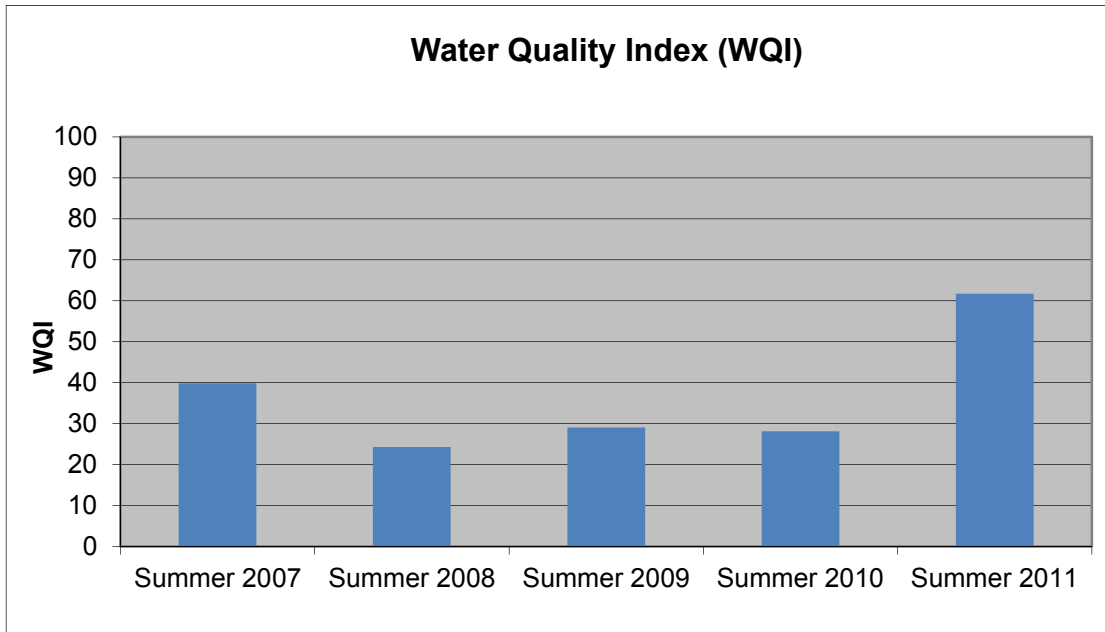


Habitat Condition:

Available physical habitat at WAPP 2.6 was classified as supporting in 2011. SRBC staff noted a lack of instream cover and variability in velocity/depth regimes.

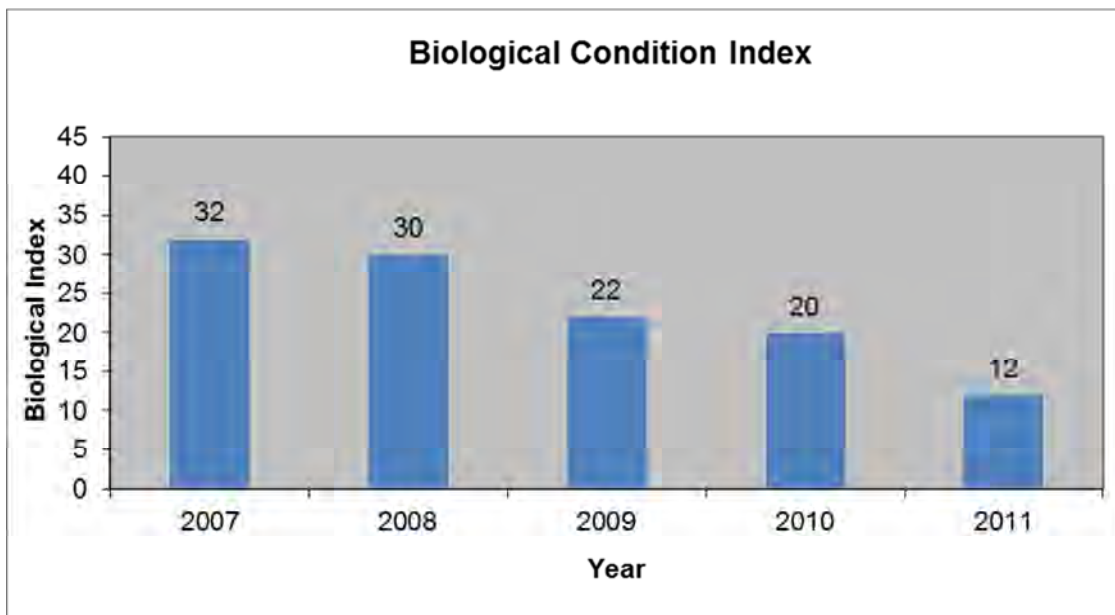
Water Quality:

Total iron concentration was found to be in excess of accepted water quality criteria.



Biological Condition: The macroinvertebrate community was classified as moderately impaired in 2011.

Biological Condition		
Year	Score	Rating
2007	32	Slightly Impaired
2008	30	Slightly Impaired
2009	22	Slightly Impaired
2010	20	Slightly Impaired
2011	12	Moderately impaired



Site Results for Group 3 Streams on the New York-Pennsylvania Border

Babcock Run (BABC)

Group 3



Biological Condition		
Year	Score	Rating
2007	26	Slightly Impaired
2008	22	Slightly Impaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	14	Moderately Impaired

In May 2011, SRBC staff assessed Babcock Run near Cadis, Pa. Overall physical habitat was rated as supporting within minimal channel alteration with frequent, well-developed riffles. The station suffered biologically from poor taxonomic richness and possessed relatively few EPT taxa. All water quality parameters tested within acceptable limits.

Bill Hess Creek (BILL)

Group 3



Biological Condition		
Year	Score	Rating
2007	16	Moderately Impaired
2008	16	Moderately Impaired
2009	22	Slightly Impaired
2010	28	Slightly Impaired
2011	18	Slightly Impaired

Bill Hess Creek, located near Route 49 in Nelson, Pa., received a biological condition rating of slightly impaired when sampled in 2011. This represents the third consecutive year the stream has attained this classification. The macroinvertebrate sample scored well on the Shannon Diversity Index but lacked significant numbers of EPT taxa. Overall physical habitat was rated as supporting. All water quality parameters tested within acceptable limits.

Bird Creek (BIRD)

Group 3



Biological Condition		
Year	Score	Rating
2007	28	Slightly Impaired
2008	28	Slightly Impaired
2009	30	Nonimpaired
2010	30	Nonimpaired
2011	18	Slightly Impaired

SRBC staff assessed Bird Creek located near Webb Mills, N.Y., in May 2011. Water chemistry parameters measured in the field were all within accepted criteria. Overall available physical habitat was rated as supporting. Streambank erosion issues identified in prior surveys remained evident in the 2011 habitat assessment. The biological condition rating of Bird Creek declined to slightly impaired after two years of attaining a nonimpaired status. The macroinvertebrate sample possessed a large proportion of Ephemeroptera taxa but did score poorly on the modified Hilsenhoff Index.

Biscuit Hollow (BISC)

Group 3



Biological Condition		
Year	Score	Rating
2007	22	Slightly Impaired
2008	NA	NA
2009	10	Moderately Impaired
2010	24	Slightly Impaired
2011	22	Slightly Impaired

Biscuit Hollow, near Austinburg, Pa., received a biological condition rating of slightly impaired when SRBC staff evaluated the stream in May 2011. BISC possessed the highest taxonomic richness of all Group 3 streams surveyed in 2011, netting 29 distinct taxa. Available physical habitat was rated as excellent and conditions continued to improve as surrounding pasture lands revert back to forest. All measured water quality parameters fell within accepted limits.

Briggs Hollow Run (BRIG)

Group 3



Biological Condition		
Year	Score	Rating
2007	24	Slightly Impaired
2008	26	Slightly Impaired
2009	26	Slightly Impaired
2010	30	Nonimpaired
2011	24	Slightly Impaired

Briggs Hollow Run near Nichols, N.Y., received a slightly impaired rating of its biological community in 2011. The macroinvertebrate sample contained good taxonomic evenness and a favorable Shannon Diversity Index score. Available physical habitat was rated as supporting with minimal embeddedness and good riffle frequency. Bank conditions were problematic with poor vegetative protective cover on the left descending bank. All measured water quality parameters tested within acceptable limits.

Bulkley Brook (BULK)

Group 3



Biological Condition		
Year	Score	Rating
2007	12	Moderately Impaired
2008	NA	NA
2009	26	Slightly Impaired
2010	32	Nonimpaired
2011	26	Slightly Impaired

SRBC staff evaluated Bulkley Brook, near Knoxville, Pa., in May 2011. BULK received a biological condition rating of slightly impaired and a habitat assessment rating of supporting. The site possessed generally favorable habitat conditions despite lower flow conditions at the time of the survey. All measured water quality parameters tested within acceptable limits.

Camp Brook (CAMP)

Group 3



Biological Condition		
Year	Score	Rating
2007	26	Slightly Impaired
2008	24	Slightly Impaired
2009	8	Moderately Impaired
2010	12	Moderately Impaired
2011	28	Nonimpaired

Camp Brook, located outside of Osceola, Pa., received a nonimpaired biological condition assessment in 2011. The macroinvertebrate sample taken from this stream possessed the best overall rating since the 2006 monitoring year. Despite receiving mostly sub-optimal physical habitat parameter ratings, the overall assessment classified the stream as supporting. Key areas for improvement included velocity/depth regimes and sediment deposition. All measured water quality parameters tested within acceptable limits.

Cook Hollow (COOK)

Group 3



Biological Condition		
Year	Score	Rating
2007	28	Slightly Impaired
2008	26	Slightly Impaired
2009	24	Slightly Impaired
2010	28	Slightly Impaired
2011	22	Slightly Impaired

Cook Hollow Brook, near Austinburg, Pa., attained a biological condition rating of slightly impaired for the sixth consecutive year. The available physical habitat was rated as excellent featuring a minimally altered channel and frequent riffles. Bank conditions and vegetative protective widths received the highest scores of all Group 3 streams monitored in 2011. All measured water quality parameters tested within acceptable limits.

Deep Hollow Brook (DEEP)

Group 3



Biological Condition		
Year	Score	Rating
2007	40	Nonimpaired
2008	26	Slightly Impaired
2009	30	Nonimpaired
2010	30	Nonimpaired
2011	24	Slightly Impaired

Deep Hollow Brook, assessed near Danville, N.Y., received a biological condition rating of slightly impaired in 2011. Available physical habitat was deemed excellent as the stream is located in a mostly forested drainage. Deep Hollow Brook possessed a diverse macroinvertebrate community but was limited by a high proportion of a single dominant taxa. Alkalinity was determined to be 18 mg/L which falls under Pennsylvania's water quality criteria of 20 mg/L.

Denton Creek (DENT)

Group 3



Biological Condition		
Year	Score	Rating
2007	20	Moderately Impaired
2008	22	Slightly Impaired
2009	18	Slightly Impaired
2010	14	Moderately Impaired
2011	10	Moderately Impaired

SRBC staff assessed Denton Creek near the Hawkins Pond Nature Area outside of Hickory Grove, Pa., in May 2011. The stream received a biological condition rating of moderately impaired. Limiting biological conditions were low overall taxonomic richness and a high (33 percent) proportion of pollution tolerant Chiromidae taxa. Measured alkalinity was found to be 12 mg/L which is below the Pennsylvania water quality criteria of 20 mg/L. Available physical habitat was rated as excellent with optimal epifaunal substrate and instream cover.

Dry Brook (DRYB)

Group 3



Biological Condition		
Year	Score	Rating
2007	2	Severely Impaired
2008	8	Slightly Impaired
2009	10	Moderately Impaired
2010	26	Slightly Impaired
2011	16	Moderately Impaired

Dry Brook, sampled in Waverly, Pa., possessed a moderately impaired biological community when sampled in May 2011. Available physical habitat was classified as supporting. Dry Brook continues to be one of the most impaired Group 3 streams within the monitoring project. Draining a highly developed and populated watershed, depressed biological conditions have persisted at this site throughout the majority of the duration of the Interstate Streams Monitoring Project. All measured water quality parameters tested within acceptable limits.

Little Wappasening Creek (LWAP)

Group 3



Biological Condition		
Year	Score	Rating
2007	NA	NA
2008	30	Slightly Impaired
2009	28	Nonimpaired
2010	36	Nonimpaired
2011	24	Slightly Impaired

Little Wappasening Creek near Nichols, N.Y., received a biological condition rating of slightly impaired when assessed by SRBC staff in May 2011. Supported by available physical habitat rated as excellent, the stream continued to score well across a variety of macroinvertebrate evaluation indices. All measured water quality parameters tested within acceptable limits.

Parks Creek (PARK)

Group 3



Biological Condition		
Year	Score	Rating
2007	24	Slightly Impaired
2008	26	Slightly Impaired
2009	26	Slightly Impaired
2010	24	Slightly Impaired
2011	28	Nonimpaired

Parks Creek near Litchfield, N.Y., was designated as having a nonimpaired biological community in 2011 after receiving a rating of slightly impaired for the previous six years. The biological community received high scores in the Modified Hilsenhoff Index, percent Ephemeroptera, and percent Chironomidae in particular. Available physical habitat was classified as supporting. All measured field chemistry parameters were within acceptable limits at the time of sampling.

Prince Hollow Run

Group 3



Biological Condition		
Year	Score	Rating
2007	8	Moderately Impaired
2008	14	Moderately Impaired
2009	16	Moderately Impaired
2010	20	Slightly Impaired
2011	24	Slightly Impaired

Prince Hollow Run near Cadis, Pa., received a biological condition rating of slightly impaired when sampled in May 2011. Despite the sub-optimal biological rating, the stream has continued to show gradual improvement from previous sampling efforts. The biological community scored well in most categories with the exception of the EPT Index. Available physical habitat was rated as supporting. All measured water quality parameters tested within acceptable limits.

Redhouse Run/Beagle Hollow (REDH)

Group 3



Biological Condition		
Year	Score	Rating
2007	22	Slightly Impaired
2008	NA	NA
2009	22	Slightly Impaired
2010	34	Nonimpaired
2011	24	Slightly Impaired

Redhouse Run (Beagle Hollow) located near Osceola, Pa., received a biological condition rating of slightly impaired in 2011. The stream did have a measured pH value of 8.65 which is above the water quality standards of the state of New York. Available physical habitat was rated as supporting. Habitat areas of concern are primarily on the left descending bank which lies adjacent to Holden Brook Rd. SRBC staff noted a narrow riparian buffer and a lack of vegetative protective cover.

Russell Run (RUSS)

Group 3



Biological Condition		
Year	Score	Rating
2007	22	Slightly Impaired
2008	28	Slightly Impaired
2009	24	Slightly Impaired
2010	24	Slightly Impaired
2011	14	Moderately Impaired

Russell Run near Windham, Pa., had a moderately impaired biological community when sampled in May 2011. This designation represents declining conditions when compared to previous data. In May 2006, the biological community was rated as nonimpaired. Physical habitat remains designated as supporting and all measured water quality parameters tested within acceptable limits.

Sacket Creek (SACK)

Group 3



Biological Condition		
Year	Score	Rating
2007	28	Slightly Impaired
2008	28	Slightly Impaired
2009	32	Nonimpaired
2010	26	Slightly Impaired
2011	22	Slightly Impaired

SRBC staff surveyed Sackett Creek near Nichols, N.Y., in May 2011. The biological condition was rated as slightly impaired and available physical habitat was deemed supporting. Instream habitat features rated well, though the site appeared limited by unstable, eroding banks. Biological conditions were limited by few low taxonomic richness, particularly few EPT taxa. All measured water quality parameters tested within acceptable limits.

Smith Creek (SMIT)

Group 3



Biological Condition		
Year	Score	Rating
2007	34	Nonimpaired
2008	38	Nonimpaired
2009	26	Slightly Impaired
2010	36	Nonimpaired
2011	8	Moderately Impaired

Located near East Lawrence, Pa., Smith Creek was surveyed by SRBC staff in May 2011. In 2010, Smith Creek was designated as the reference site to which all other Group 3 streams were compared. While physical habitat remained excellent, the biological condition of the stream was rated as moderately impaired. It is noted that the macroinvertebrate sample for this site did not contain enough organisms for a quality subsample. Biological conditions reported in 2011 may not accurately reflect the condition of the stream. All measured water quality parameters tested within acceptable limits.

Strait Creek (STRA)

Group 3



Biological Condition		
Year	Score	Rating
2007	26	Slightly Impaired
2008	30	Slightly Impaired
2009	18	Slightly Impaired
2010	30	Nonimpaired
2011	32	Nonimpaired

Possessing the highest biological condition score of all Group 3 streams in 2011, Strait Creek near Nelson, Pa., was designated as the reference stream to which all other Group 3 streams were compared. All measured water quality parameters tested within acceptable limits. Available physical habitat conditions continue to improve and were rated as excellent. In 2011, Strait Creek possessed the best combination of biological condition, water quality, and available physical habitat amongst all Group 3 streams.

White Branch Cowanesque River (WBCO)

Group 3



Biological Condition		
Year	Score	Rating
2007	2	Severely Impaired
2008	6	Severely Impaired
2009	8	Moderately Impaired
2010	0	Severely Impaired
2011	4	Severely Impaired

Located immediately downstream of a recently completed reservoir, the White Branch of Cowanesque River received a biological condition rating of severely impaired. This site is the only Group 3 stream to receive this designation. Water quality parameters were found to be within accepted limits but the presence of the reservoir upstream and associated impacts appears to be severely restricting the biological community of the stream at the sampling site. Physical habitat assessed downstream of the reservoir and its influence was rated as excellent.

White Hollow (WHIT)

Group 3



Biological Condition		
Year	Score	Rating
2007	36	Nonimpaired
2008	23	Slightly Impaired
2009	24	Slightly Impaired
2010	22	Slightly Impaired
2011	22	Slightly Impaired

White Hollow, near Wellsburg, N.Y., received a biological condition rating of slightly impaired when sampled in May 2011. Available physical habitat was designated as excellent, featuring optimal riffle frequency and minimal channel alteration and embeddedness. Measured water quality parameters were all within acceptable limits.

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Appendix

Narrative Descriptions of Stream Biological Integrity Associated with Each of the IBI Categories (Roth et al., 2000)

Good	IBI score 4.0-5.0	Comparable to reference streams considered to be minimally impacted. On average, biological metrics fall within the upper 50% of reference site conditions.
Fair	IBI score 3.0-3.9	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of these minimally impacted streams. On average, biological metrics are within the lower portion of the range of reference sites (10 th to 50 th percentile).
Poor	IBI score 2.0-2.9	Significant deviation from reference conditions, with many aspects of biological integrity not resembling qualities of minimally degraded streams, indicating some degradation. On average, biological metrics fall below the 10 th percentile of reference site values.
Very Poor	IBI score 1.0-1.9	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally impacted streams, indicating severe degradation. On average, biological metrics fall below the 10 th percentile of reference site values; most or all metrics are below this level.

Criteria Used to Evaluate Physical Habitat

Habitat Parameter	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
1. Epifaunal Substrate (R/R)¹	Well-developed riffle/run; riffle is as wide as stream and length extends 2 times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than 2 times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the width; some cobble present.	Riffle or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
1. Epifaunal Substrate (G/P)²	Preferred benthic substrate abundant throughout stream site and at stage to allow full colonization (i.e., log/snags that are not new fall and not transient).	Substrate common but not prevalent or well suited for full colonization potential.	Substrate frequently disturbed or removed.	Substrate unstable or lacking.
2. Instream Cover (R/R)	> 50% mix of boulders, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	< 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.
2. Instream Cover (G/P)	> 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	30-50% mix of stable habitat; adequate habitat for maintenance of populations.	10-30% mix of stable habitat; habitat availability less than desirable.	Less than 10% stable habitat; lack of habitat obvious.
3. Embeddedness^a (R/R)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediments.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediments.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediments.	Gravel, cobble, and boulder particles are >75% surrounded by fine sediments.
3. Pool Substrate Characterization (G/P)	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
4. Velocity/Depth Regimes^b (R/R)	All 4 velocity/depth regimes present (slow/deep, slow/shallow, fast/deep, fast/shallow).	Only 3 of 4 regimes present (if fast/shallow is missing, score lower than if missing other regimes).	Only 2 of 4 regimes present (if fast/shallow or slow/shallow are missing, score low).	Dominated by 1 velocity/depth regime.
4. Pool Variability^c (G/P)	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.

Criteria Used to Evaluate Physical Habitat—Continued

Habitat Parameter	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
5. Sediment Deposition (R/R)	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; >50% of the bottom changing frequently; pools almost absent due to sediment deposition.
5. Sediment Deposition (G/P)	Less than 20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of island of point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial movement during storm events.	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to substantial sediment deposition.
6. Channel Flow Status (R/R) (G/P)	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
7. Channel Alteration^d (R/R) (G/P)	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 yr) may be present, but not recent.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; >80% of the reach channelized and disrupted.
8. Frequency of Riffles (R/R)	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the stream width is between 15-25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is >25.
8. Channel Sinuosity (G/P)	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long time.
9. Condition of Banks^e (R/R) (G/P)	Banks stable; no evidence of erosion or bank failure, little potential for future problems; <5% of bank affected; on Glide/Pool streams side slopes generally <30%.	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion; on Glide/Pool streams side slopes up to 40% on one bank; slight erosion potential in extreme floods.	Moderately unstable, 30-60% of banks in reach have areas of erosion; high erosion potential during floods; on Glide/Pool streams side slopes up to 60% on some banks.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars; on Glide/Pool streams side slopes > 60% common.
(score each bank 0-10)	(9-10)	(6-8)	(3-5)	(0-2)

Criteria Used to Evaluate Physical Habitat—Continued

Habitat Parameter	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
10. Vegetative Protective Cover (R/R) (G/P) (score each bank 0-10)	>90% of the streambank surfaces covered by vegetation; vegetative disruption through grazing or mowing minimal. (9-10)	70-90% of the streambank surfaces covered by vegetation; disruption evident but not affecting full plant growth potential to any great extent. (6-8)	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation. (3-5)	<50% of the streambank surfaces covered by vegetation; disruption is very high; vegetation removed to 5 cm or less. (0-2)
11. Riparian Vegetative Zone Width (R/R) (G/P) (score each bank 0-10)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone. (9-10)	Width or riparian zone 12-18 meters; human activities have impacted zone only minimally. (6-8)	Width of riparian zone 6-12 meters; human activities have impacted zone only minimally. (3-5)	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. (0-2)

- ¹ R/R – Riffle/Run Habitat assessment parameters used for streams characterized by riffles and runs.
- ² G/P – Glide/Pool Habitat assessment parameters used for streams characterized by glides and pools.
- ^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 Velocity/Depth Regimes The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow.
- ^c Pool Variability 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. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.
- ^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.
- ^e Condition of Banks Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks and are therefore considered to be unstable. Left and right bank orientation is determined by facing downstream.

Source: Modified from Barbour et al., 1999.

***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 200-organism subsample. Number decreases with increasing stress.
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. Index value decreases with increasing stress.
3. Modified Hilsenhoff Biotic Index (a)	A measure of the organic pollution tolerance of a benthic macroinvertebrate community. Index value increases with increasing stress.
4. EPT Index (a)	The total number of Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichoptera (caddisfly) taxa present in the 200-organism subsample. Number decreases with increasing stress.
5. Percent Ephemeroptera (a)	The percentage of Ephemeroptera in the 200-organism subsample. Percentage decreases with increasing stress.
6. Percent Dominant Taxa (a)	Percentage of the taxon with the largest number of individuals out of the total number of macroinvertebrates in the sample. Percentage increases with increasing stress.
7. Percent Chironomidae (a)	The percentage of Chironomidae in a 200-organism subsample. Percentage increases with increasing stress.

Sources: (a) Barbour et al., 1999 (b) Klemm et al., 1990

Summary of Criteria Used to Classify the Biological Conditions of Sample Sites

SAMPLING AND ANALYSIS



TOTAL BIOLOGICAL SCORE DETERMINATION				
Metric	Biological Condition Scoring Criteria			
	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. Percent Ephemeroptera (c)	>25 %	10 – 25 %	1 – 9 %	<1 %
6. Percent Chironomidae (c)	<5 %	5 – 20 %	21 – 35 %	>36 %
7. Percent Dominant Taxa (c)	<20 %	20 – 30 %	31 – 40 %	>40 %
Total Biological Score (d)				



BIOASSESSMENT	
Percent Comparability of Study and Reference Site Total Biological Scores (e)	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) Scoring criteria evaluate actual percent contribution, not percent comparability to the reference station.
- (d) Total Biological Score = the sum of Biological Condition Scores assigned to each metric.
- (e) Values obtained that are intermediate to the indicated ranges will require subjective judgment as to the correct placement into a biological condition category.

Summary of Criteria Used to Classify the Habitat Conditions of Sample Sites

DETERMINATION OF HABITAT ASSESSMENT SCORES				
Parameter	Habitat Parameter Scoring Criteria			
	Excellent	Good	Fair	Poor
Epifaunal Substrate	20-16	15-11	10-6	5-0
Instream Cover	20-16	15-11	10-6	5-0
Embeddedness/Pool Substrate	20-16	15-11	10-6	5-0
Velocity/Depth Regimes/Pool Variability	20-16	15-11	10-6	5-0
Sediment Deposition	20-16	15-11	10-6	5-0
Channel Flow Status	20-16	15-11	10-6	5-0
Channel Alteration	20-16	15-11	10-6	5-0
Frequency of Riffles/Channel Sinuosity	20-16	15-11	10-6	5-0
Condition of Banks (a)	20-16	15-11	10-6	5-0
Vegetative Protective Cover (a)	20-16	15-11	10-6	5-0
Riparian Vegetative Zone Width (a)	20-16	15-11	10-6	5-0
Habitat Assessment Score (b)				



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) Combined score of each bank
- (b) Habitat Assessment Score = Sum of Habitat Parameter Scores