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Chemung Subbasin Small Watershed Study: Cohocton River

A Water Quality and Biological Assessment, April 2007 - February 2008

The Susquehanna River Basin Commission (SRBC) completed a water quality survey in the Cohocton River Watershed from April 2007-February 2008 as part of the Year-2 small watershed study in the Chemung Subbasin (Figure 1). Year-1 and Year-2 surveys are part of SRBC's Subbasin Survey Program, which is funded in part by the United States Environmental Protection Agency (USEPA). This program consists of two-year assessments in each of the six major subbasins in the Susquehanna River Basin on a rotating schedule. The Year-1 studies are broad-brush, one-time samples of about 100 stream sites to assess water quality, macroinvertebrates, and physical habitat. The Year-2 studies focus on a particular region or small watershed within the major subbasin, and typically consist of quarterly sampling over a one-year period at a set number of sampling locations. SRBC conducted the Chemung Subbasin Year-1 study from June-August 2006 (Buda, 2007). The Year-2 sampling plan is tailored for the individual needs or concerns of a chosen watershed, and, through sampling seasonally at various flow regimes, a more detailed evaluation of the watershed can be made. For more information on SRBC's Subbasin Survey Program, see reports by Buda (2006 and 2007) and Steffy (2007). These reports are posted on SRBC's web site at *www.srbc.net/pubinfo/techdocs/Publications/techreports.htm.*

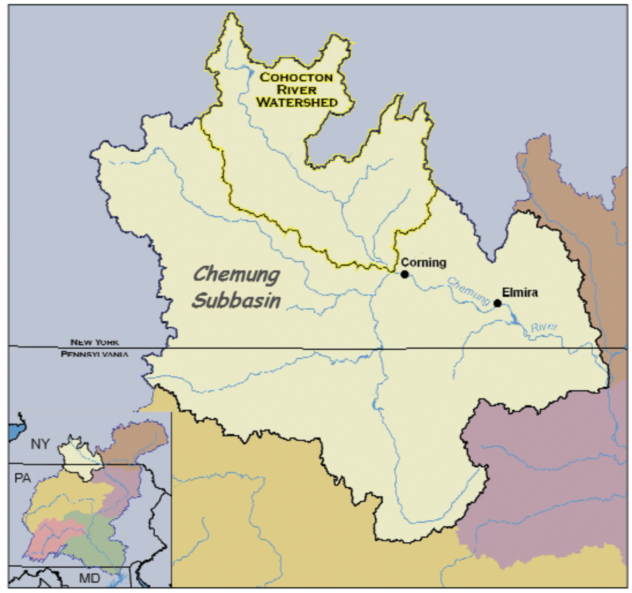


Figure 1. *Location of Cohocton River Watershed in the Chemung River Subbasin*

Headwaters of the Cohocton River west of Atlanta, N.Y.

The Cohocton River Watershed was chosen for the detailed Year-2 study for several reasons. During initial coordination meetings with state and local agencies in the area, many groups expressed interest in having additional data for the Cohocton River, as there has not been any recent ongoing monitoring in the watershed. Based on these coordination meetings, SRBC created a sampling plan, which included establishing 25 sampling locations to address numerous potential issues in the Cohocton River Watershed.

The Cohocton River Watershed is one of the major drainages in the Chemung Subbasin, and much of the land remains forested and undeveloped. However, agriculture does represent almost 20 percent of the land use in the watershed, and there are local concerns about the resulting impacts of nutrients and sediment. Nineteen sites were sampled throughout the watershed to assess ambient water quality and document nutrient levels likely resulting from agricultural practices.

The water quality of tributaries entering Lamoka and Waneta Lakes was another concern that was addressed in the sampling plan. To evaluate where excess nutrients in the lakes may be originating, SRBC sampled six sites around, between, and downstream of the lakes. Quarterly sampling at these 25 sites was conducted throughout the watershed to provide information for determining any temporal or spatial changes in water quality and to provide evidence of anthropogenic influence, particularly with regard to agricultural sources of nutrients or the possibility of other sources, such as septic systems.

In addition, due to the numerous large automobile salvage yards in the watershed, quarterly volatile organics sampling (specifically looking for BTEX - benzene, toluene, ethyl benzene, xylenes mix) also was incorporated upstream and downstream of two salvage yards to assess any surface water impacts from these facilities.

SRBC also has numerous other involvements in and around the Cohocton River Watershed that will benefit from the additional data provided from this project. Since October 2005, staff has been conducting water quality sampling on the Cohocton River at Campbell, N.Y., as part of the Chesapeake Bay Program's Non-tidal Water Quality Monitoring Network. Monthly nutrient and sediment data are collected, as well as seasonal storm samples, weather permitting. More information on this program can be found at *www.srbc.net/programs/CBP/nutrient-program.htm.*

Additionally, in 2007, SRBC expanded its Early Warning System (EWS) program into the New York State portion of the Susquehanna River Basin to protect public drinking water supplies. This program helps protect public water supplies that serve the almost 700,000 customers in the Elmira and Binghamton, N.Y., areas. The EWS program involves a monitoring network that helps minimize the impact from contaminant spills, and provides data for improving day-to-day treatment operations, further ensuring a continuous and safe supply of drinking water. The City of Elmira's water treatment facilities, included in the EWS network, are located downstream of the outlet of the Cohocton River. The treatment facility benefits from the real-time monitors that record temperature, turbidity, dissolved oxygen, and conductance. There is also an ultraviolet absorbance monitoring system, which can be used to detect organic contaminants. By monitoring these few major parameters continuously, any changes can be detected early, before they threaten the safe supply of drinking water. For more information on the EWS program at SRBC, go to *http://www.srbc.net/programs/docs/ EWSGeneral(2_07).pdf.*

This Year-2 watershed study will provide valuable biological, chemical, and habitat information to SRBC and other agencies, including the Upper Susquehanna Coalition (USC), New York State Department of Environmental Conservation (NYSDEC), Southern Tier Central Regional Planning and Development Board (STCRPB), the Soil and Water Conservation Districts of Steuben and Schuyler Counties, local citizens, and other interested parties.

DESCRIPTION of the Cohocton River Watershed

The Cohocton River Watershed drains 604 square miles and flows southeast through the southern tier of New York State (Figure 1). More than 80 percent of the watershed is located in Steuben County, with smaller sections located in Schuyler (ten percent), Livingston (three percent), Yates (two percent), and Ontario (less than one percent) counties. The Cohocton River and the Tioga River converge in the Village of Painted Post, N.Y., to form the mainstem of the Chemung River. Most of the streams in the Cohocton River Watershed, including all the sampling locations, are designated as either Class B or Class C waters, which are typically intended for primary and secondary recreation and fishing. Two sampling sites, the Cohocton River south of Avoca (about river mile 25.0) and the mouth of Meads Creek (MEAD 0.1), are in reaches designated as trout waters. In addition, Twelvemile Creek (TWVE 0.5) is listed by NYSDEC as trout spawning waters.

The Cohocton River Watershed is a primarily rural area with forested lands covering more than 75 percent of the basin. Agriculture makes up almost 20 percent of the watershed, and just over one percent is developed land. Two large lakes and numerous sizeable wetland areas make up most of the remaining area. The largest population center is Bath, located in the central region of Steuben County (Figure 2). Land use information is based on the 2000 land use coverage from the Chesapeake Bay Program.

The entire Cohocton River Watershed falls within Ecoregion 60, which is the Northern Appalachian Plateau. This ecoregion is a combination of agriculture and forested land and is considered a transition ecoregion between the more agricultural and urban ecoregions to the north and west and the more mountainous and forested ecoregions to the south and east. The geology of these areas consists mainly of sandstone and shale (*www.newyork.geology-forum.com*).

Recreational opportunities are abundant in the Cohocton River Watershed, with Lamoka and Waneta Lakes and the Cohocton River providing for many outdoor activities. NYSDEC maintains numerous public fishing areas along the entire extent of the river. Information on the location of these access areas, as well as fishing regulations for these areas, can be found under Region 8, Steuben County at *http://www.dec.ny.gov/outdoor/9924.html*.

The Cohocton River also provides opportunities for canoeing and kayaking, especially on the lower reaches and onto the Chemung River. There are three specific launches for canoes and kayaks: along Route 11 in the Town of Bath (sampling site COHO 16.5), at Wood Road in the Town of Campbell (sampling site COHO 9.7), and at Kinsella Park in the Town of Erwin (sampling site COHO 0.5). The Chemung Basin River Trail Partnership is an active organization in the area and was formed in 1999 to promote protection of the Chemung basin, including the Cohocton River Watershed. For more information on this group or to sign up for its newsletter, please see the partnership's web site at *http://www.chemungrivertrail.com*.

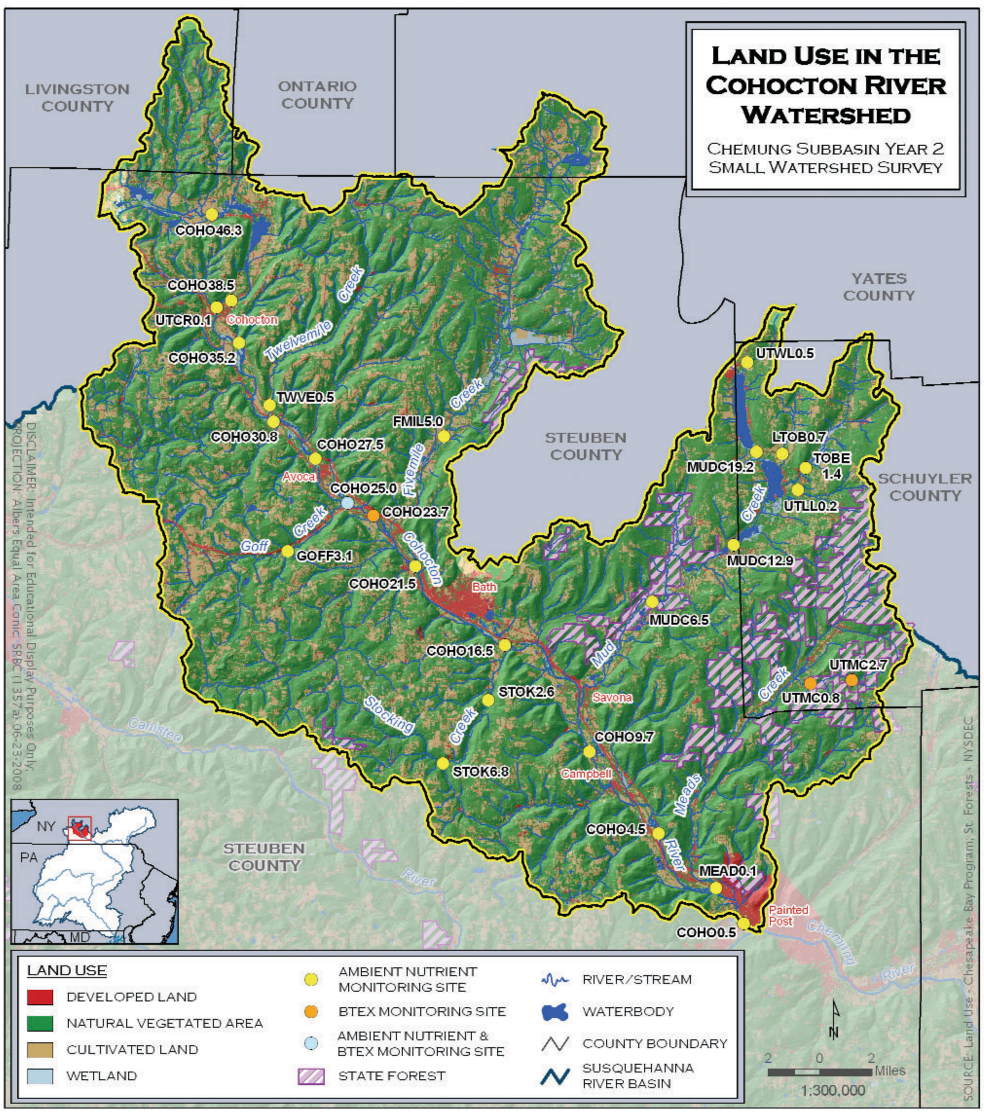


Figure 2. Land Use in the Cohocton River Watershed

METHODS

DATA COLLECTION

Between April 2007 and February 2008, SRBC staff collected quarterly water chemistry samples and measured stream discharge at 25 stream sites in the Cohocton River Watershed. Macroinvertebrate samples were collected, and habitat assessments were completed at each site in June 2007. Appendix A contains a list of station names, sampling location descriptions, drainage areas, and latitude and longitude coordinates for each of these sites. In addition, volatile organic samples were collected at one of the original 25 sites as well as three additional locations. These additional sites were located upstream and downstream of large automobile salvage yards and are listed in red in Appendix A. The site listed in blue was sampled for both volatile organics and nutrient parameters.

The sampling sites were selected so SRBC staff could collect biological, water quality, and habitat data from specific stream and river segments, as well as major tributaries, primarily to assess nutrient impacts. Water quality samples were collected in April 2007, July 2007, October 2007, and February 2008, and analyzed for field and laboratory parameters. Water was collected using a hand-held, depth-integrated sampler at six verticals across the stream channel. At locations that were not wadeable, a depth-integrated bridge sampler was used. The water was put into a churn splitter, mixed thoroughly, and split into two 500-ml bottles, one fixed with sulfuric acid for nutrients, two 125-ml bottles, one filtered, and both fixed with nitric acid for metals, and two amber pre-fixed vials for total organic carbon (TOC). Staff collected duplicate samples for lab chemistry once per day to meet quality assurance standards.

Additionally, staff collected two bottles, one fixed with nitric acid for additional analysis using a spectrophotometer. A glass sediment bottle also was filled for a suspended sediment sample at each site. These two analyses were completed in the SRBC laboratory.

Staff used the remaining water to complete field chemistry analysis. Temperature was measured in degrees Celsius with a field thermometer. A Cole-Parmer Model 5996 meter was used to measure pH. Conductivity was measured with a Cole-Parmer 1481 meter, and dissolved oxygen was measured with a YSI 55 meter. Turbidity also was measured in the field with a Hach 2100P portable turbidometer.

Cohocton River south of Bath, N.Y.

Stream discharge was measured, when wading was possible, using a Scientific Instruments pygmy or AA meter, or a FlowTracker according to United States Geological Survey (USGS) methods (Buchanan and Somers, 1969). Three sites were located at USGS gage sites, where the discharge for the time of sampling was obtained from the appropriate USGS web site. During the February sampling round, no discharge measurements were taken due to ice.

In June 2007, staff sampled for benthic macroinvertebrates (organisms that live on the stream bottom, including aquatic insects, crayfish, clams, snails, and worms) at 22 locations in the Cohocton River Watershed, using a modified version of Rapid Bioassessment Protocol (RBP) III (Barbour and others, 1999). Two kick screen samples were taken at each station by disturbing the substrate of representative riffle/run areas and collecting the dislodged material with a one-meter-square 600-micron mesh screen. Each sample was preserved in 95 percent denatured ethyl alcohol and returned to SRBC's lab. A 200-count subsample was picked for each sample, and organisms were identified to genus (when possible), except for midges and aquatic worms, which were identified to family. Duplicate macroinvertebrate samples were completed at 10 percent of the sites for quality assurance purposes.

Physical habitat conditions were assessed using a modified version of RBP III (Plafkin and others, 1989; Barbour and others, 1999). Staff evaluated stream sites based on physical characteristics relating to pool and riffle composition, substrate, conditions of banks, and the extent of riparian zone. Each habitat parameter was assessed on a scale of 0-20, with 20 being optimal; all parameter scores were added together to generate the total habitat score for each site. Other field observations also were recorded regarding weather, land use, substrate composition, and any other relevant watershed features.

Volatile organic/BTEX samples were collected by hand directly from the stream. Water was poured carefully into an amber 40-ml vial so as to minimize aeration and volatilization. The sample was preserved with 1:1 HCl to a pH of between 1 and 2. Two vials were collected at each site and were wrapped together in a 500-ml wide-mouth Nalgene bottle and placed immediately on ice. For quality assurance, a blank sample was completed using organic free de-ionized water once during each sampling round.

Staff could not conduct storm sampling as planned due to insufficient rainfall during the periods of interest. A few samples were taken in April 2008 during a small storm that covered only the lower half of the watershed. For these samples, water was collected using a depth-integrated bridge sampler, placed into a churn splitter, mixed thoroughly and split into three 500-ml bottles, one 125-ml bottle, two vials for TOC, and one glass sediment bottle. The remainder of the water was used for field chemistry, including temperature, dissolved oxygen, conductivity, pH, and turbidity.

DATA ANALYSIS

Water quality was assessed by examining field and laboratory parameters that included nutrients and major ions (Table 1). Staff compared the data collected to water chemistry levels of concern based on current state and federal regulations, background levels of stream chemistry, or references for approximate tolerances for aquatic life (Table 2). The difference between the yearly average value for each parameter was calculated for each site. If the value did exceed the level of concern, the difference was listed; if not, then the site was given a score of zero. For each location, the sum of all the exceeded values was calculated and averaged by the number of parameters. Sites with a water quality score between 0-0.25 were classified as "higher" quality. Sites between 0.26-0.75 were classified as "middle" quality, and sites with a score greater then 0.75 were ranked as "lower" quality. For the water quality calculations, an average for each parameter at each location was used. Any seasonal trends also were noted and will be discussed in the results section. Table 3 lists all the parameters that were analyzed with the volatile organics sampling.

Staff analyzed benthic macroinvertebrate samples using six metrics: (1) taxonomic richness; (2) modified Hilsenhoff Biotic Index; (3) percent Ephemeroptera; (4) number of Ephemeroptera/Plecoptera/Trichoptera (EPT) taxa; (5) percent Chironomidae; and (6) Shannon-Wiener Diversity Index (Table 4). Three reference categories were developed for the macroinvertebrate data analysis: mainstem Cohocton River, tributaries with a drainage area of greater than 20 square miles, and tributaries with a drainage area less than 20 square miles. The metric scores for each site were compared to the reference scores, and a biological condition category was assigned based on RBP III methods (Plafkin and others, 1989; Barbour and others, 1999). The same reference sites were used in the analysis for the habitat scores. The ratings for each habitat parameter were totaled, and a percentage of the reference site score was calculated for each site. The percentages were used to assign a habitat condition category to each sampling site (Plafkin and others, 1989; Barbour and others, 1999).

Table 1. *Water Quality Parameters Sampled in the Cohocton River Watershed*

Field Parameters	
Flow, instantaneous cfs	Conductivity, µmhos/cm
Temperature, °C	Turbidity, NTU
Dissolved Oxygen, mg/l	Suspended sediment, ppm
pH	
Parameters analyzed on the Spectrophotometer	
Chloride, mg/l	
Sulfate, mg/l	
Laboratory Analysis Parameters – Ambient Monitoring	
Total Sodium, mg/l	Total Orthophosphate, mg/l
Total Suspended Solids, mg/l	Total Organic Carbon, mg/l
Total Dissolved Solids, mg/l	Dissolved Aluminum, µg/l
Total Nitrogen, mg/l	Total Lead, µg/l
Total Ammonia, mg/l	Total Phosphorus, mg/l
Total Nitrate, mg/l	
Laboratory Analysis Parameter – Storm Sampling	
5-Day Biological Oxygen Demand, mg/l	Total Aluminum, µg/l
Alkalinity, mg/l	Total Cadmium, µg/l
Total Nitrite, mg/l	Total Zinc, µg/l
Total Magnesium, mg/l	Total Calcium, µg/l
Total Hardness, mg/l	Total Copper, µg/l
Total Iron, µg/l	Total Chromium, µg/l

Table 2. *Water Quality Standards and Levels of Concern with References*

Parameters	Limits	Reference Code	Parameters	Limits	Reference Code
Temperature	>25 °C	a,f	Phosphorus	>0.1 mg/l	e,j
D.O.	<4 mg/l	a,g	TOC	>10 mg/l	b
Conductivity	>800 µmhos/cm	d	Hardness	>300 mg/l	e
			Calcium	>100 mg/l	m
pH	6.5-8.5	i	Magnesium	>35 mg/l	i
Alkalinity	<20 mg/l	a,g	Sodium	>20 mg/l	i
TSS	>25 mg/l	h	Chloride	>250 mg/l	a,i
Nitrogen*	>1.0 mg/l	j	Sulfate	>250 mg/l	a
Nitrite-N	>0.06 mg/l	f,i	Iron	>300 µg/l	ai
Nitrate-N	>1.0 mg/l	e,j	Aluminum	>100 µg/l	i
Turbidity	>150 NTU	h	Orthophosphate	>0.05 mg/l	l,f,j,k

Reference

a. http://www.pacode.com/secure/data/025/chapter93/s93.7.html
b. Hem (1970) - http://water.usgs.gov/pubs/wsp/wsp2254/
c. Gagen and Sharpe (1987) and Baker and Schofield (1982)
d. http://www.uky.edu/WaterResources/Watershed/KRB_AR/wq_standards.htm
e. http://www.uky.edu/WaterResources/Watershed/KRB_AR/krww_parameters.htm
f. http://www.hach.com/h2ou/h2wtrqual.htm
g. http://sites.state.pa.us/PA_Exec/Fish_Boat/education/catalog/pondstream.pdf
h. http://www.epa.gov/waterscience/criteria/sediment/pdf/appendix3.pdf
i. http://www.dec.ny.gov/regs/4590.html
j. http://water.usgs.gov/pubs/circ/circ1225/images/table.html
k. http://water.usgs.gov/nawqa/circ-1136.html
l. http://www.epa.gov/waterscience/criteria/goldbook.pdf
m. based on archived data at SRBC

Table 3. *Volatile Organic Compound Parameters*

All parameters measured in µg/l
Acetone
Benzene
Bromobenzene
Bromochloromethane
Bromodichloromethane
Bromoform
Bromomethane
2-butanone (mek)
N-butylbenzene
Carbon tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
O-chlorotoluene
P-chlorotoluene
Dibromochloromethane
1,2-dibromo-3-chloropropane (dbcp)
1,2-dibromoethane (edb)
Dibromomethane
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
Dichlorodifluoromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
Cis-1,2-dichloroethene
Trans-1,2-dichloroethene
Dichloromethane (methylene chloride)
1,2-dichloropropane
1,3-dichloropropane
2,2-dichloropropane
1,1-dichloropropene
Cis-1,3-dichloropropene
Trans-1,3-dichloropropene
1,1-dimethylethylbenzene (tert-butylbenzene)
Ethylbenzene
Hexachloro-1,3-butadiene
2-hexanone
4-isopropyltoluene
2-methoxy-2-methylpropane (mtbe)
1-methylethylbenzene (isopropylbenzene)
4-methyl-2-pentanone (mibk)
1-methylpropylbenzene (sec-butylbenzene)
Napthalene
N-propylbenzene
Styrene
1,1,1,2-tetrachloroethane
1,1,2,2-tetrachloroethane
Tetrachloroethene
Toluene
1,2,3-trichlorobenzene
1,2,4-trichlorobenzene
1,1,1-trichloroethane
1,1,2-trichloroethane
Trichloroethene
Trichlorofluoromethane
1,2,3-trichloropropane
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
Chloroethene
M/p-xylene
T-butyl alcohol
O-xylene

Loading rates for total nitrogen and total phosphorus were calculated using concentrations in mg/l, and the stream discharge measured in the field (or obtained from USGS gages when applicable) when that sample was collected. When a measured stream discharge was not available due to high flows or ice, staff estimated the flow based on known flow ratios from USGS gages and previous flow measurements at the sites. Drainage areas were calculated by ESRI ArcGIS 9.2 software based on the North American Albers Equal Area Conical projection. A 1:24,000 scale watershed GIS dataset was used as a base layer. Additional watershed boundary lines were added manually where needed (i.e., at new monitoring sites) to the base layer. The data were converted to lbs/acre/year so nutrient loading rates could be compared between sites regardless of watershed size. These loading rates are only a rough estimate, as there are only four discrete data points taken throughout the year.

RESULTS

Water quality, biological community, and physical habitat site conditions for each sampling site in the Cohocton River Watershed are depicted in Figure 3. Seven sites, COHO 35.2, COHO 25.0, TWVE 0.5, TOBE 1.4, LTOB 0.7, UTLL 0.2, and MUDC 6.5, demonstrated the best overall conditions in each category with nonimpaired macroinvertebrates, "higher" water quality, and excellent physical habitat. Eight sites (32 percent) did not exceed water quality standards or levels of concern for any parameter, and 11 other sites (44 percent) also were ranked as having "higher" water quality. Three sites (12 percent) slightly exceeded water quality standards or levels of concern and were given a "middle" water quality rating. The remaining three sites (12 percent) received a "lower" water quality ranking based on

Table 4. *Explanation of Biological Metrics*

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

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

Percent Ephemeroptera: Percentage of number of Ephemeroptera (mayflies) in the sample divided by the total number of macroinvertebrates in the sample. Percentage decreases with increasing stress.

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

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

Percent Chironomidae: Percentage of number of Chironomidae individuals out of total number of macroinvertebrates in the sample. Percentage increases with increasing stress.

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

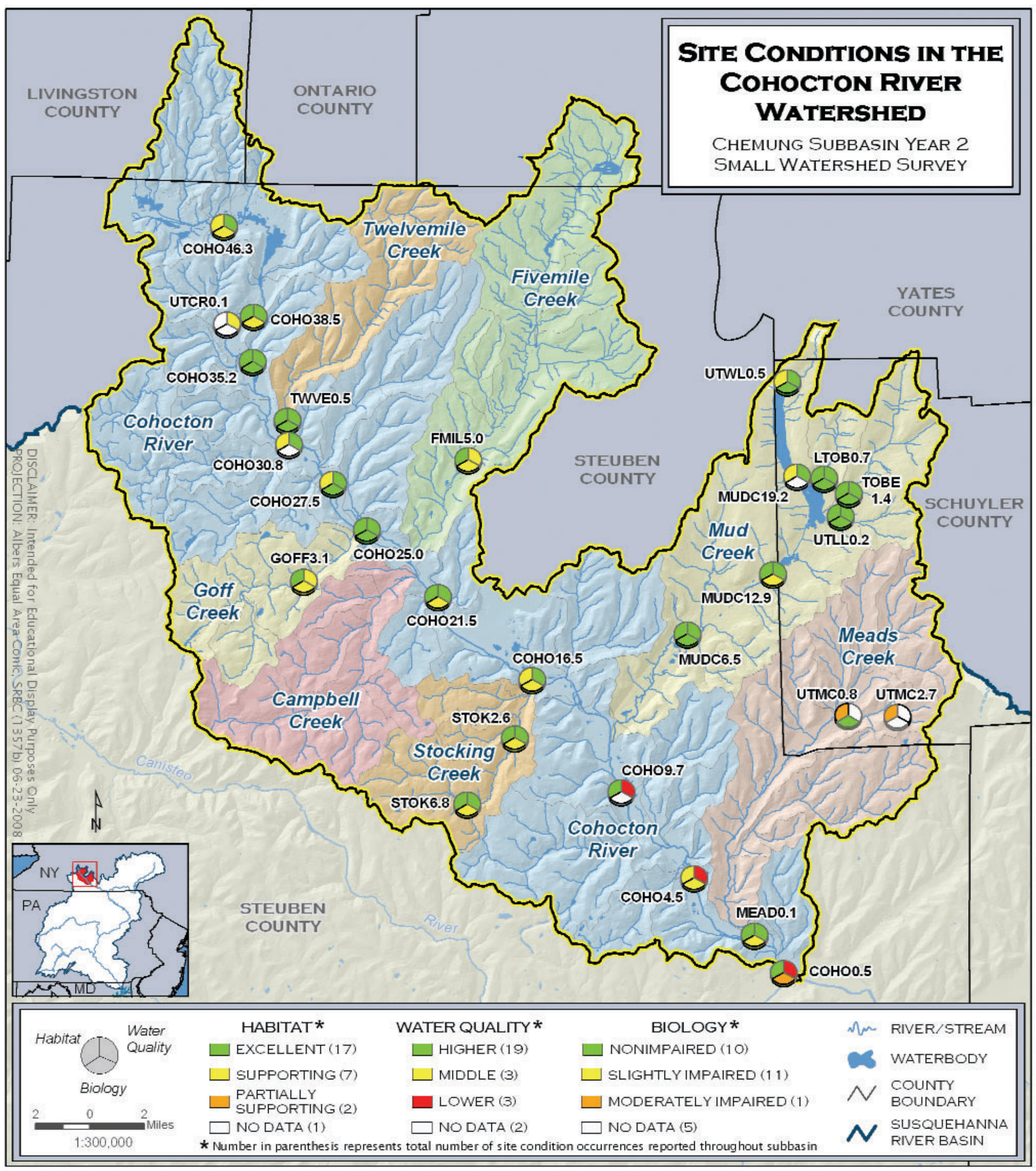


Figure 3. *Site Conditions in the Cohocton River Watershed*

numerous or high exceedances over water quality standards and levels of concern. The parameters exceeding levels of concern at the greatest number of sites were total nitrogen (13), nitrate (10), and sodium (10).

Stream flows during the July and October sampling rounds were very low throughout the Cohocton River Watershed. In fact, the flows for June-October 2007 at the USGS gages in Avoca and Campbell were at their lowest in at least five years. In addition, for eight months during 2007, average monthly flows were lower than the average monthly flows for the last 89 years since continuous flow records were kept, including February and April through October. This lack of rain likely contributed to the lower nutrient concentrations in the summer and fall sampling periods since there was little or no runoff, which is often the source of excess nutrients in agricultural areas. In wetter years, a marked increase in nutrient concentrations, especially in agricultural areas, would not be unexpected.

Nonimpaired biological conditions were found at 10 sites (45 percent), slightly impaired conditions were found at 11 sites (50 percent), and the remaining site (5 percent) was ranked as moderately impaired. Habitat conditions were excellent at 17 sites (65 percent), seven sites (27 percent) were rated as having supporting habitat, and two sites (8 percent) had partially supporting habitat conditions.

For the data analysis, sampling locations were broken down into three different groups. The sites that demonstrated the best overall conditions in each category with nonimpaired macroinvertebrates, "higher" water quality, and excellent habitat were chosen as the reference sites. All of the mainstem Cohocton River sites were compared to each other so that an evaluation of conditions along the entire river could be seen easily. For the river sites, COHO 35.2 (downstream of the Village of Cohocton at Jones Road) was used as the reference site, as it had the best combination of macroinvertebrates, habitat, and water quality. Tributaries with drainage areas greater than 20 square miles and less than 20 square miles were grouped together, respectively. For the large tributary sites, MUDC 6.5 (on Mud Creek along Sonora Road) demonstrated the best combination of macroinvertebrates, habitat, and water quality. It should be noted that the macroinvertebrate sample for MUDC 6.5 was collected a few miles downstream of the actual sampling station due to deep pools, lack of riffles, and limited access at the site. For the small tributaries, LTOB 0.7 (along DeCamp Road near Weston, N.Y.) was chosen as the reference site, as it had the best overall conditions.

Cohocton River

The mainstem Cohocton River overall had a variety of biological conditions from the headwaters to the mouth. The best sites biologically were generally in the middle stretches of the river, with the worst sites located towards the mouth. The reference site at river mile 35.2 was chosen based not only on its high ranking biological condition but also its excellent habitat and good water quality. Two other sites, COHO 28.0, upstream of Avoca, and COHO 25.0, downstream of Avoca, also were designated as non-impaired. The remaining eight river sites were characterized by fairly high taxa richness and good species diversity, but very low EPT index. In addition, most sites had a high percentage of Chironomidae and a high percent dominant species, both of which are negative characteristics. However, the only mainstem Cohocton River site that was ranked as lower than slightly impaired was at the mouth of the river. This site, COHO 0.5, was scored as moderately impaired, as it had the lowest scores for six of the seven metrics. The downstream sites had considerably lower species diversity and EPT Indices, fewer pollution intolerant genera, and greater dominance of Chironomidae. Macroinvertebrates were not collected at COHO 30.8 or COHO 9.7 due to lack of riffles and deep water.

Cohocton River near Avoca, N.Y.

The biggest concerns with physical habitat along the Cohocton River are width of riparian buffer and sediment deposition. Some stretches of the river have adequate riparian zones, but many do not. The river sites with the best habitat were COHO 35.2, COHO 38.5, and COHO 25.0. Sites lacking a good riparian vegetated zone often have higher water temperatures during the summer months, as was the case at COHO 4.5, COHO 9.7, COHO 25.0, and COHO 30.8, where instream water temperatures were above 25.0°C. Another factor that likely led to higher average instream temperatures at the lower sites is the greater prevalence of developed land, which leads to warmer runoff entering the creek during rain events.

Water quality along most of the Cohocton River mainstem was fairly consistent and unremarkable. The eight upstream sites all were ranked as having high water quality. Nutrients were not a huge problem in the mainstem, despite the prevalence of agriculture in the watershed. The nitrogen concentrations were well below the drinking water standard of 10 mg/l. The background level of nitrogen in natural streams with no human influence is generally considered to be 1.0 mg/l (USGS, 1999), and while all but one of the mainstem sites had an average for the year above 1.0 mg/l, none of them were above 1.8 mg/l. The background level for phosphorus in natural streams is 0.1 mg/l (USGS, 1999), and average yearly concentrations at all Cohocton River sites fell below that value.

The lower three sites on the mainstem, from the gage at Campbell down to the mouth, all were considered to have lower water quality largely due to elevated concentrations of sodium and chloride. The average concentration of sodium was well over the water quality standard of 20 mg/l at these lower three sites. While chloride concentrations did not exceed water quality standards (250 mg/l), they were considerably higher at these three sites as compared to the other mainstem locations. In April, sodium and chloride concentrations at the lower three sites on the mainstem Cohocton River were more than four times the average concentrations at the rest of the sites in the watershed. These high concentrations of salt are likely due to a flow-based permitted discharge of brine located just south of the Village of Bath. During the rest of the year, concentrations at these sites were between 1-1.8 times the average concentrations of the rest of the sites in the watershed.

Larger Tributary Sites

The second group of sites consisted of larger tributaries to the Cohocton River, where the watershed at the sampling location drained more than 20 square miles. This included sites on Fivemile, Meads, Mud, Stocking, Goff, and Twelvemile Creeks. Mud Creek drains more than 80 square miles and includes the two large lakes in the watershed, Lamoka and Waneta Lakes. The reference site for this second group of sites was MUDC 6.5, which had the best combination of macroinvertebrates, habitat, and water quality.

The only other nonimpaired large tributary was Twelvemile Creek. This stream was sampled upstream of the Route 415 bridge near the mouth of Twelvemile Creek. The rest of the larger tributary streams were designated as slightly impaired biologically. Meads Creek scored high on a majority of the biological metrics but had a very high percentage of Chironomidae (44 percent), which were also the dominant taxa. These two metrics brought the overall score for the site down to slightly impaired. The upper site on Mud Creek (MUDC 12.9) had the lowest biological score in this reference group and scored very low for EPT Index, Hilsenhoff Biotic Index, and taxa richness. Fivemile Creek also had a poor quality biological community, with low diversity and a dominance of midges. At the lower site on Stocking Creek, staff collected water quality samples upstream of a small lake, but due to lack of riffles and backwater from the lake at this site, macroinvertebrates were collected and physical habitat was assessed at the mouth of Stocking Creek along Mail Route Road. This site scored fairly average on some metrics but had a very low percent Ephemeroptera and was dominated by Chironomidae (46 percent of the sample). A majority of the metrics were above average at Goff Creek, but like many other tributaries, the biological sample was dominated by Chironomidae, which lowered its overall biological score into the slightly impaired category.

Water quality in the large tributaries was quite good overall. Four of the seven sites had no parameters that exceeded water quality standards or levels of concern. These stations include Meads, Mud, and Twelvemile Creeks. The lower site on Stocking Creek also was ranked in the higher water quality category. Goff Creek had the highest concentrations of total nitrogen and nitrate in the entire Cohocton River Watershed, with yearly averages of 2.4 mg/l and 2.2 mg/l, respectively. Sodium also exceeded water quality standards at Goff Creek. Fivemile Creek was ranked as having “middle” water quality due to exceedances in sodium and total suspended solids.

Overall, the larger tributaries were rated as having excellent habitat, although there were some sites that scored low in various categories. MUDC 12.9, which is along Rabbit Road near Bradford, N.Y., had the highest total habitat score. This site is adjacent to a large wetland area and has excellent riparian cover and instream cover. The most common problems at these seven sites were sediment deposition, embeddedness, and lack of adequate vegetated riparian buffer.

Smaller Tributary Sites

The third group of sites consisted of sampling locations on tributaries with drainage areas of less than 20 square miles. This group included sites on Stocking, Tobehanna, and Little Tobehanna Creeks, as well as unnamed tributaries to Waneta Lake and Meads Creek. The sampling site on Little Tobehanna Creek demonstrated the best combination of conditions for this group of sites, with nonimpaired biology, excellent habitat, and “higher” water quality. Little Tobehanna Creek had high taxa richness, good species diversity, and 30 percent of macroinvertebrates in the sample were mayflies (Ephemeroptera). Tobehanna Creek and the unnamed tributary to Waneta Lake also were designated as nonimpaired. TOBE 1.7 had the highest EPT Index of all the small sites, as well as high species diversity and taxa richness. The UTWL 0.5 macroinvertebrate sample had the highest taxa richness and species diversity. However, both Tobehanna Creek and UTWL 0.5 had a relatively low percentage of Ephemeroptera. The upstream site on Stocking Creek, STOK 6.8, was the only site that ranked as slightly impaired in this group. It had the lowest scores for five of the seven metrics, and the macroinvertebrate sample was dominated (68 percent) by Chironomidae.

Macroinvertebrates also were sampled at the site downstream of the salvage yard on the unnamed tributary to Meads Creek, which was sampled primarily for BTEX. The upstream site was not sampled due to extremely low flows during the time of sampling. The macroinvertebrate community at the downstream site was compared to the other small tributaries and was designated as nonimpaired. This site had good scores for Hilsenhoff Biotic Index and percent Ephemeroptera but lower than average scores for taxa richness and EPT Index. Two genera with very low pollution tolerance were frequently seen at this site: *Epeorus* (Ephemeroptera: Heptagenidae) and *Alloperla* (Plecoptera: Chloroperlidae). Habitat was designated as partially supporting at this site downstream of the large auto salvage yard as well as at the one upstream. Overall, this tributary has numerous physical habitat issues including unstable banks, lack of vegetative protective cover on banks, sedimentation, and poor instream cover. However, macroinvertebrates seem to be thriving in this small tributary despite below average physical habitat conditions.

One additional site, UTLL 0.1, was grouped by itself due to the exceptional biological data. The results for the macroinvertebrate metrics were in the 95th percentile for all parameters when compared to all the other small tributaries. This site is on an unnamed tributary to Tobehanna Creek and was sampled along Route 226 near Tyrone, N.Y. So as not to skew the rest of the results, this site was removed from the analysis. UTLL 0.1 showed excellent macroinvertebrate scores for all seven metrics, including 26 taxa, 53 percent Ephemeroptera, less than 20 percent Chironomidae, and less than 20 percent dominance by any one genera. In addition, the Hilsenhoff Index was considerably better at this site than any other site in the entire Cohocton River Watershed. This resulted from of a large portion of the sample being comprised of genera with Hilsenhoff values of 0 or 1; meaning they are very intolerant of pollution and thus, usually only exist in high quality streams. Some examples of these genera found in UTLL 0.1 are *Alloperla*, *Paraleptophlebia* (Ephemeroptera: Leptophlebiidae), *Epeorus*, and *Cinygmula* (Ephemeroptera: Heptagenidae).

Water quality was very good at these smaller tributary sites with all five sites being ranked in the "higher" water quality group. Three of the five sites had no parameters that exceeded any water quality standards or levels of concern. Nutrient concentrations were low in these streams, with average total nitrogen values well below 1.0 mg/L. As expected due to seasonal nitrogen trends, nutrient concentrations were slightly higher during spring and late winter, in correlation with higher flows, more runoff, and snow melt. At the four streams near the lakes, pH was below the NYSDEC standard of 6.5 during the sampling in April. This is likely due to natural stream conditions related to geology and local hydrology.

Physical habitat was rated as excellent at all but one of the smaller tributaries. The sites with the highest overall scores for habitat were Little Tobehanna Creek and the unnamed tributary to Tobehanna Creek. Both ranked very high for epifaunal substrate, instream cover, condition of banks, and vegetative protective cover. The unnamed tributary to Waneta Lake was rated as having supporting habitat, with riparian cover and sedimentation being the biggest problems. Some of the habitat concerns in several of these smaller streams are sedimentation and lack of adequate riparian vegetative cover. The water temperature in some of these very small tributaries can increase during the summer primarily because of lack of riparian vegetative cover along the stream banks to provide shading. Instream water temperatures at TOBE 1.2 and UTWL 0.5 were greater than 25°C during the July sampling.

Winter at unnamed tributary to Tobehanna Creek.

Two other sites were sampled, but for various reasons, no macroinvertebrates were collected, and physical habitat was not evaluated. An unnamed tributary to the Cohocton River in the Village of Cohocton was scheduled to be sampled; however, it was only flowing during the April sampling event. It appears that this may be more of a storm channel that only contains water after rain events and quickly goes dry. Also, the half-mile long channel connecting Lamoka and Waneta Lakes was sampled at the boat access area off of Route 23. This channel is deep and conducive only for water quality sampling. Because water quality in the lakes was a concern, this site was chosen to document the water quality coming out of Waneta Lake and entering Lamoka Lake. The water quality was quite good at this site between the lakes, with no parameters exceeding water quality standards or levels of concern.

State and local organizations were concerned about nutrient enrichment in the lakes; however, high concentrations of nitrogen and phosphorus were not found flowing out of Waneta Lake or Lamoka Lake. Portions of these lakes are routinely treated for the nuisance aquatic plant, Eurasian watermilfoil, so there may be nutrient enrichment in certain portions of the lakes. In-lake sampling, however, was beyond the scope of this project. None of the tributaries sampled contributed any significant concentrations of nitrogen or phosphorus to the lakes. One recommendation is that the septic systems or other waste disposal practices of the homes that surround these lakes be investigated. More information about Lamoka and Waneta Lakes can be found on the lake association's web site at *http://www.lamokawaneta.com.*

Nutrient loading rates were calculated using flow data and total nitrogen and phosphorus concentration averages from the four sampling events. Even with the small sample size, these loading estimates provide a general idea of where the greatest amounts of nitrogen and phosphorus are originating. Overall, nutrient loadings throughout the Cohocton River Watershed were relatively low, although there was a noticeable increase in total nitrogen loads at sampling locations that drain primarily agricultural or developed land as opposed to forested land. Other agricultural watersheds throughout the Susquehanna River Basin often have much higher nutrient loads than the Cohocton River Watershed. For example, the nutrient loadings in the Conestoga River Watershed in Lancaster County, Pa., can average 40-50 lbs/acre/year for total nitrogen and 2-3 lbs/acre/year for total phosphorus at the mouth. In contrast, the mouth of the Cohocton River contributes approximately 4.4 and 0.18 lbs/acre/year of total nitrogen and phosphorus, respectively.

Figures 4 and 5 show a comparison of the nitrogen and phosphorus loads across sampling locations. The sampling sites are organized in the chart with the Cohocton River mainstem sites first from upstream to downstream and then the tributaries. The last six sites are the sites around Lamoka and Waneta Lakes, including Mud Creek, which flows out of the lakes. For total phosphorus, loading rates around the lakes are comparable with the rest of the Cohocton River Watershed. For total nitrogen, loads around the lakes are considerably lower than the loads found in much of the rest of the watershed. One exception is the unnamed tributary to Waneta Lake, which does appear to contribute more lbs/acre/year of nitrogen than some of the other surrounding tributaries. Throughout the Cohocton River Watershed, nitrogen loads generally correlate with areas of higher agricultural land use. For example, there is a higher percentage of agriculture in the watershed of Goff and Fivemile Creeks than in either Meads or Stocking Creek. Correspondingly, the nitrogen loads are higher in Goff and Fivemile Creeks. Total phosphorus, however, does not follow a comparable pattern as total phosphorus loads are similar throughout the watershed, except for COHO 16.5 and COHO 4.5, which have higher loading rates.

Because NYSDEC uses a slightly different method for analysis of macroinvertebrate data to determine the impairment status of a particular stream location, SRBC staff also analyzed its macroinvertebrate data using the NYSDEC protocol (Bode, 2005) as a means of comparison. It should be noted that the methods of collection and subsampling were slightly different.

Boating on Waneta Lake, July 2007.

SRBC composites two 1-meter kick screen samples in riffle areas and takes a 200 count subsample. NYSDEC uses a 9" x 18" aquatic net (mesh size 0.8 mm x 0.9 mm) and composites kicks from five meters over five minutes in an upstream diagonal direction across a riffle and utilizes a 100-count subsample. Some of the metrics overlap between analysis methods, (i.e., taxa richness, Hilsenhoff Biotic Index, and EPT Index) but others are different (i.e., percent model affinity). When comparing results from SRBC metrics to NYSDEC metrics for the mainstem Cohocton River sites, the results were quite similar. The same three sites were ranked as being nonimpaired, and all other sites were rated slightly impaired. The only difference was the moderately impaired COHO 0.5, which ranked as slightly impaired with NYSDEC's metrics. For the tributaries, there was a little more variation with NYSDEC methods ranking sites a little lower than SRBC. However, when looking closely at the data, a majority of these sites were on the border between two categories, so no glaring disparity existed between the results of the two methods.

In 2004, NYSDEC completed a biological assessment of eight sites along the mainstem Cohocton River (Bode, 2005). According to the NYSDEC report, based on macroinvertebrate analysis, conditions ranged from slightly impacted to non-impacted, gradually improving downstream. NYSDEC also listed nutrient enrichment as the primary stressor causing the impacts. The common sites between the two projects yielded comparable results, designating the upper portion of the watershed as having slight impairment. However, the results from SRBC's analysis ranked the lower sites on the Cohocton River as slightly to moderately impaired, while the NYSDEC study pointed to an improvement to non-impacted downstream. SRBC staff collected data in an 11-mile stretch of river (not sampled by NYSDEC) which contained three of the best overall sites along the river during the current survey.

Volatile Organics/BTEX sampling

The sampling for volatile organics indicated that none of the sampled compounds were present at detectable levels in any of the samples. Sampling was conducted in numerous ranges of flows, from very low flows in summer and fall 2007 to a storm event in spring 2008. These results, based only on surface water sampling, can not conclusively exclude the salvage yards as potential sources of groundwater contamination. While there is no evidence of any volatile organics in the surface water upstream or downstream of these areas, volatile organic compounds volatilize in air and are more stable in groundwater. Groundwater sampling was beyond the scope of this project but would make an interesting follow-up study in the future.

Storm sampling

Sampling during and after storms (wet-weather sampling) in late spring and early fall was part of the original sampling plan for this project, to better quantify the amount and impact of nutrients running off from agricultural land. During the

Figure 4. Total Nitrogen Loading Rates by Sampling Site, Cohocton River Watershed

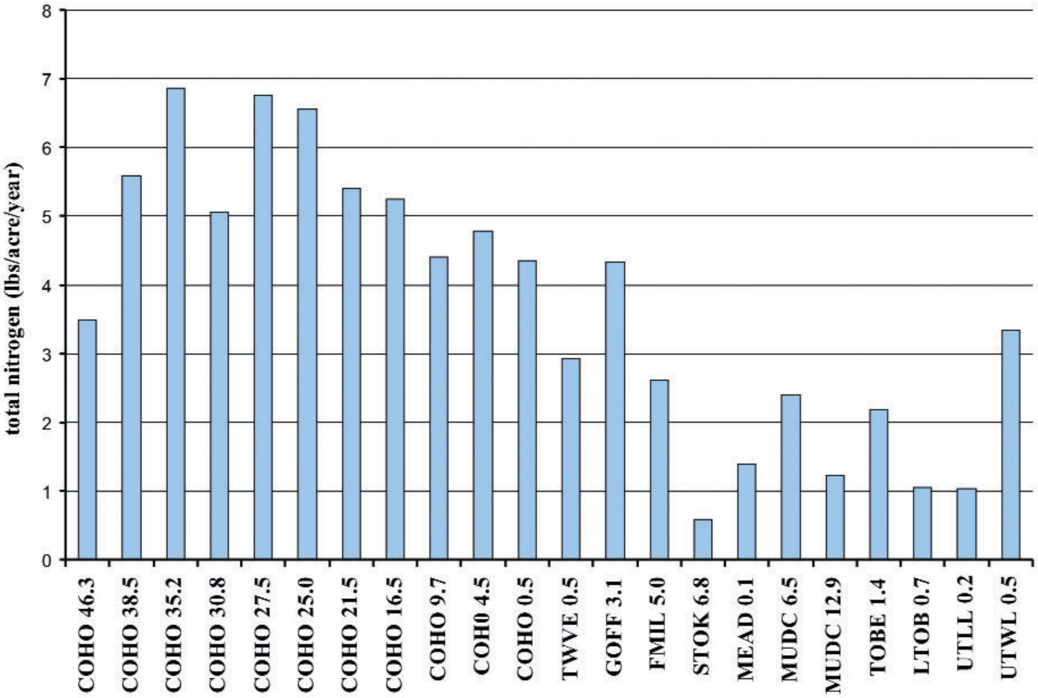
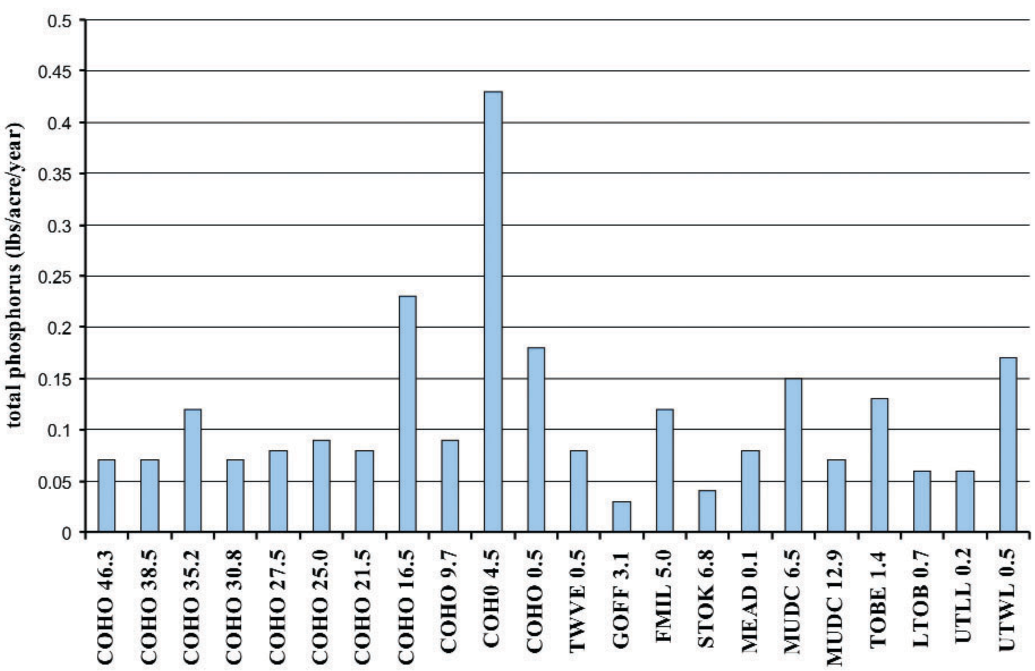


Figure 5. Total Phosphorus Loading Rates by Sampling Site, Cohocton River Watershed



2007 sampling year, however, this portion of the Susquehanna River Basin experienced very dry conditions. Due to the prolonged period of low flows and lack of large rain events during the targeted timeframe, storm sampling could not be completed as planned.

As mentioned previously, summer flows were extremely low throughout the Cohocton River Watershed during 2007. In April 2008, storm samples were taken at a few sites in the lower portion of the watershed during a small storm event. The results did not show nutrient concentrations any higher than those during the ambient sampling. During the storm sampling, conductivity and turbidity were higher and pH was lower than the ambient average for the year. Total aluminum and total iron also were sampled during the high flow event and were elevated above New York State water quality standards at all five sites sampled. It is unknown whether these concentrations are elevated only during storm events or are ambient levels in the stream system.

CONCLUSIONS

Overall, the Cohocton River Watershed is in excellent condition and should be considered a valuable water resource worth protecting. The outstanding work performed by local planning commissions and soil and water conservation districts to promote ecologically sound agricultural practices and educate the public about the importance of watershed protection is reflected in the condition of the entire watershed.

Data from this study will be used by SRBC in managing the water resources in the New York portion of the Susquehanna River Basin and will be available for New York State and local agencies to supplement and support their efforts. An electronic version of this report and all the raw data for the project are available to the public on the SRBC web site. Additional hard copies of this report are also available from SRBC.

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APPENDIX

Station #	Stream	County/State	USGS Quad	Latitude	Longitude	Site Description	Drainage area (mi2)
COHO 0.5	Cohocton River	Steuben/NY	Corning	42.1558	-77.0994	Near mouth of Cohocton River, at Kinsella Park	603.78
COHO 4.5	Cohocton River	Steuben/NY	Campell	42.2229	-77.1808	Cohocton River at Rt. 17 crossing, upstream of Curtis Creek	518.64
COHO 9.7	Cohocton River	Steuben/NY	Savona	42.2525	-77.2169	Cohocton River upstream of Campbell at the USGS gaging station, Wood Rd.	469.54
COHO 16.5	Cohocton River	Steuben/NY	Bath	42.3124	-77.2815	Cohocton River at Rt. 11 bridge downstream of Bath	328.87
COHO 21.5	Cohocton River	Steuben/NY	Bath	42.3566	-77.3496	Cohocton River, upstream of Bath, downstream of Knight Creek at Rt. 15	309.57
COHO 25.0	Cohocton River	Steuben/NY	Avoca	42.3923	-77.4013	Cohocton River, downstream of Avoca, at Owens Rd., DEC Fishing Access	192.03
COHO 28.0	Cohocton River	Steuben/NY	Avoca	42.4170	-77.4258	Cohocton River, at Rt. 415 bridge, at USGS gaging station	154.27
COHO 30.8	Cohocton River	Steuben/NY	Haskinville	42.4377	-77.4578	Cohocton River, south of Wallace, at DEC Fishing Access Area	98.01
COHO 35.2	Cohocton River	Steuben/NY	Avoca	42.4821	-77.4846	Cohocton River, downstream of the Village of Cohocton at Jones Rd.	63.24
COHO 38.5	Cohocton River	Steuben/NY	Naples	42.5059	-77.4905	Cohocton River at Rt. 371 bridge at DEC Fishing Access	43.03
COHO 46.3	Cohocton River	Steuben/NY	Wayland	42.5544	-77.5058	Cohocton River, west of Atlanta, NY, at Parks Rd.	26.37
FMIL 5.0	Fivemile Creek	Steuben/NY	Rheims	42.4301	-77.3282	Fivemile Creek, at Gardner Rd. off Rt. 53	57.46
GOFF 3.1	Goff Creek	Steuben/NY	Avoca	42.3647	-77.4467	Goff Creek at Chamberlain Rd.	20.44
LTOB 0.7	Little Tobehanna Creek	Schuyler/NY	Wayne	42.4206	-77.0706	Little Tobehanna Creek, at DeCamp Rd., upstream of Weston, NY	4.31
MEAD 0.1	Meads Creek	Steuben/NY	Corning	42.1759	-77.1207	Meads Creek, at mouth, at Rt. 415 bridge	69.87
MUDC 6.5	Mud Creek	Steuben/NY	Savona	42.3370	-77.1693	Mud Creek at Sonara Rd.	71.68
MUDC 12.9	Mud Creek	Steuben/NY	Bradford	42.3692	-77.1077	Mud Creek downstream of Lamoka Lake, at Rabbit Rd. near Bradford, NY	44.93
MUDC 19.2	Mud Creek	Schuyler/NY	Wayne	42.4216	-77.0903	Mud Creek at Rt. 23 bridge between Lamoka Lake and Waneta Lake	NA
STOK 2.6	Stocking Creek	Steuben/NY	Bath	42.2813	-77.2937	Stocking Creek, upstream of lake at Tucker Rd.	16.68
STOK 6.8	Stocking Creek	Steuben/NY	Bath	42.2456	-77.3280	Stocking Creek upstream of agricultural area, at Bonny Hill Rd. (Rt. 11)	10.54
TOBE 1.4	Tobehanna Creek	Schuyler/NY	Wayne	42.4125	-77.0528	Tobehanna Creek at Rt. 23A bridge, near Tyrone, NY	11.84
TWVE 0.5	Twelvemile Creek	Steuben/NY	Avoca	42.4472	-77.4611	Twelvemile Creek near Wallace, NY, along Rt. 415	25.18
UTCR 0.1	UNT Cohocton River	Steuben/NY	Wayland	42.5021	-77.5016	UNT Cohocton River at mouth in Village of Cohocton, at Allen St.	7.79
UTLL 0.2	UNT Tobehanna Creek	Schuyler/NY	Wayne	42.4003	-77.0589	Unnamed tributary to Tobehanna Creek, along Rt. 226	3.4
UTWL 0.5	UNT Waneta Lake	Schuyler/NY	Wayne	42.4722	-77.0973	UNT Waneta Lake at Rt. 25 bridge east of Wayne, NY	2.15
UTMC 2.7	UNT Meads Creek	Schuyler/NY	Bradford	42.2931	-77.0176	UNT Meads Creek along Coon Hollow Rd. in state forest lands	1.58
UTMC 0.8	UNT Meads Creek	Schuyler/NY	Bradford	42.2912	-77.0492	NT Meads Creek along Coon Hollow Rd. upstream of Hornby Rd.	4.24
COHO 23.7	Cohocton River	Steuben/NY	Avoca	42.3852	-77.3815	Cohocton River, upstream of Fivemile Creek, near Kanona, NY, along Rt. 415	193.29

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