Susquehanna River Basin Commission

Upper Susquehanna Subbasin Year-2 Survey

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The Susquehanna River Basin Commission (SRBC) completed a water quality and biological survey on the watersheds surrounding Whitney Point Lake from June-October 2008 as part of the Year-2 small watershed study in the Upper Susquehanna Subbasin (Figure 1). Year-1 and Year-2 surveys are part of SRBC's Subbasin Survey Program, which is funded 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 from about 100 stream sites to assess the 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 more intensive, repeated sampling at a smaller number of locations. SRBC conducted the Upper Susquehanna Subbasin Survey during June-August 2007 (Buda, 2008). The Year-2 sampling is tailored for the individual needs of a chosen watershed or region or is designed to complement and support another already ongoing SRBC project. For more information on SRBC's Subbasin Survey Program, see reports by Buda (2007 and 2008) and Steffy (2008). These reports are posted on SRBC's web site at www.srbc.net/pubinfo/techdocs/Publications/techreports.htm.

The watersheds surrounding Whitney Point Lake were chosen for the Upper Susquehanna Year-2 study to complement a recently funded, large scale environmental restoration project on Whitney Point Lake. Since 1996, SRBC, U.S. Army Corps of Engineers (USACE), New York State Department of Environmental Conservation (NYSDEC), and others have been working to establish a water management and environmental restoration project at Whitney Point Lake. In 2007, funding was secured to implement the plans and the project monitoring began in 2008. The restoration project provides for environmental releases from the lake to augment low flow conditions downstream in the Otselic, Tioughnioga, Chenango, and, ultimately, Susquehanna Rivers. The supplemental flows are expected to reduce stress on the river ecosystem, benefiting fish and macroinvertebrates. The long-term goal of the monitoring plan is to document potential effects of flow augmentation on aquatic communities in Whitney Point Lake and the surrounding watersheds. The short-term goals of the baseline monitoring were to provide information to: (1) assess the chemical and biological conditions of Whitney Point Lake and the surrounding watersheds (Tioughnioga, Otselic, Chenango, and Susquehanna Rivers); (2) document changes in stream quality over various flow regimes; (3) identify side channel/backwater habitats that may be critical for fish populations; and (4) assess fish and macroinvertebrate use of riverine side channel/backwater areas.

An Adaptive Management Plan (AMP) for the project, which describes the goals and sampling design of the overall restoration plan, will be re-evaluated every year to make sure

This report and all data are available on the Internet at www.srbc.net/pubinfo/techdocs/publication_264/techreport264.htm

Upper Susquehanna Subbasin Small Watershed Study:

A Water Quality and Biological Assessment of the Watersheds Surrounding Whitney Point Lake, Broome and Cortland Counties, N.Y.

Report by Luanne Steffy, Aquatic Ecologist

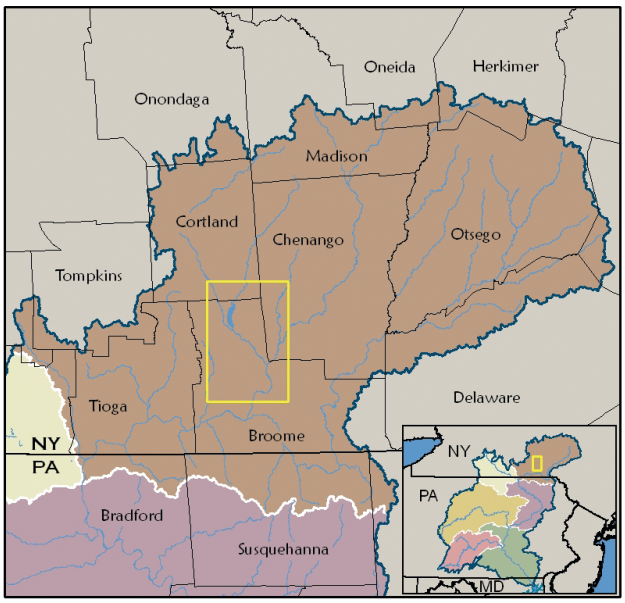

Figure 1. *Location of the Whitney Point Study Area in the Upper Susquehanna Subbasin*

the project goals are being met. This Year-2 study will provide valuable biological, chemical, and habitat information to SRBC for the implementation of the Whitney Point AMP. SRBC will continue monitoring at least annually for the next five years at the same locations that were sampled in 2008, in addition to sampling before, during, and after any low flow releases that may occur. The data also will be available to federal, state, and local agencies, including USACE, NYSDEC, and Broome and Cortland County Water and Soil Conservation Districts, as well as any other interested parties and the general public.

Description of the Study Area

In 1942, USACE created Whitney Point Lake by building a dam on the Otselic River for the purpose of providing flood control along the lower Tioughnioga River, the lower Chenango River, and the Susquehanna River downstream of Binghamton, N.Y. Whitney Point Lake is located in Broome County and controls a drainage area of 225 square miles (Figure 1). In the late 1960s, recreational facilities were added to Dorchester Park, which is adjacent to the southeastern portion of the lake, and the summer pool level was raised to provide a larger lake and more recreational opportunities. The lake is approximately 1,200 acres and provides 10.5 miles of shoreline for a variety of recreational activities.

The land use in the study area is primarily forested and agricultural, with the two largest developed areas surrounding the villages of Whitney Point and Marathon. A majority of the study area is in Broome County, with the exception of the most upstream sites on the Tioughnioga and Otselic Rivers, which are in Cortland County. The study area does not include the entire watersheds of any of the three rivers being sampled (Figure 2). The most upstream sampling location on the Tioughnioga River is in Marathon, N.Y. Five additional mainstem sampling sites and two side channel sampling sites are located between Marathon and the mouth of the river. On the Otselic River, there are two sampling sites: one upstream of Whitney Point Lake in Landers Corners and one downstream of the dam, which is very close to the mouth of the river. Finally, the Chenango River was sampled at two locations: at Chenango Valley State Park and at the Route 12A crossing, which is the most downstream sampling location in the study area. Both of these Chenango River sites are downstream of the confluence with the Tioughnioga River.

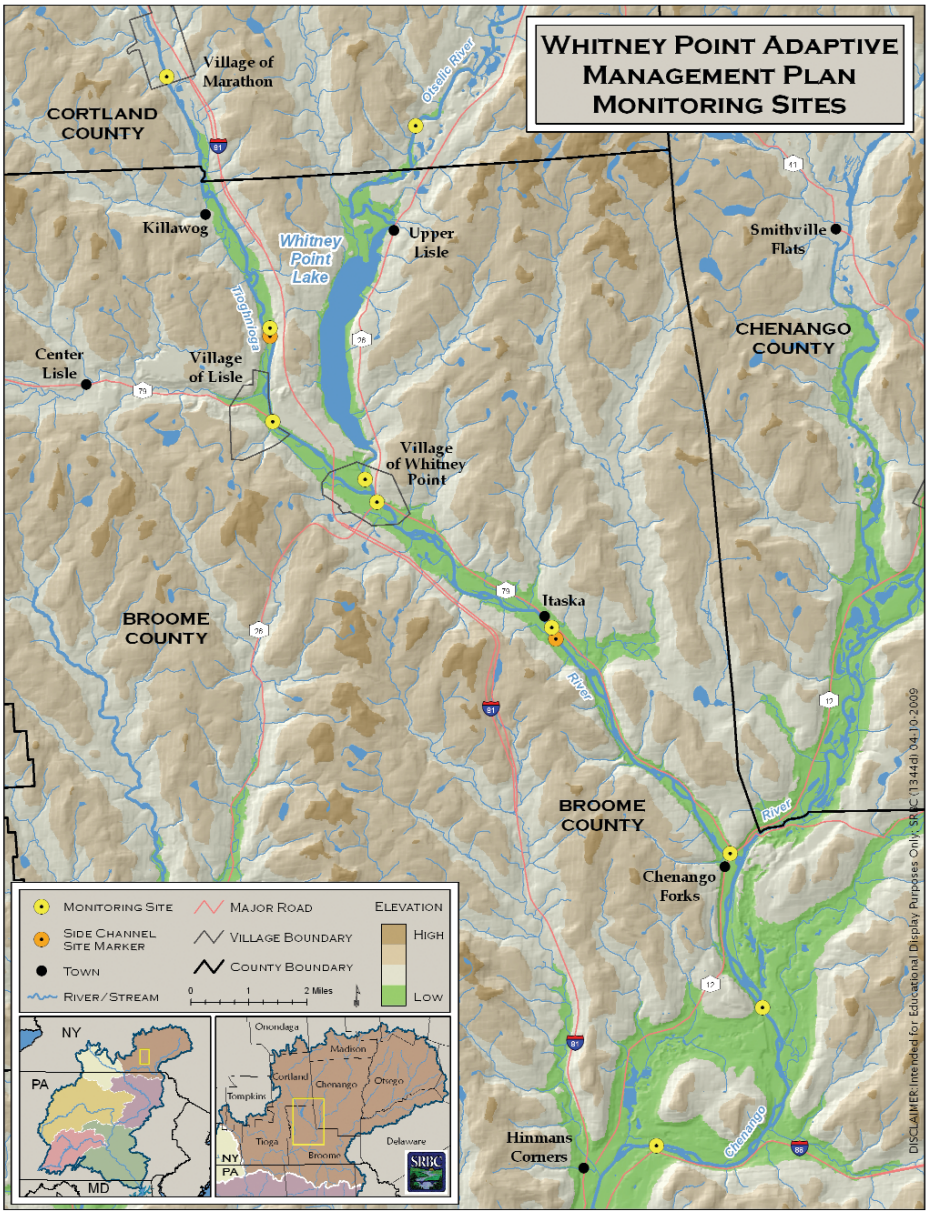

Figure 2. *Location of Whitney Point Adaptive Management Plan Monitoring Sites*

METHODS

Data Collection

Between June and October 2008, SRBC staff completed three rounds of sampling at the ten instream and two side channel locations listed in Table 1. Sampling included water chemistry, electrofishing, macroinvertebrate sampling, stream discharge measurements, and habitat assessments. Water was collected using a hand-held, depth-integrated sampler at six locations across the stream channel. The water was put into a churn splitter, mixed thoroughly, and split into two 500-ml bottles, one 125-ml bottle fixed for nutrient analysis,

Backpack electroshocking in the Tioughnioga River.

and two amber pre-fixed vials for total organic carbon (TOC). Water quality parameters are listed in Table 2. The remainder of the water was used to complete standard field chemistry analyses. Temperature was measured instream 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 instream with a YSI 55 meter. Turbidity also was measured in the field with a Hach 2100P portable turbidometer. Alkalinity and acidity were determined using field titrations. Alkalinity was measured in the field by titrating a known volume of sample water to pH 4.5 with 0.02N H_2SO_4. Acidity was measured in the field by titrating a known volume of sample water to pH 8.3 with 0.02N NaOH. When wading was possible, stream discharge was measured using a FlowTracker and according to the U.S. Geological Survey (USGS) methods (Buchanan and Somers, 1969).

Macroinvertebrate assessments were adapted from Rapid Bioassessment Protocol (RBP) III, described by Barbour and others (1999) and Plafkin and others (1989) and followed NYSDEC's "Quality Assurance Work Plan for Biological Stream Monitoring in New York State" (Bode and others, 2002). Macroinvertebrate sampling was conducted in the best available riffle/run habitats at each main channel and side channel reach, where available. Sampling was conducted by placing an aquatic net (size 9 in. X 18 in., mesh opening 0.8 mm X 0.9 mm) perpendicular to the current and disturbing the substrate so dislodged macroinvertebrates were carried into the net. Sampling was continued in an upstream direction for five minutes for a distance of five meters. All collected specimens were preserved in 95 percent ethanol and returned to SRBC for identification and enumeration.

Fish community assessments were adapted from the RBP manual (Barbour and others, 1999) and from NYSDEC's quality assurance plan (Bode and others, 2002). Fish sampling was conducted in a representative stream reach that was selected so that riffle, run, and pool habitat were included within the reach, when possible. In June, a backpack electroshocker was used with poor results due to the size of the rivers being sampled, so the remaining sampling rounds were electrofished

Table 1. *Instream Monitoring Locations in the Whitney Point Study Area*

Site	Stream Name	Location	Latitude	Longitude
OTSL 8.7	Otselic River	Upstream of lake at Landers Corners	42.4225	-75.94861
OTSL 0.1	Otselic River	At mouth at Whitney Point	42.33073	-75.96607
TIOU 18.8	Tioughnioga River	At Marathon	42.4407	-76.0356
TIOU 13.2	Tioughnioga River	Along Rt. 11, approximately 1.5 miles north of Lisle	42.3705	-75.99981
TIOUB 13.2	Tioughnioga River	Side channel/backwater area at TIOU 13.2	42.3705	-75.99981
TIOU 11.8	Tioughnioga River	Upstream of Otselic River @ Lisle	42.35075	-75.99982
TIOU 9.5	Tioughnioga River	Downstream of Otselic River at Rt. 11 bridge at Whitney Point	42.33083	-75.96694
TIOU 5.7	Tioughnioga River	Downstream of Otselic River at Itaska	42.2987	-75.909
TIOUB 5.4	Tioughnioga River	Side channel/backwater area about 0.3 miles downstream of TIOU 5.7	42.29528	-75.90587
TIOU 0.1	Tioughnioga River	Upstream of Rt. 12 bridge at Chenango Forks	42.23833	-75.8475
CHEN 11.9	Chenango River	Downstream of Tioughnioga River at gaging station near Chenango Forks	42.2188	-75.8486
CHEN 7.0	Chenango River	Downstream of Rt. 12A	42.165783	-75.87293

Table 2. *Water Quality Parameters Sampled*

Field Parameters
Flow, instantaneous cfs
Temperature, °C
Dissolved Oxygen, (mg/l)
Conductivity, µmhos/cm
pH
Alkalinity, mg/l
Acidity, mg/l
Turbidity, NTU

Laboratory Analysis Parameters
Biological Oxygen Demand, 5-day, mg/l
Total Suspended Solids, mg/l
Total Organic Carbon, mg/l
Total Nitrogen, mg/l
Total Phosphorus, mg/l
Total Orthophosphate, mg/l

with a tote barge. (Note that in the results, the fish data from June are not included due to the difference in sampling methods.) Electrofishing with the tote barge proceeded in an upstream direction covering the maximum amount of habitat possible. All wadeable habitats within the reach, which changed with varying flow regimes, were sampled during a single pass. The exact length of sampling time, with a goal of approximately 40 minutes, was recorded at each site.

Physical habitat conditions at each reach were assessed using a slightly modified version of the habitat assessment procedure outlined by Barbour and others (1999). Eleven habitat parameters were field-evaluated at each reach and were used to calculate a site-specific habitat assessment score. Physical habitat assessments were performed for riffle/run or glide/pool areas, depending on stream type. Additional habitat information, including length of side channel, type of connection to main channel, and habitat unit types, were noted at both side channel/backwater reaches.

Data Analysis

Water quality was assessed by examining field and laboratory parameters, and comparing 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 3). The water quality throughout the study area was quite good with only a few sites exceeding any of these thresholds. Chemical concentrations for the three sampling rounds were averaged, and the following rankings were based on those means. The eight sites that had zero or one parameter exceeding the level of concern were ranked as having "higher" water quality and the four sites that had two parameters exceeding levels of concern were ranked as having "middle" water quality.

For macroinvertebrates, subsampling and sorting procedures were based on the 1999 RBP document (Barbour and others, 1999). In the laboratory, composite samples were sorted into 200-organism subsamples using a gridded pan and a random numbers table. The organisms contained in the subsamples were identified to genus (except Chironomidae and Oligochaeta), when possible, and enumerated. See Table 4 for an explanation of the metrics used for macroinvertebrate analysis.

Fish were identified, weighed, and measured in the field when possible, and, when necessary, fish were preserved in formalin and returned to the lab for verification. The data for each reach were analyzed with the following metrics: (1) species richness, weighted by stream size; (2) percent non-tolerant individuals; (3) percent non-tolerant species; and (4) percent model affinity, by trophic class. See Table 5 for a more detailed explanation of these metrics. Table 6 shows a list of fish species caught in order of abundance.

"The water quality throughout the study area was quite good with only a few sites exceeding any of these thresholds."

Habitat assessment scores of the reaches were calculated to classify each reach into a habitat condition category. Any reach that scored 220 to 171 was designated excellent. A habitat score of 170 to 116 was designated supporting; partially supporting conditions were characterized as 115 to 61; and a score of less than 60 was rated as nonsupporting.

Overall rankings, based on the averages of all three sampling rounds, for water quality, macroinvertebrates, fish, and physical habitat are displayed graphically in Figure 3.

Table 3. *Water Quality Standards and Aquatic Life Tolerances*

Parameters	Limit	Reference Code
Temperature	> 25 degrees C	a,f
Dissolved Oxygen	< 4 mg/l	a,g
Conductivity	> 800 mmhos/cm	d
pH	6.5 – 8.5	c
Acidity	> 20 mg/l	k
Alkalinity	< 20 mg/l	a,g
Turbidity	> 50 NTU	l
Total Suspended Solids	> 15 mg/l	h
Total Nitrogen	> 1.0 mg/l	i,j
Total Phosphorus	> 0.1 mg/l	e
Biological Oxygen Demand	> 5 mg/l	m
Total Organic Carbon	> 10 mg/l	b
Total Orthophosphate	> 0.05 mg/l	i,j

Reference Code & References

a. http://www.pacode.com/secure/data/025/chapter93/s93.7.html
b. Hem (1970)
c. http://www.dec.ny.gov/regs/4590.html#16132
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://adm.idaho.gov/adminrules/rules/idapa58/0102.pdf
i. http://water.usgs.gov/pubs/circ/circ1225/images/table.html
j. http://www.water.ncsu.edu/watersheds
k. based on archived data at SRBC
l. http://www.epa.gov/waterscience/criteria/sediment/appendix3.pdf
m. http://www.ciese.org/curriculum/dipproj2/en/fieldbook/index.html

Table 4. *Explanation of Macroinvertebrate 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.
EPT Index:	Total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa present in a sample. Number decreases with increasing stress.
Percent Model Affinity:	Measure of similarity between collected sample and model (non-affected) sample based on percent abundance of seven major groups. 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.
Percent Ephemeroptera:	Percentage of number of Ephemeroptera (mayflies) in the sample divided by the total number of individuals in the sample. Percentage decreases with increasing stress.
Percent Chironomidae:	Percentage of number of Chironomidae individuals out of the total number of macroinvertebrates in the sample. Percentage decreases with increasing stress.
Shannon-Wiener Diversity Index:	A measure of the taxonomic diversity of the community. Index value decreases with increasing stress.

Metrics in **bold constitute the NYSDEC assessment methodology.*

Table 5. *Explanation of Fish Metrics*

Species Richness, weighted:	Total number of species present in the sample, weighted by stream size. Streams over 20 meters wide are total number minus four and anything over 14 species is given the maximum value of 10.
Percent Non-Tolerant Individuals:	Percentage of total individuals belonging to the species considered intolerant or intermediate to environmental perturbations.
Percent Tolerant Species:	Similar to percentage non-tolerant individuals but calculated for species.
Percent Model Affinity:	The highest percentage of similarity of any of five models of non-impacted fish communities, by trophic class.

Whitney Point Lake.

Table 6. *Species List of Fish Collected (listed in order of relative abundance)*

Central Stoneroller	Greenside Darter
Banded Darter	Yellow Perch
White Sucker	Swallowtail Shiner
Longnose Dace	Fallfish
Tessellated Darter	Blacknose Dace
Spotfin Shiner	Common Carp
Rock Bass	Shield Darter
White Crappie	Golden Shiner
Northern Hog Sucker	Walleye
Bluegill	Common Shiner
Margined Madtom	River Chub
Comely Shiner	Northern Pike
Cutlips Minnow	Redbreast Sunfish
Pumpkinseed	Yellow Bullhead
Spottail Shiner	Banded Killifish
Mottled Sculpin	Brown Bullhead
Creek Chub	Chain Pickerel
Mimic Shiner	Muskellunge

Walleye from the Chenango River.

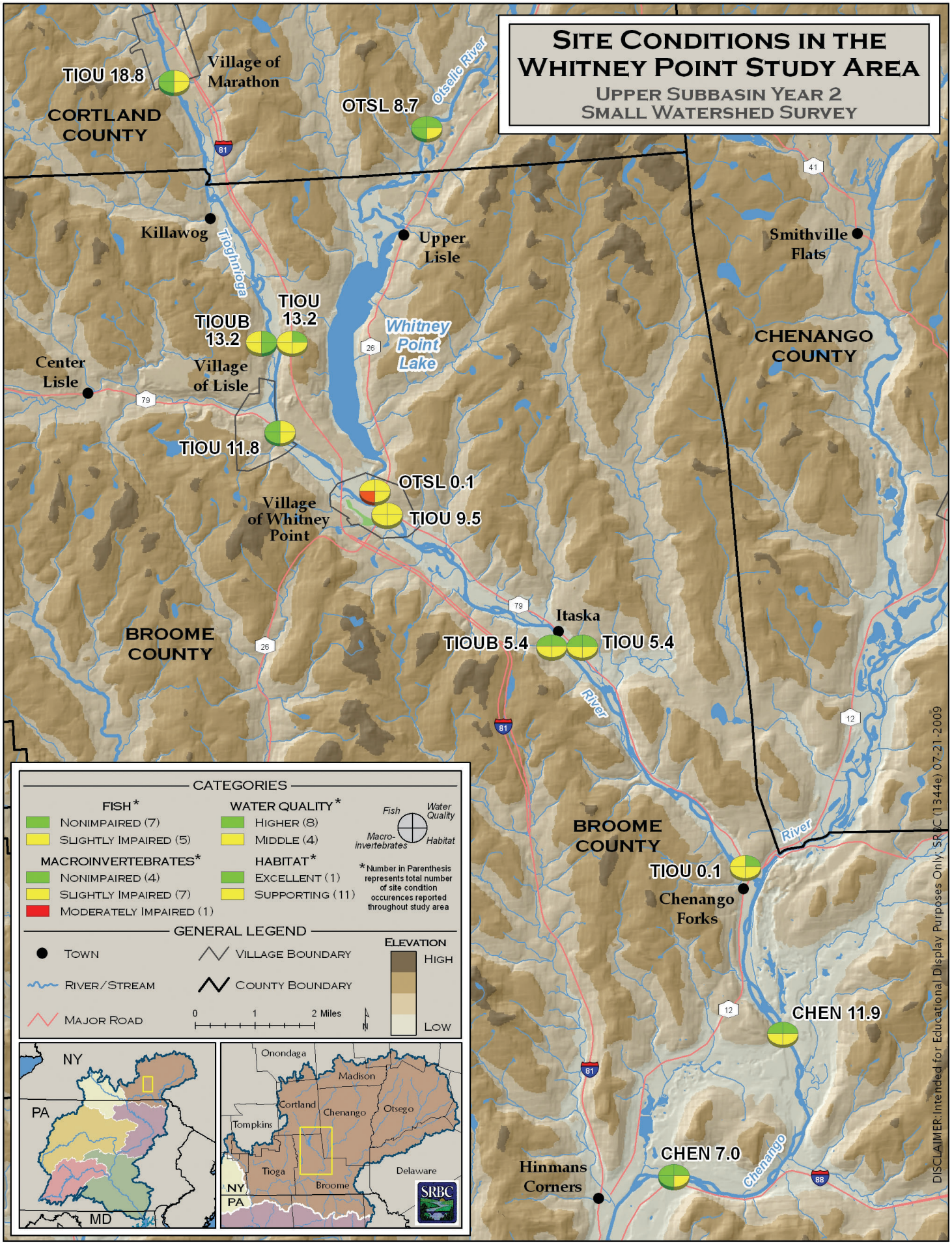

Figure 3. *Site Conditions in the Whitney Point Study Area*

Otselic River

With the formation of Whitney Point Lake through the construction of a dam on the Otselic River, there are obvious hydrologic alterations that impact the biological community and habitat downstream of the dam. Although the Otselic River extends farther upstream, the most upstream sampling site for this project is OTSL 8.7. This site is located at the NYSDEC fishing access area at Landers Corners where the stream averaged about 45 meters in width. Overall habitat conditions were rated as supporting, although there was poor vegetative cover on the banks and an inadequate riparian buffer, particularly on the western side as West River Road closely borders the river. Water quality at this site was excellent, with no parameters exceeding water quality standards. Nutrient concentrations were low in each of the three sampling rounds, and all field chemistry parameters fell within normal ranges.

Otselic River at Landers Corners, N.Y.

The fish community at this site was comparable in August and October, with similar numbers of fish and similar percent model affinity. There were three more species caught in August than October, which may be attributable to decreased habitat availability due to lower flows. Both fish assemblages collected were rated as nonimpaired, with nearly 75 percent of the fish species caught being classified as either intolerant or intermediately tolerant of environmental perturbations. A majority of the habitat at this site is riffle/run habitat with some exposed bedrock, overhanging vegetation, and undercut banks providing much of the fish habitat. Smallmouth bass were the dominant predator, with a large range of year classes collected. The macroinvertebrate samples collected during all three sampling periods indicated a high-quality community, with samples from all three events rated as nonimpaired. The river here consistently exhibits high taxa richness and EPT (Ephemeroptera/Plectoptera/Trichoptera) Index, along with low percent dominant taxa and Hilsenhoff Biotic Index. OTSL 8.7 also was sampled as part of SRBC's Upper Susquehanna Subbasin Year-1 Survey during the summer of 2007 (Buda, 2008). For that project, OTSL 8.7 was used as a reference site for macroinvertebrates at sites with a drainage area between 100-500 square miles.

Another Otselic River site (OTSL 0.1) is located approximately a quarter mile downstream from the outlet of the dam. This site is unique in that its biological status is linked to how much water is released from the dam. For example, in August, only 15 cubic feet per second (cfs) was being released, causing very little flow movement through the 200 meter sampling reach. This resulted in very shallow, stagnant water throughout the reach, except for large pools directly downstream of the dam, which are too deep to electroshock. In October, sampling was performed hours after the dam began releasing at 55 cfs, and 100 more individual fish were caught in the same reach of stream than were caught in August. The fish communities in both August and October were rated as slightly impaired. There are two reasonable theories for this occurrence: (1) with the increased flow, fish are swimming up from the Tioughnioga into the Otselic where temperatures are cooler and habitat is more available; or (2) when flows are lower, most of the fish stay in the deep pool directly downstream of the dam and swim farther downstream when flows increase. This section of river had a good range of smallmouth bass year classes and also seemed to provide good habitat for small bluegill, yellow perch, and young-of-the-year smallmouth bass.

The 2002 NYSDEC Quality Assurance Work Plan for Biological Stream Monitoring in New York State discusses the effects of lake outlets and impoundments on aquatic macroinvertebrate communities. The traits listed in this document mirror what is found at the mouth of the Otselic River. Some examples are: lower species richness; depressed percent model affinity; and abundance of midges, isopods, and filter-feeding caddisflies (i.e., Hydropsychidae). The index means for OTSL 0.1 were distributed in the middle of the range of expected results for impoundment impacted streams in New York for EPT richness (5), Hilsenhoff biotic index (5.9), and percent model affinity (49), and on the low end for species richness (9). The three sampling rounds were fairly similar, with the August (slightly impaired) sample scoring slightly better than either June or October (both moderately impaired).

> ***"The macroinvertebrate samples collected during all three sampling periods indicated a high-quality community, with samples from all three events rated as nonimpaired."***

Tioughnioga River - Upstream of Otselic River

Two original monitoring locations are located on the Tioughnioga River upstream of the confluence of the Otselic River as discussed in the AMP. When side channel monitoring was added, an additional instream site adjacent to the upstream side channel was included in the monitoring program since the side channel was a long distance from either of the other two original sites. All of the upstream sites are being used to assess the general conditions of the Tioughnioga River above Whitney Point Lake and will serve as controls during low flow release events.

The most upstream site sampled on the Tioughnioga River is at river mile 18.8 in Marathon. This 300-meter reach was sampled at the park downstream of the Rt. 221 bridge. Water quality analysis at this site revealed the highest concentrations of total phosphorus, orthophosphate, total nitrate, and total nitrogen of any of the Whitney Point instream monitoring locations. This may be related to the proximity of the reach to the Marathon wastewater treatment plant.

Tioughnioga River upstream of Lisle, N.Y.

Fewer fish were caught at this site than anywhere else in the study region; the reasons for this are largely unknown, but may be a result of poorer habitat conditions. The habitat at this reach scored as supporting; some problems noted were a lack of riffles, increased sedimentation, and inadequate riparian corridor. Habitat is better at the downstream end of the reach, while the upper half of the reach is deep, consists largely of pools, and provides little habitat or fish cover. The fish collected were primarily juvenile smallmouth bass and a variety of suckers and minnows. Despite lower numbers of fish, this river reach was rated as nonimpaired based on the fish data in both August and October. The macroinvertebrate community at this upper Tioughnioga River site was rated as nonimpaired for all three sampling times. Consistently high taxa richness, including 27 taxa in August, low Hilsenhoff Biotic Index (indicating the presence of sensitive taxa), and a high percentage of Ephemeroptera characterize the macroinvertebrate community at this site. All samples were collected along a well-formed riffle at the top of a small side channel on the western side of the river.

The second original upstream site on the Tioughnioga River is located in Lisle at river mile 11.8. The 220-meter sampling reach is bordered by Rt. 11 along the eastern bank and a flood control area on the western bank. Habitat was rated as supporting with lack of adequate riparian corridor and increased sediment deposition noted. Water quality was fairly good overall. Total nitrogen concentrations were slightly higher than what is expected in undisturbed streams but were still less than 2.0 mg/L. The fish community at this location was characterized by a large number of top predator species, including walleye, rock bass, yellow perch, and smallmouth bass. Using fish as an indicator, this site was rated as nonimpaired in August and October. However, due to lower flows during fall sampling, staff was able to sample more stream area with the tote barge and wading in October, so the fish numbers may be slightly depressed in August, as typically larger predatory fish are found in deeper water. These same fish likely were present in August, but could not be collected in the sample.

The macroinvertebrate communities in this river reach were rated as nonimpaired in June and August, but slipped to slightly impaired in October. Water levels were only a half foot lower in October but seemed to have more of an effect on the macroinvertebrates here than at some other locations with similar conditions. In October, there was a substantial drop off in taxa richness, EPT index, and species diversity. Despite the slight decline in October, this stream reach still had some of the highest metric scores of all the sampling sites.

> ***"Water quality analysis at this site* revealed the highest concentrations of total phosphorus, orthophosphate, total nitrate, and total nitrogen of any of the Whitney Point instream monitoring locations."***
>
> ** Refers to sampling site at Park downstream of Rt. 221 bridge near Marathon, N.Y.*

Tioughnioga River - Downstream of Otselic River

This 220-meter sampling reach is located immediately downstream of the confluence of the Otselic and Tioughnioga Rivers, downstream of the Rt. 79 bridge in Whitney Point. Habitat was ranked as supporting with the lowest scores being given for lack of riparian vegetated width and increased sediment deposition. Epifaunal substrate also received a sub-optimal score. Water quality was generally good, with total nitrogen concentrations just above 1.0 mg/L. Total suspended solids concentrations were some of the highest of all the sites sampled. The fish communities at this site were quite different in August and October, and this is likely due (as at TIOU 11.8) to the use of the tote barge and the fact that virtually the entire eastern bank of the river was too deep to access by wading during the August sampling. Number of fish caught and species richness were both considerably higher in October when flows were lower and the eastern side could be fished. Due to this discrepancy in available fishable habitat, the entire fish assemblage was not sampled, which resulted in a much lower percent model affinity in August. This reach was rated as slightly impaired in August and nonimpaired in October. In October, good size ranges of smallmouth bass and rock bass were collected.

At the confluence of the Tioughnioga and Otselic Rivers.

The macroinvertebrates at this site showed a decline during times of lower flows in August and October. This site is unique in that there is a deep channel on the eastern bank while the western side is very shallow. As water levels drop, the substrate on the western side becomes more exposed and macroinvertebrate habitat is lost as rocks that made up riffles become exposed above the water line. In June, the macroinvertebrate sample was nonimpaired, with high scores for all of the metrics, including a greater than 70 percent model affinity. However, in August and October, there was a marked decrease in taxa richness, species diversity, EPT Index, and an increase in percent Chironomidae, which also became the dominant taxa.

The mouth of the Tioughnioga River (TIOU 0.1) was sampled at the NYSDEC Fishing Access in Chenango Forks. Habitat was scored as supporting, with low scores for riparian vegetated width, as this 300-meter reach is bordered by roads on both sides with very little buffer. There was also a limited amount of fish cover, but epifaunal substrate was abundant. Water quality was excellent, with no parameters exceeding water quality standards. The fish community in August was markedly different from the community present in October. Unlike at some other locations, there were not large sections of river at TIOU 0.1 that could not be fished in August due to deeper water, so the reasons for increased number of species and greater percent model affinity are unknown. In August, this site ranked as slightly impaired based on the fish data, while it was scored as nonimpaired in October. In October, the most dominant fish other than minnows were suckers, primarily northern hognose, which are more sensitive and indicative of good water quality than other sucker species.

The macroinvertebrate samples collected in this reach were fairly consistent over the three sampling seasons, although the October sample was rated slightly better with a nonimpaired ranking. The June and August samples were rated as slightly impaired and the biggest difference between the first two rounds and the last one in October was a higher percent model affinity. Overall, the mouth of the Tioughnioga River had excellent macroinvertebrate habitat, and the samples indicated high taxa richness and species diversity.

Chenango River

Two sites on the Chenango River are included in the Whitney Point monitoring plan. The most downstream site is at approximately river mile 7.0 (CHEN 7.0) and is located at the Rt. 12A bridge in Chenango Forks near a golf course. This site was moved after the June sampling, which was performed about four miles further downstream. The previous station was located downstream of a sewage treatment plant, and the technical team decided to move the station above the potential influence of the treatment facility. For that reason, only the data for August and October will be presented here.

As CHEN 7.0 is the largest stream site sampled and has more substantial and complex habitat, there is a different type of fish community here than at the other sites sampled.

Chenango River *(continued)*

Much larger fish were more abundant, including more large top carnivores like walleye, chain pickerel, and northern pike. There was also a large range of smallmouth bass, ranging from young-of-the-year to large, 14-inch adults. The fish community

Chenango River near Chenango Bridge, N.Y.

data for August and October are quite similar, with 18 species collected each time, nearly the same number of individuals, and similar percentages of intolerant species. Using fish as the indicator, this site was nonimpaired in both sampling months.

The macroinvertebrate scores at this site on the Chenango River were very good, with each metric score falling among the highest of all sites sampled. Using the NYSDEC metrics and water quality index based on macroinvertebrate data, CHEN 7.0 was nonimpaired in August and slightly impaired in October. The main differences between the two sampling rounds were lower taxonomic richness, percent Ephemeroptera, and EPT Index in October.

The second Chenango River site (CHEN 11.9) is located directly downstream of the USGS gage near Chenango Forks, in Chenango Valley State Park. This gage is used to determine when a low flow release should be made under the Whitney Point operations plan. Samples were collected in June, August, and October. The lowest flow condition sampled was in October when the river discharge was 299 cfs, which is approximately twice the release trigger. At this site, almost the entire western half of the river is lined with bedrock, and at 299 cfs, most of this bedrock is exposed or covered with less than six inches of water. This reduced flow eliminates much of the available habitat since microhabitats in and around the pieces of broken bedrock are exposed.

The fish community at CHEN 11.9 was similar in August and October, with the same number of species collected both times and greater than 80 percent model affinity. About 100 more individual fish were caught during October sampling. Using fish as an indicator, CHEN 11.9 was rated as nonimpaired for both sampling events. Many small white crappie were caught in October that were not present in August. Crappie typically are seen in river systems downstream of impoundments or reservoirs, such as Whitney Point Lake.

The macroinvertebrates at CHEN 11.9 were fairly consistent over the three sampling periods. In June, taxa richness, percent Ephemeroptera, and species diversity were lower than during the other sampling events. This could be due to lack of available riffle habitat during the higher June flows. In June and October, the metric scores indicated a slightly impaired condition at this site, while in August, nonimpaired conditions existed. In August, this site had the best scores for species diversity index, Hilsenhoff Index, EPT Index, percent Ephemeroptera, and percent dominant taxa of all the sites sampled.

Initially, biological sampling was slated to be performed on the Susquehanna River at Smithboro, which is 20 miles downstream of the confluence with the Chenango River. This site was sampled in June; however, since no biological impacts seen at this site can be directly linked to changes in flows from Whitney Point Lake given the distance involved, only water quality data will be collected at this site, and only during low flow releases.

Smallmouth bass from the Tioughnioga River.

> ***"There was also a large range of smallmouth bass, ranging from young-of-the-year to large, 14-inch adults."***

Side Channel Sampling Sites

The purpose of locating and monitoring side channel and backwater reaches on the Tioughnioga River, upstream and downstream of the confluence with the Otselic River, is to determine the extent that macroinvertebrates and fish utilize these side channels and the potential extent of habitat loss in low flow situations. The downstream side channel/backwater reach is located on the Tioughnioga River, downstream of the bridge in Itaska, about four miles downstream of the confluence of the Otselic River. The sampled length of the side channel area is about 290 meters and includes a representative riffle, run, and pool habitat unit. This reach was sampled in August and October 2008. The instream sampling point at Itaska (TIOU 5.7) was used as the corresponding instream reach.

The upstream side channel/backwater reach is located on the Tioughnioga River between Lisle and Killawog. This reach was sampled in June, August, and October 2008. An extra instream sampling site was added along this side channel to represent instream conditions corresponding to this side channel. The side channel is about 170 meters in length and also contains a representative riffle, run, and pool habitat unit. For both upstream and downstream side channels, staff surveyed the designated riffle, run, and pool, as well as control points, measuring channel bottom elevation and water surface elevation. This information will also be used as a baseline to compare and quantify loss of habitat and document the effects of flow augmentation during critical low flow situations.

Tioughnioga River
Upstream of Otselic River Confluence

The upstream side channel habitat site is located along Rt. 11, about two miles north of Lisle. The side channel contains excellent fish habitat, including backwater pools, undercut banks, emergent vegetation, overhanging cover, and rocky riffles. The high quality fish community, composed largely of minnow taxa, in the side channel reach probably is characteristic of this reach type. There were 18 and 20 species, and 615 and 798 individuals, in August and October, respectively. Due to the overwhelming numbers of herbivorous central stonerollers, the percent model affinity metric score was very low, which reduced the overall score for the site. There were numerous large smallmouth bass and suckers in the backwater pools along the side channel. This side channel likely would be cut off at least partially from the main channel in lower flows, as there was already a marked difference from August to October when flows were reduced from 182 cfs to 96 cfs in the Tioughnioga River at this site. The macroinvertebrate communities in the upstream side channel reach were rated as slightly impaired for all three sampling events. A majority of the metrics received high scores, but percent model affinity metric was very low and reduced the entire score. Also, percent Ephemeroptera, which is not included in the NYSDEC metrics, was very low when compared to other streams in the area. Lower flows in October did not seem to impact the macroinvertebrate communities.

Top of the upstream side channel in the Tioughnioga River.

The instream reach adjacent to the side channel also was sampled as a comparison. The fish community of the instream reach was very diverse, with 19 and 23 species in August and October, respectively. The percent model affinity at this site was quite good, with over 75 percent similarity in October. The smallmouth bass at this site were mostly small in size but generally larger than the ones collected in the side channel. Based on fish community data, staff ranked this river reach as slightly impaired in August and nonimpaired in October. The instream macroinvertebrate community was similar to the side channel community. There is a large riffle area in this stream reach that provides excellent macroinvertebrate habitat even in higher flows, such as were seen in June. During all three sampling events, the macroinvertebrate samples were scored as slightly impaired with very similar results for each metric in all three samples.

Tioughnioga River
Downstream of Otselic River Confluence

The downstream side channel is located on the western side of the Tioughnioga River less than a half mile downstream of the bridge in Itaska. The fish community was composed primarily of a variety of minnows and darters, along with suckers and young-of-the-year smallmouth bass. The fish community was rated as nonimpaired in August and October. Species richness was lower at this site than at the upstream side channel site. The macroinvertebrates in the side channel were comparable to the nonimpaired small streams throughout the Upper Susquehanna Subbasin (Buda, 2008) with the exception of a lower than average EPT Index. Using the NYSDEC water quality index based on macroinvertebrates, this reach ranked as slightly impaired in August and nonimpaired in October. There was excellent habitat throughout the side channel for both fish and macroinvertebrates.

The reach of the Tioughnioga River used as the corresponding stream reach for the downstream side channel area was also one of the original instream monitoring points (TIOU 5.7).

Tioughnioga River
Downstream of Otselic River Confluence *(continued)*

The fish sampled in August and October were quite different, but again this may be due to increased availability of sampling area due to lower flows during October. Twice as many species and three times as many individual fish were collected in October than in August. Despite this, the reach was rated as nonimpaired in both months due to high percentages of intolerant and moderately tolerant fish. In October, there was a good range of size classes for smallmouth bass collected within this reach.

The sampling reach at TIOU 5.7 was moved slightly downstream after the June sampling due to access issues. As a result, in June, macroinvertebrates were sampled above the bridge in Itaska, in a large riffle, which was outside of the sampling reach once the site was moved. The new sampling reach had very limited macroinvertebrate habitat, which is evident in the poor macroinvertebrate scores from August, when the community was ranked as severely impaired. In October, abundant leaf packs and woody debris provided improved habitat and increased food supply, which is reflected in improved macroinvertebrate scores.

In October, when flows were the lowest but not low enough to trigger a release, there were noticeable changes and loss of habitat in both of the side channel/backwater reaches. Undercut banks and tree roots were no longer submerged, parts of some riffles were exposed, pools were functioning more as runs, and small offshoots from the main side channel were dry. During lower flow events that were experienced in 2008, these side channels could be disconnected completely from the main channel and possibly even dewatered.

CONCLUSIONS

The sampling that was completed during 2008 in the Whitney Point Lake study area was just the first portion of the monitoring for the larger Whitney Point Lake project, which is targeted to improve water management and implement various environmental restoration strategies. At least five years of additional project monitoring will be performed. Since there was very little extensive water quality or biological data on the rivers that surround Whitney Point Lake, the baseline sampling for this effort was especially significant. SRBC is confident that the data collected through this Year-2 study will be beneficial in evaluating the success of the low flow augmentation protocol to be implemented in the years to come.

Data from this study as well as an electronic version of this report are available on SRBC's web site at *www.srbc.net/pubinfo/techdocs/publication_264/techreport264.htm*. Additional hard copies of the summary or complete reports are also available from SRBC.

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