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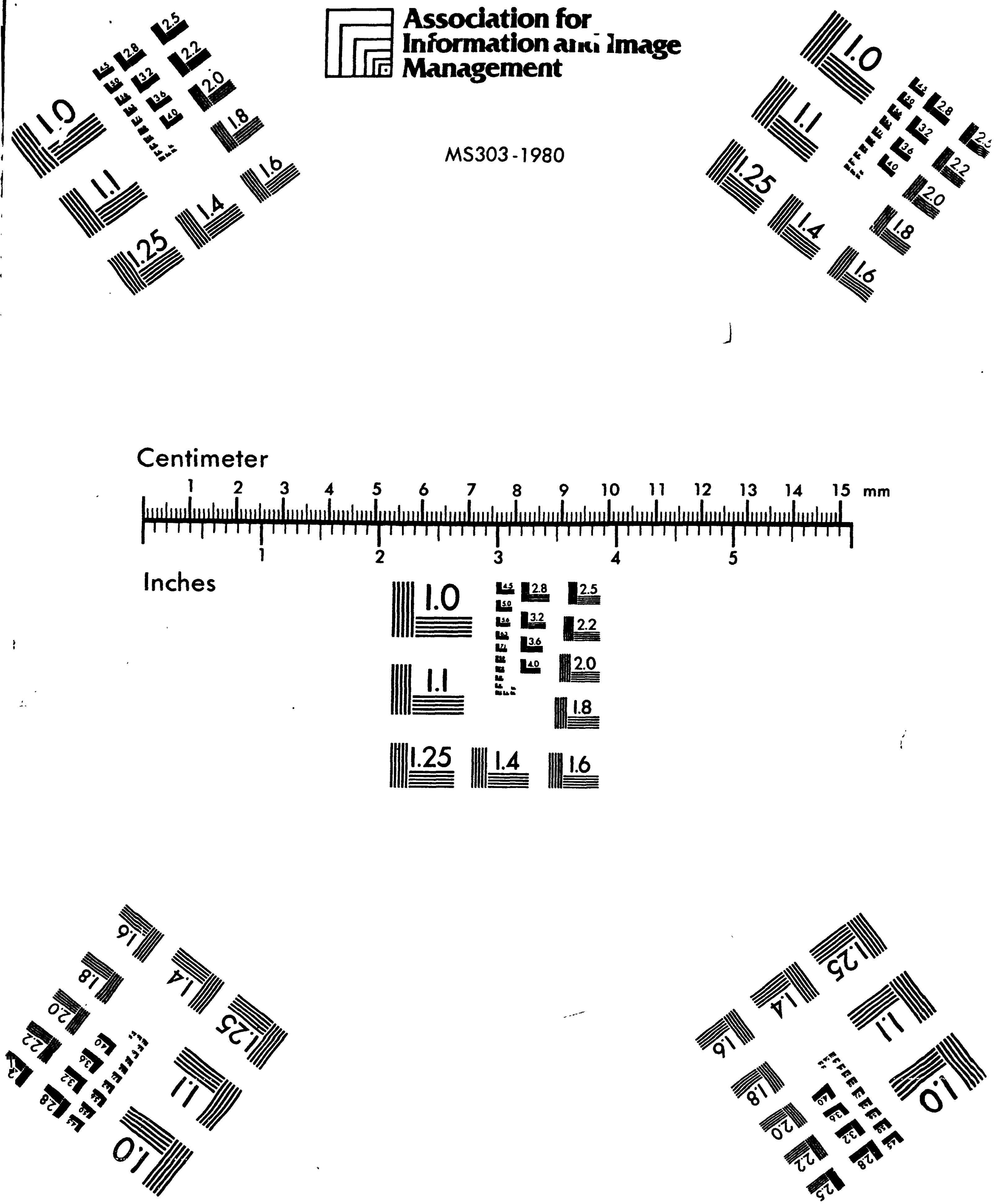

New York State
Department of Environmental Conservation

Division of Water

Flint Creek

Biological Assessment

2002 Survey

GEORGE E. PATAKI, *Governor*　　ERIN M. CROTTY, *Commissioner*

BIOLOGICAL STREAM ASSESSMENT

Flint Creek
Ontario and Yates Counties, New York

Survey date: July 16, 2002
Report date: November 20, 2002

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CONTENTS

Stream: Flint Creek, Ontario and Yates Counties, New York

Reach: Italy to Phelps, New York

Background:

The Stream Biomonitoring Unit conducted biological sampling on Flint Creek on July 16, 2002. The purpose of the sampling was to assess general water quality, and to provide documentation on conditions in the reach from the hamlet of Potter north to the Ontario County line, listed in the Priority Waterbodies List (see Appendix XIII). Water supply use is listed as threatened in this reach, because of the potential for pesticide runoff from intensive agriculture. In particular, the area of the mouth of Nettle Valley Creek in Potter (a tributary to Flint Creek within the PWL reach) has been of concern to regional staff. In addition to benthic sampling, crayfish were collected for tissue analysis at three sites within the PWL reach. Traveling kick samples for macroinvertebrates were taken in riffle areas at 7 sites on Flint Creek and 1 site on Nettle Valley Creek in Potter, using methods described in the Quality Assurance document (Bode et al., 2002) and summarized in Appendix I. The contents of each sample were field-inspected to determine major groups of organisms present, and then preserved in alcohol for laboratory inspection of a 100-specimen subsample. Macroinvertebrate community parameters used in the determination of water quality included species richness, biotic index, EPT value, and percent model affinity (see Appendices II and III). Table 2 provides a listing of sampling sites, and Table 3 provides a listing of all macroinvertebrate species collected in the present survey. This is followed by macroinvertebrate data reports, including individual site descriptions and raw invertebrate data from each site.

Results and Conclusions:

1. Based on macroinvertebrate indicators, water quality in Flint Creek ranged from non-impacted to moderately impacted. The likely contributing factor to impairment is nutrient enrichment as a result of agricultural practices within the entire Flint Creek watershed.

2. However Impact Source Determination suggests water quality may be influenced by complex municipal/industrial contributions within the reach extending from Station 4, to Station 5. Moderate impact at these sites may also be the result of the drained and irrigated swamp land upstream of these stations.

3. The majority of impairment within Flint Creek is attributed to non-point source nutrient runoff from surrounding agricultural areas, and toxic: industrial, municipal or urban runoff. Poor habitat throughout the stream is also considered to be a contributing factor to impairment.

Discussion

Historically, biological monitoring on Flint Creek has been conducted at Phelps, NY (Station 7) as part of the State's Rotating Intensive Basin (RIBS) monitoring and assessment activities in 1995, 1996 and 2001. Water quality at this site has consistently been assessed as slightly impacted (NYS DEC, 1999)(NYS DEC unpublished, 2001). As part of a DEC study investigating pesticide use in the Flint Creek watershed, benthic invertebrate community samples were collected from 3 sites in 1999. These stations were located at sites corresponding to those of the present survey, located within the reach of Potter to Stanley. The study found water quality to range from slightly impacted just above Potter, to moderately impacted in Gorham (G. Neuderfer, study conductor, pers. comm.).

Based on macroinvertebrate results from the current survey, water quality in Flint Creek ranged from non-impacted to moderately impacted (Figure 1). The headwater reaches of the stream are located in forested upland habitat with cool, oxygenated waters. Although results from Station 1 reflect reduced species richness, this is attributed to the effects of the headwater environment (see Appendix XI). Downstream of Station 1, agricultural practices intensify throughout the watershed. Water quality declines to slightly impacted at Stations 2 and 3 (Figure 1), most likely the result of non-point source runoff from crop-lands (Station 2) and impoundment effects (Station 3) from the swamp land habitat in the area of Station 3 (see Appendix XII).

The stream reach from the hamlet of Potter (Station 3) north to the Ontario County line (near Station 4) has been listed on the DEC Priority Waterbodies List (PWL), with the use of the stream as a water supply cited as the area of concern due to "extensive use of pesticides in the watershed" (NYS DEC, 1996). Because of this concern, three sampling sites (Stations 3-5) were concentrated within this reach to provide documentation of the possible impairment. Macroinvertebrate data indicate water quality upstream of the reach is only slightly impaired (Station 3), worsening downstream to moderate impact at Stations 4 - 5. Results of Impact Source Determination (Table 1) suggest the impairments at these stations are the product of more complex municipal/industrial, toxic and organic effluents than of nutrient enrichment from non-point source runoff (see also Appendix X). Impoundment effects are also indicated, likely reflecting the physical nature of the area, with the stream flowing through an extensive series of muckland drainage ditches (see Figure 3b).

Water column sampling for pesticides by the USGS at Phelps in 1997 (Phillips et al., 1998) found atrazine, simazine, and alachlor. This indicates the presence of pesticides in Flint Creek which may influence the biological assessment of water quality. In the present study, invertebrate tissue samples were collected for analysis of pesticides at Stations 3-5, but results of the analysis are not yet available. Earlier investigations of the reach by DEC in 1999 suggested that municipal/industrial, toxic and organic runoff was the source of the impact at the moderately impacted stations (Gary Neuderfer pers. comm.). Point source discharges located between Stations 4 and 5 include the SPDES permitted Gorham (T) Sewage Treatment Plant and Agrilinks Food Inc. The Potter landfill is also located nearby in the watershed.

Water quality improves downstream of Station 5 and is assessed as slightly impacted, with siltation as the contributing factor to impairment (Table 1). This is likely the result of sediment contributed by runoff from the upstream agricultural areas settling out in the lower reaches of the stream. Conditions continue to improve steadily to Phelps (Station 7), the most downstream site. Nettle Valley Creek, a tributary to Flint Creek which joins the stream between Stations 3 and 4, is assessed as slightly impacted (Table 1).

Flint Creek flows through a range of habitats. Even without nutrient additions, many portions of the stream may appear to be slightly impaired simply as a result of the lowland habitat dominating the landscape. However, the high percentage of agricultural land-use within the watershed contributes to non-point source nutrient enrichment within the stream. The use of pesticides by farm operations in certain areas, along with scattered villages, may be causing a greater reduction in water quality. This is especially true within the area located between Stations 3 and 5. The results of invertebrate tissue analysis and additional water column sampling may help to further define this problem.

Literature Cited:

Bode, R. W., M. A. Novak, and L. E. Abele. 2002. Quality assurance work plan for biological stream monitoring in New York State. New York State Department of Environmental Conservation, Technical Report, 115 pages.

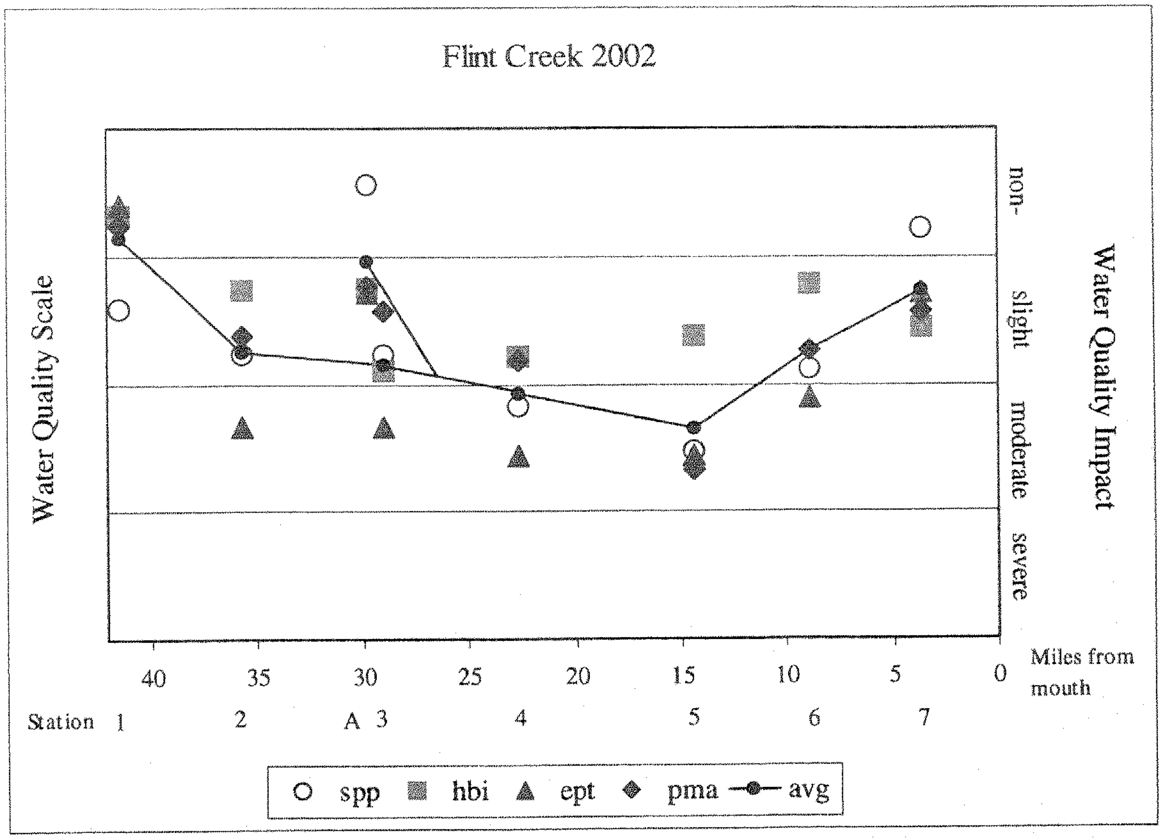
New York State Department of Environmental Conservation. 1999. The Oswego-Seneca-Oneida Rivers Basin, Biennial Report, 1995-96. Rotating Intensive Basin Studies. New York State Department of Environmental Conservation, Technical Report. 115 pages + appends.

New York State Department of Environmental Conservation. 2001. Unpublished report for The Oswego-Seneca-Oneida Rivers Basin. Rotating Intensive Basin Studies

New York State Department of Environmental Conservation. 1996. Priority Waterbodies List for The Oswego-Seneca-Oneida River Basin. New York State Department of Environmental Conservation, Technical Report. 196 pages.

Phillips, P. J., G. R. Wall, D. A. Eckhardt, D. A. Freehafer, and L. A. Rosenmann. 1998. Pesticide concentrations in surface waters of New York State in relation to land use - 1997. U. S. Geological Survey publication WRIR 98-4104. 10 pages.

Figure 1. Biological Assessment Profile of index values, Flint and Nettle Valley Creeks, 2002. Values are plotted on a normalized scale of water quality. The line connects the mean of the four values for each site, representing species richness, EPT richness, Hilsenhoff Biotic Index, and Percent Model Affinity. See Appendix IV for more complete explanation.



Overview of field data

On the date of sampling, July 16, 2002, Flint Creek at the sites sampled was 3-15 meters wide, 0.1-0.2 meters deep, and had current speeds of 40-91 cm/sec in riffles. Dissolved oxygen was 6.8-12.1 mg/l, specific conductance was 163-318 µmhos, pH was 7.5-8.6, and the temperature was 15.5-27.7 °C. Measurements for each site are found on the field data summary sheets.

Table 1. Impact Source Determination, Flint and Nettle Valley Creeks, 2002. Numbers represent similarity to community type models for each impact category. The highest similarities at each station within approximately 5% are highlighted. Similarities less than 50% are less conclusive.

	STATION, FLINT & NETTLE VALLEY CREEKS							
Community Type	1	2	3	4	5	6	7	A
Natural: minimal human impacts	58	40	32	31	31	33	36	39
Nutrient additions; mostly nonpoint, agricultural	55	37	47	51	51	51	48	43
Toxic: industrial, municipal, or urban run-off	45	28	58	64	65	60	55	39
Organic: sewage effluent, animal wastes	24	23	43	64	66	58	45	33
Complex: municipal/industrial	26	19	44	59	68	51	53	31
Siltation	44	31	46	58	57	72	62	42
Impoundment	40	30	64	60	62	50	49	41

TABLE

STATION	COMMUNITY TYPE
1	Natural / Non - point source
2	Natural / Non - point source
3	Impoundment
4	Toxic / Organic / Complex / Impoundment
5	Toxic / Organic / Complex
6	Siltation
7	Siltation
A	Natural / Non - point source / Toxic / Siltation /

TABLE 2. STATION LOCATIONS FOR FLINT AND NETTLE VALLEY CREEKS, ONTARIO AND YATES COUNTIES, NEW YORK (see map).

STATION	LOCATION
01	Italy 20 m downstream of Basset Rd. bridge Latitude/Longitude: 42°36'05"; 77°19'25" 41.5 river miles above mouth
02	Italy 20 m downstream of County Rte. 18 bridge Latitude/Longitude: 42°39'06"; 77°16'15" 35.6 river miles above mouth
03	Potter 50 m downstream of Rte. 364 bridge Latitude/Longitude: 42°42'10"; 77°12'20" 29.0 river miles above mouth
A (Nettle Valley Creek)	Potter Immediately downstream of Rte. 364 bridge Latitude/Longitude: 42°41'34"; 77°11'22" 29.8 river miles above mouth
04	Cole Corners Immediately downstream of Rte. 4 bridge Latitude/Longitude: 42°45'20"; 77°09'03" 22.7 river miles
05	Stanley 30 m below Mott Rd. bridge Latitude/Longitude: 42°49'33"; 77°07'28" 14.4 river miles above mouth
06	Seneca Castle At Ferguson Rd. bridge Latitude/Longitude: 42°53'01"; 77°06'02" 8.9 river miles above mouth
07	Phelps 30 m upstream of Griffith Rd. bridge Latitude/Longitude: 42°56'41"; 77°05'22" 3.6 river miles above mouth

Figure 2 Site Overview Map Flint Creek

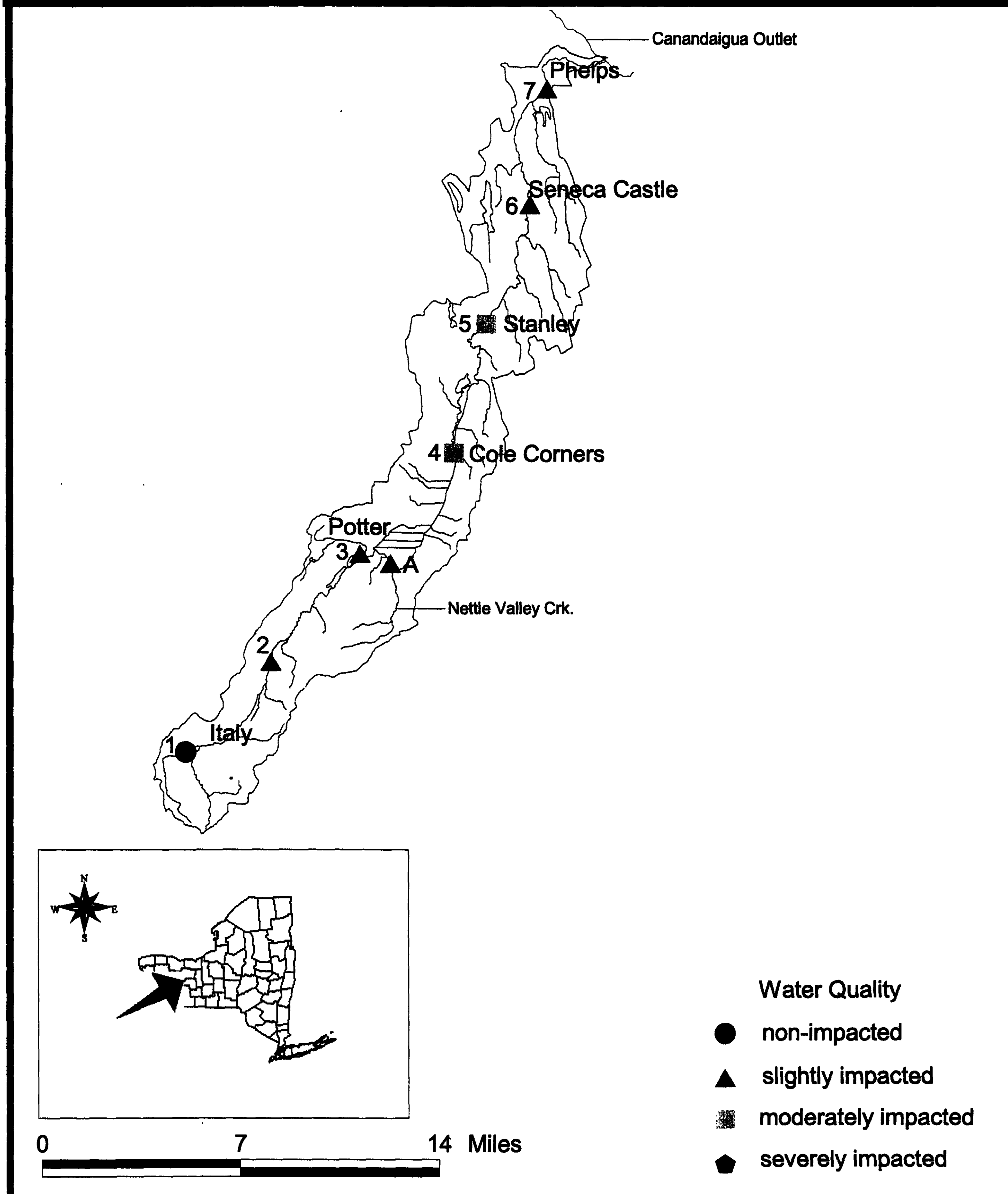
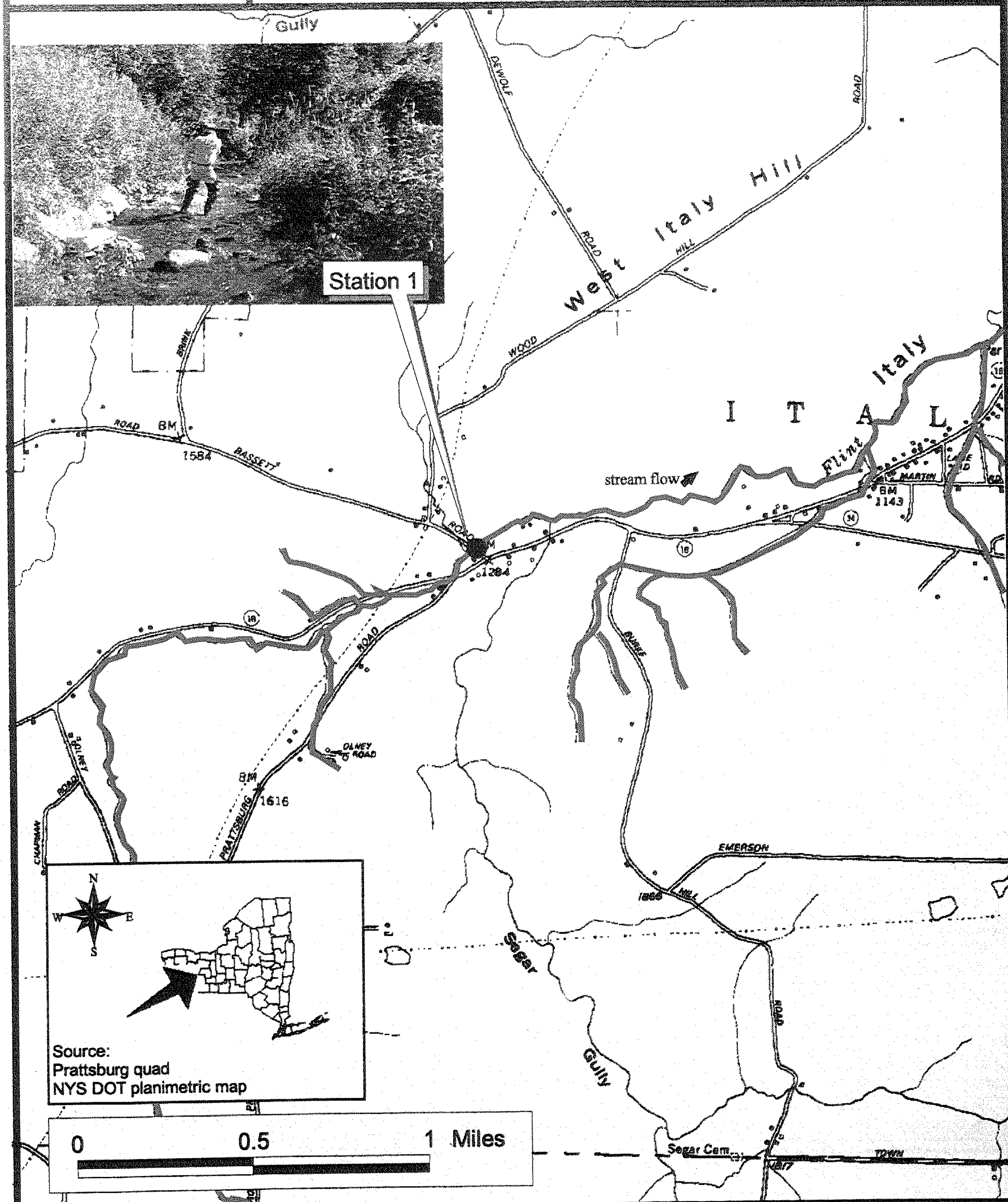


Figure 3. | Site Location Map | Flint Creek



Source:
Prattsburg quad
NYS DOT planimetric map

Figure 3a. Site Location Map Flint Creek

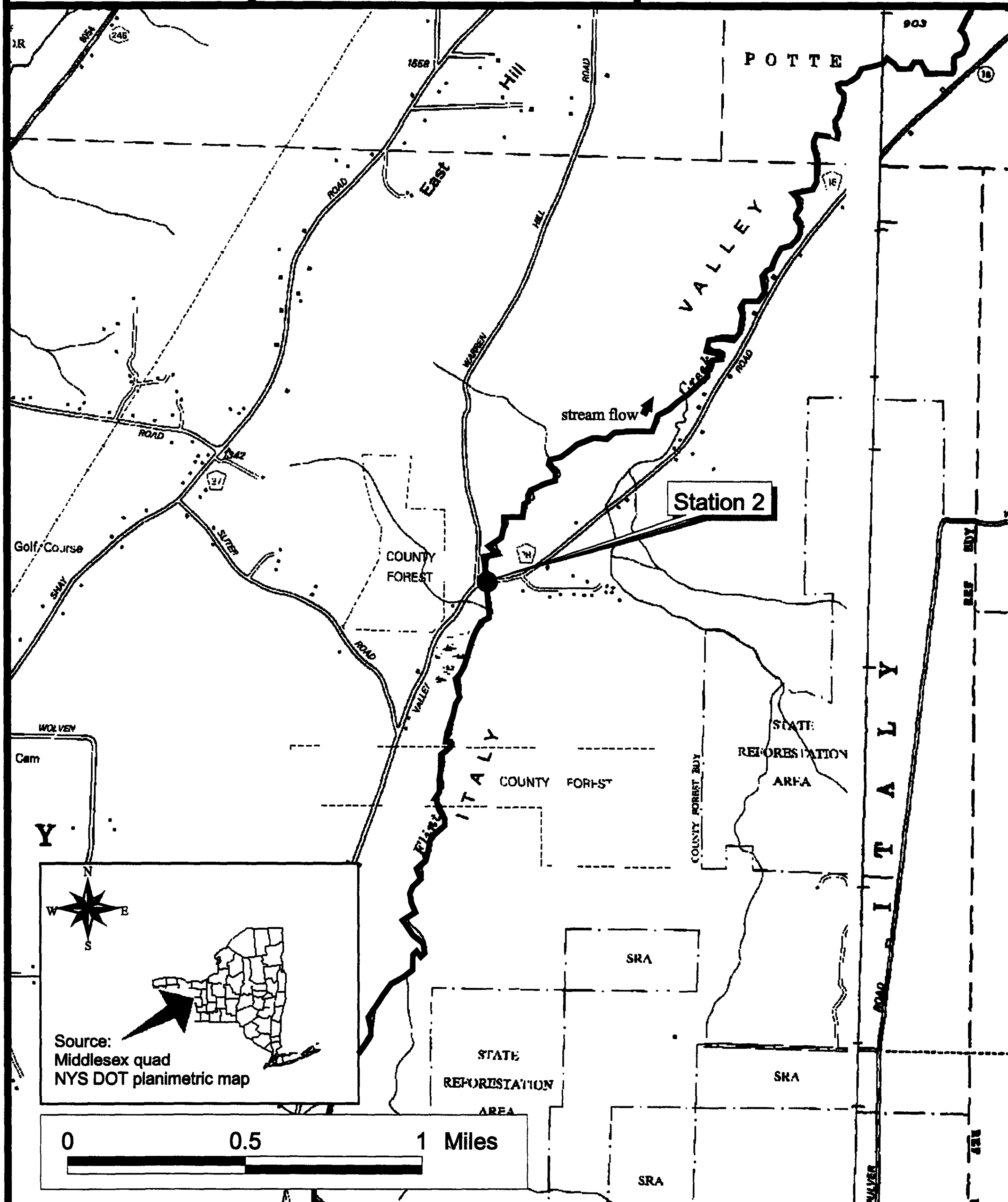


Figure 3b. | Site Location Map | Flint Creek

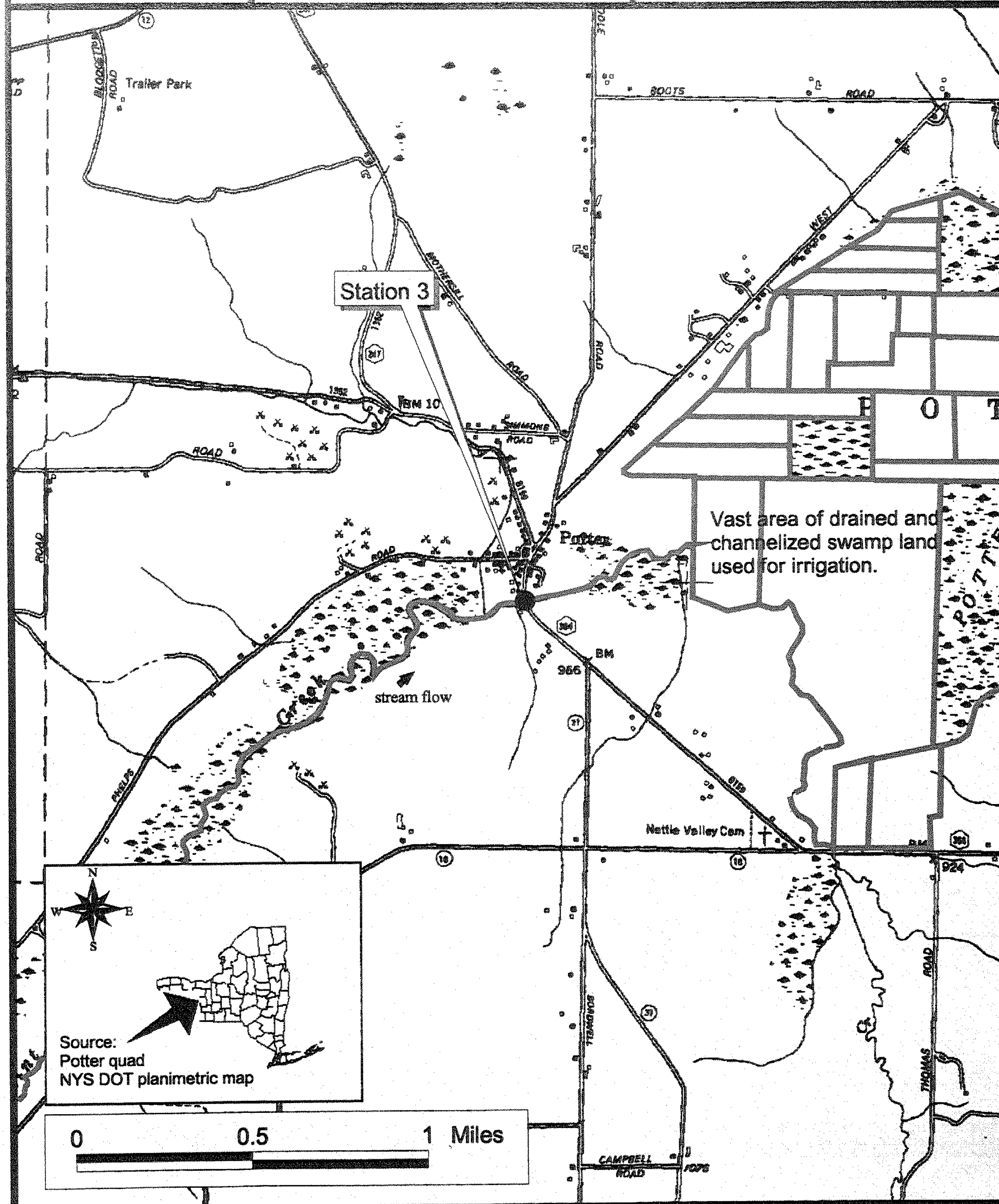


Figure 3c.	Site Location Map	Nettle Valley Creek

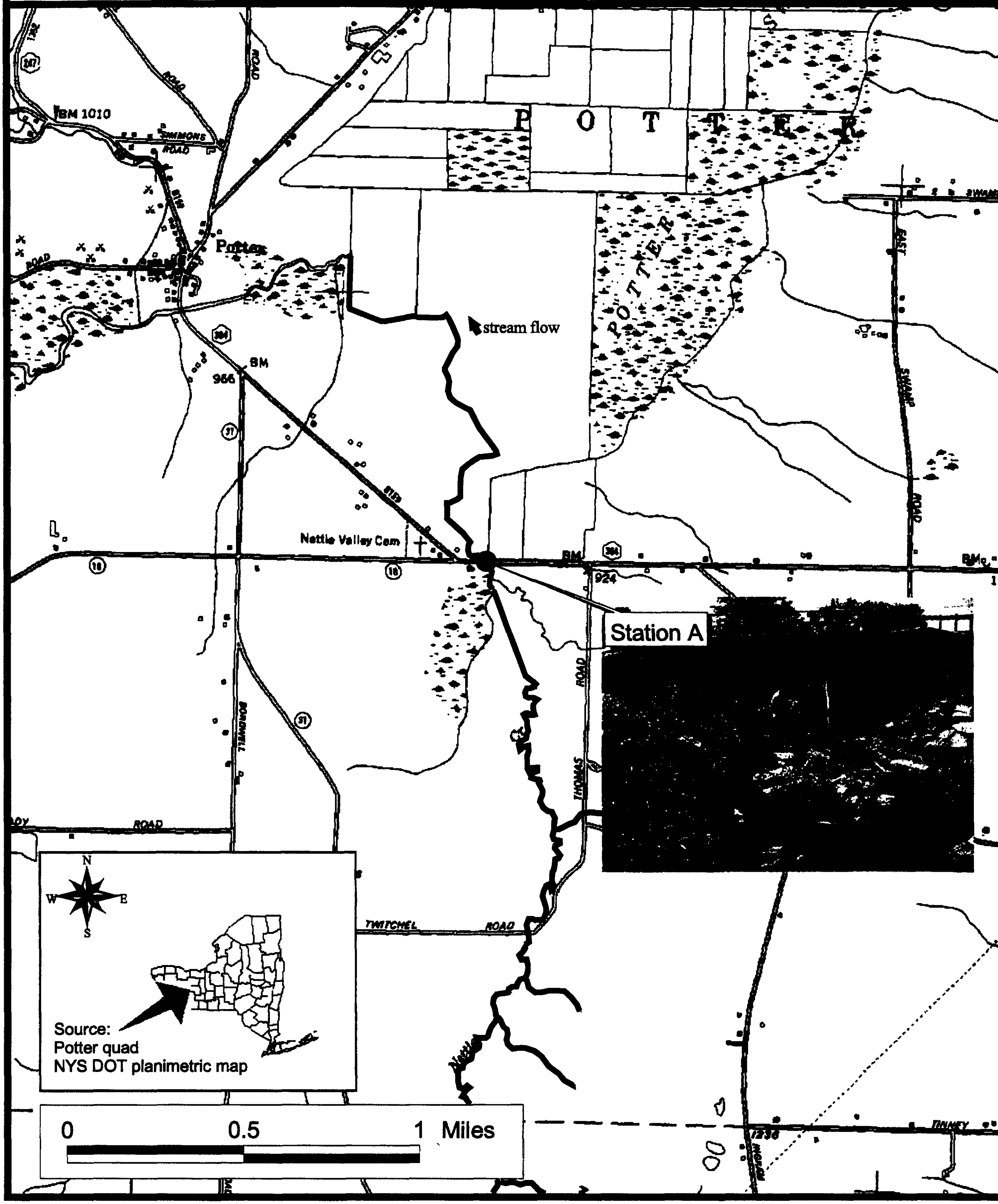


Figure 3d.	Site Location Map	Flint Creek

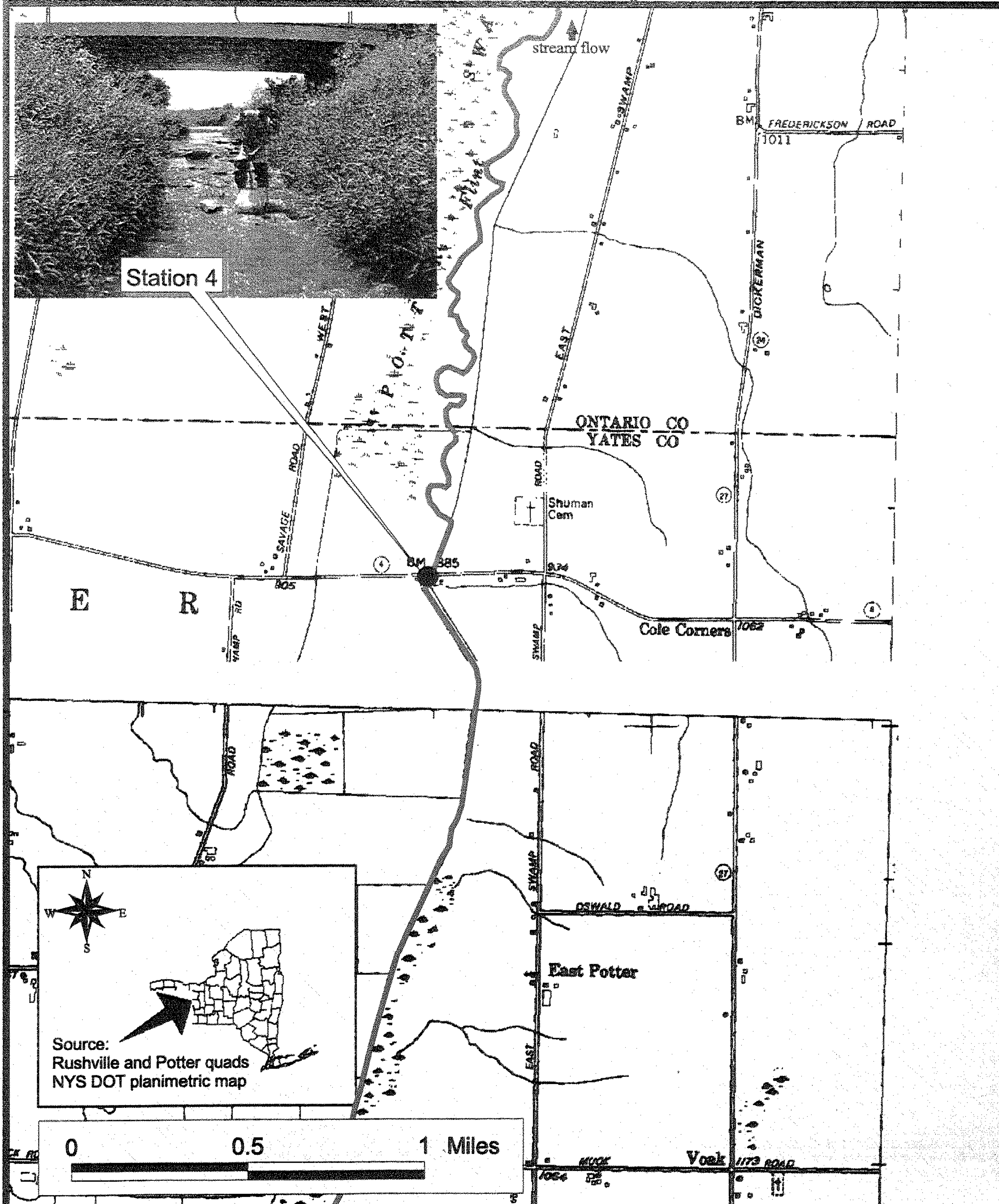


Figure 3e.	Site Location Map	Flint Creek

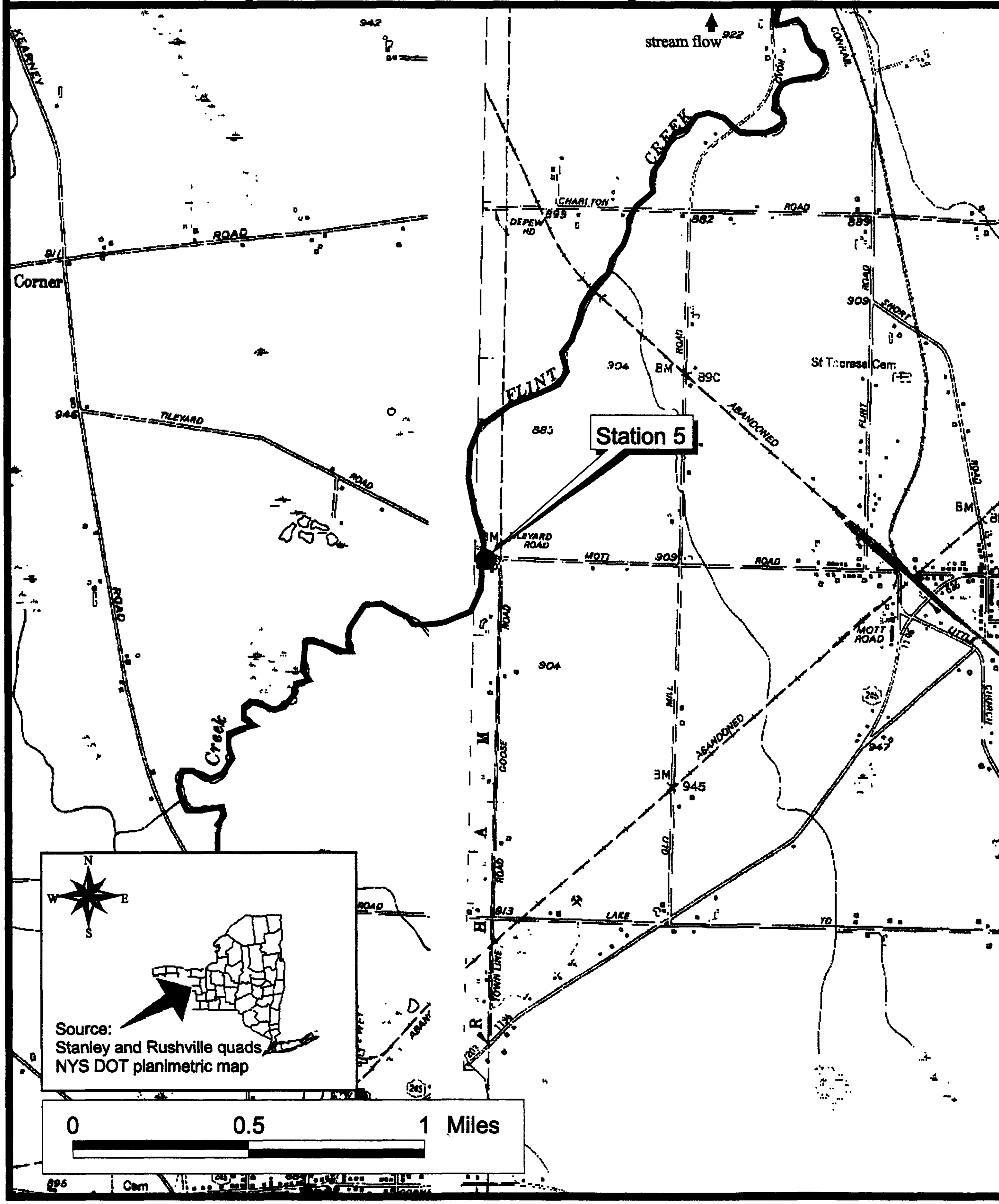


Figure 3f. Site Location Map Flint Creek

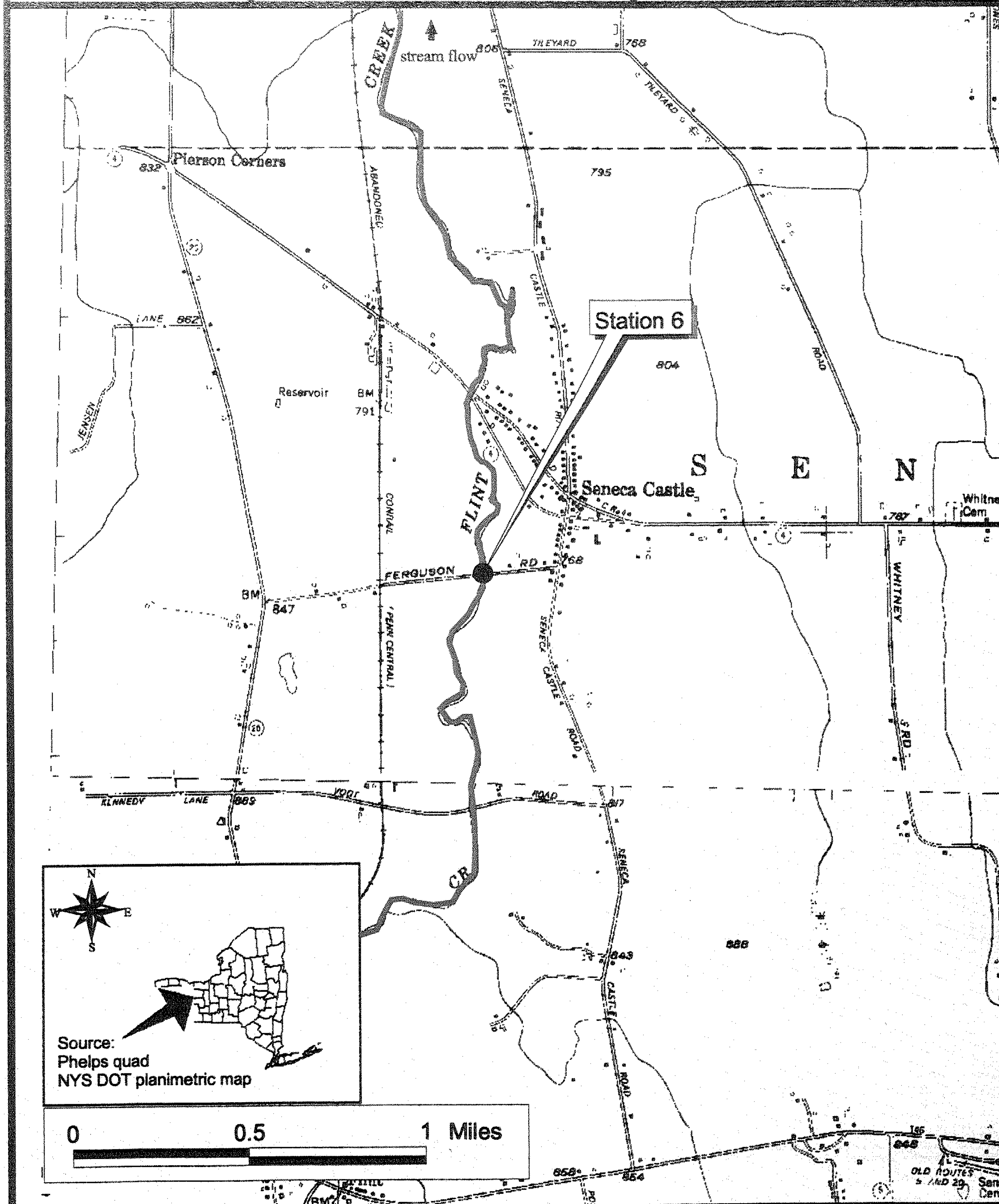


Figure 3g.	Site Location Map	Flint Creek

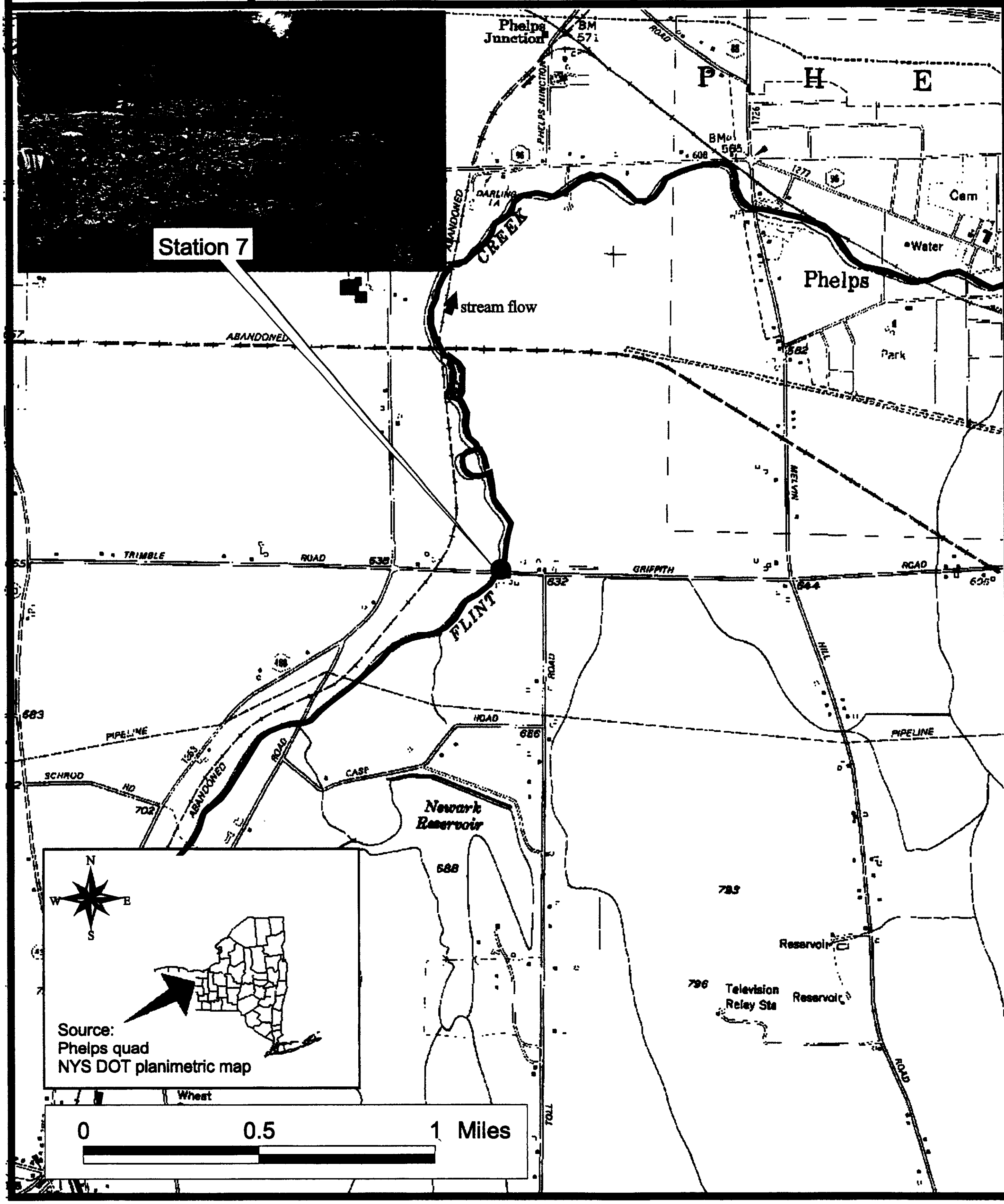


TABLE 3. MACROINVERTBERATES COLLECTED IN FLINT CREEK, ONTARIO AND YATES COUNTIES, NEW YORK, 2002.

PLATYHELMINTHES
 TURBELLARIA
  Undetermined Turbellaria
ANNELIDA
 OLIGOCHAETA
  LUMBRICIDA
   Undetermined Lumbricina
  LUMBRICULIDA
   Lumbriculidae
    Undetermined Lumbriculidae
  TUBIFICIDA
   Tubificidae
    Limnodrilus hoffmeisteri
    Undet. Tubificidae w/o cap. setae
   Naididae
    Nais bretscheri
    Nais variabilis
HIRUDINEA
  Undetermined Hirudinea
MOLLUSCA
 GASTROPODA
  Planorbidae
   Undetermined Planorbidae
  Ancylidae
   Ferrissia sp.
 PELECYPODA
  Sphaeriidae
   Sphaerium sp.
ARTHROPODA
 CRUSTACEA
  ISOPODA
   Asellidae
    Caecidotea racovitzai
 INSECTA
  EPHEMEROPTERA
   Isonychiidae
    Isonychia bicolor
   Baetidae
    Acentrella sp.
    Baetis brunneicolor
    Baetis intercalaris
    Plauditus sp.
   Heptageniidae
    Nixe (Nixe) sp.
    Stenacron interpunctatum
    Stenonema ithaca
    Stenonema sp.
   Leptophlebiidae
    Paraleptophlebia sp.
   Leptohyphidae
    Tricorythodes sp.
   Caenidae
    Caenis sp.
  PLECOPTERA
   Leuctridae
    Leuctra sp.
   Nemouridae
    Undetermined Nemouridae
   Taeniopterygidae
    Taeniopteryx sp.
  COLEOPTERA
   Gyrinidae
    Gyrinus sp.
   Psephenidae
    Ectopria nervosa
    Psephenus herricki
   Elmidae
    Dubiraphia bivittata
    Optioservus fastiditus
    Optioservus trivittatus
    Optioservus sp.
    Promoresia elegans
    Stenelmis crenata
  MEGALOPTERA
   Corydalidae
    Nigronia serricornis
   Sialidae
    Sialis sp.
  TRICHOPTERA
   Philopotamidae
    Chimarra obscura
    Dolophilodes sp.
   Polycentropodidae
    Polycentropus sp.
   Hydropsychidae
    Cheumatopsyche sp.
    Hydropsyche betteni
    Hydropsyche bronta

Table 3. Macroinvertberates Collected in Flint Creek, Ontario And Yates Counties, New York, 2002. Continued

Hydropsyche slossonae
Hydropsyche sparna
Hydroptilidae
Hydroptila spatulata
Rhyacophilidae
Rhyacophila fuscula
DIPTERA
Tipulidae
Antocha sp.
Dicranota sp.
Hexatoma sp.
Tipula sp.
Ceratopogonidae
Undetermined Ceratopogonidae
Simuliidae
Simulium tuberosum
Simulium vittatum
Simulium sp.
Empididae
Hemerodromia sp.
Chironomidae
Tanypodinae
Thienemannimyia gr. spp.
Diamesinae
Diamesa sp.
Orthocladiinae
Corynoneura sp.
Cricotopus bicinctus
Cricotopus tremulus gr.
Cricotopus trifascia gr.
Cricotopus vierriensis
Parametriocnemus lundbecki
Tvetenia bavarica gr.
Tvetenia vitracies
Chironominae
Chironomini
Microtendipes pedellus gr.
Polypedilum aviceps
Polypedilum flavum
Tanytarsini
Micropsectra polita
Micropsectra sp.
Rheotanytarsus exiguus gr.
Rheotanytarsus pellucidus
Tanytarsus glabrescens gr.

STREAM SITE:	Flint Creek, Station 1
LOCATION:	Italy, NY, 20 meters downstream of Basset Road.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Acentrella sp.	6
		Baetis brunneicolor	8
	Leptophlebiidae	Paraleptophlebia sp.	1
PLECOPTERA	Leuctridae	Leuctra sp.	3
	Nemouridae	Undetermined Nemouridae	1
	Taeniopterygidae	Taeniopteryx sp.	1
COLEOPTERA	Elmidae	Optioservus fastiditus	12
TRICHOPTERA	Philopotamidae	Dolophilodes sp.	13
	Polycentropodidae	Polycentropus sp.	1
	Hydropsychidae	Cheumatopsyche sp.	1
		Hydropsyche slossonae	5
		Hydropsyche sparna	7
	Rhyacophilidae	Rhyacophila fuscula	1
DIPTERA	Tipulidae	Antocha sp.	1
		Hexatoma sp.	2
	Ceratopogonidae	Undetermined Ceratopogonidae	4
	Simuliidae	Simulium tuberosum	4
	Chironomidae	Thienemannimyia gr. spp.	7
		Diamesa sp.	3
		Tvetenia bavarica gr.	1
		Polypedilum aviceps	14
		Polypedilum flavum	3
		Micropsectra sp.	1

SPECIES RICHNESS	23 (good)
BIOTIC INDEX	3.71(very good)
EPT RICHNESS	12 (very good)
MODEL AFFINITY	70 (very good)
ASSESSMENT	non-impacted

DESCRIPTION

The sampling site was located in the headwaters of Flint Creek, 20 meters downstream of Basset Road in Italy. Although the site was assessed as non-impacted the invertebrate community had reduced species richness due to its headwaters location (see Appendix XI).

STREAM SITE:	Flint Creek, Station 2
LOCATION:	Italy, NY, 20 meters downstream of County Route 18.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

ANNELIDA			
OLIGOCHAETA			
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	2
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	1
MOLLUSCA			
GASTROPODA	Ancylidae	Ferrissia sp.	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Heptageniidae	Nixe (Nixe) sp.	1
	Leptophlebiidae	Paraleptophlebia sp.	1
COLEOPTERA	Elmidae	Optioservus fastiditus	40
		Stenelmis crenata	3
MEGALOPTERA	Corydalidae	Nigronia serricornis	1
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	9
		Hydropsyche sparna	2
DIPTERA	Tipulidae	Dicranota sp.	1
		Tipula sp.	1
	Simuliidae	Simulium vittatum	5
	Empididae	Hemerodromia sp.	2
	Chironomidae	Thienemannimyia gr. spp.	6
		Diamesa sp.	1
		Parametriocnemus lundbecki	6
		Polypedilum aviceps	2
		Micropsectra sp.	14
		Rheotanytarsus exiguus gr.	1

SPECIES RICHNESS	20 (good)
BIOTIC INDEX	5.04 (good)
EPT RICHNESS	4 (poor)
MODEL AFFINITY	55 (good)
ASSESSMENT	slightly impacted

DESCRIPTION

The sample was taken 20 meters downstream of the County Rte. 18 bridge, in Italy. The invertebrate community was dominated by two organisms; the intolerant riffle beetle *Optioservus fastiditus* and the facultative midge *Micropsectra sp.*. Stoneflies were absent and mayflies were scarcely represented, resulting in similarity to communities affected by non-point source nutrient additions indicated by Impact Source Determination as explained in Appendix X. Water quality was assessed as slightly impacted.

STREAM SITE: Flint Creek, Station 3
LOCATION: Potter, NY, 50 meters downstream of Route 364.
DATE: 16 July 2002
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100 individuals

ANNELIDA			
OLIGOCHAETA			
TUBIFICIDA	Tubificidae	Limnodrilus hoffmeisteri	14
	Naididae	Nais variabilis	1
ARTHROPODA			
CRUSTACEA			
ISOPODA	Asellidae	Caecidotea racovitzai	6
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis intercalaris	1
	Heptageniidae	Stenacron interpunctatum	1
		Stenonema ithaca	2
COLEOPTERA	Psephenidae	Psephenus herricki	2
	Elmidae	Dubiraphia bivittata	5
		Stenelmis crenata	27
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	9
DIPTERA	Simuliidae	Simulium vittatum	2
	Empididae	Hemerodromia sp.	2
	Chironomidae	Thienemannimyia gr. spp.	12
		Diamesa sp.	1
		Cricotopus vierriensis	5
		Microtendipes pedellus gr.	3
		Polypedilum aviceps	2
		Micropsectra polita	1
		Micropsectra sp.	1
		Rheotanytarsus exiguus gr.	3

SPECIES RICHNESS 20 (good)
BIOTIC INDEX 6.30 (good)
EPT RICHNESS 4 (poor)
MODEL AFFINITY 58 (good)
ASSESSMENT slightly impacted

DESCRIPTION This site was located downstream of the Rte. 364 bridge in Potter. The invertebrate fauna was indicative of impoundment effects, with lower species and EPT richness than the upstream non-impacted site 1 (see Appendix XII). This is likely the result of a lowland marsh which dominates the area between sites 2 and 3. Water quality was assessed as slightly impacted, caused by natural habitat conditions.

STREAM SITE:	Flint Creek, Station 4
LOCATION:	Cole Corners, NY, immediately downstream of Route 4.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

PLATYHELMINTHES			
TURBELLARIA		Undetermined Turbellaria	3
ANNELIDA			
OLIGOCHAETA			
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	4
MOLLUSCA			
PELECYPODA	Sphaeriidae	Sphaerium sp.	1
ARTHROPODA			
INSECTA			
COLEOPTERA	Elmidae	Optioservus trivittatus	1
		Promoresia elegans	2
		Stenelmis crenata	17
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	18
		Hydropsyche betteni	26
	Hydroptilidae	Hydroptila spatulata	1
DIPTERA	Tipulidae	Dicranota sp.	1
	Simuliidae	Simulium vittatum	1
	Empididae	Hemerodromia sp.	2
	Chironomidae	Thienemannimyia gr. spp.	2
		Cricotopus tremulus gr.	7
		Cricotopus trifascia gr.	8
		Cricotopus vierriensis	5
		Polypedilum flavum	1

SPECIES RICHNESS	17 (poor)
BIOTIC INDEX	6.07 (good)
EPT RICHNESS	3 (poor)
MODEL AFFINITY	52 (good)
ASSESSMENT	moderately impacted

DESCRIPTION

The sample was collected immediately downstream of the Rte. 4 bridge, in Cole Corners. Community index results were split between slightly and moderately impacted. The overall assessment was just within the moderately impacted range. Species richness and EPT richness were reduced in comparison to upstream sites. Stoneflies and mayflies were absent from this site. Conditions at this site may be adversely affected by the swamp upstream. Dissolved oxygen levels were low for the current speed recorded at the site.

STREAM SITE:	Flint Creek, Station 5
LOCATION:	Stanley, NY, 30 meters downstream of Mott Road.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

ANNELIDA			
OLIGOCHAETA			
LUMBRICIDA		Undetermined Lumbricina	1
TUBIFICIDA	Tubificidae	Limnodrilus hoffmeisteri	6
MOLLUSCA			
GASTROPODA	Ancylidae	Ferrissia sp.	1
PELECYPODA	Sphaeriidae	Sphaerium sp.	6
ARTHROPODA			
INSECTA			
COLEOPTERA	Gyrinidae	Gyrinus sp.	1
	Elmidae	Stenelmis crenata	25
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	35
		Hydropsyche betteni	16
		Hydropsyche bronta	1
DIPTERA	Simuliidae	Simulium sp.	1
	Empididae	Hemerodromia sp.	3
	Chironomidae	Polypedilum flavum	1
		Rheotanytarsus exiguus gr.	2
		Rheotanytarsus pellucidus	1

SPECIES RICHNESS	14 (poor)
BIOTIC INDEX	5.75 (good)
EPT RICHNESS	3 (poor)
MODEL AFFINITY	39 (poor)
ASSESSMENT	moderately impacted

DESCRIPTION

This sampling location was in Stanley, 30 m downstream of the Mott Rd. bridge. The invertebrate community at this site was significantly reduced compared to upstream sites. Three species of facultative insects composed 76% of the sample. Stoneflies and mayflies were absent at this site as well.

STREAM SITE:	Flint Creek, Station 6
LOCATION:	Seneca Castle, NY, at Ferguson Road.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

ANNELIDA			
OLIGOCHAETA			
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	2
	Naididae	Nais bretscheri	1
HIRUDINEA		Undetermined Hirudinea	1
MOLLUSCA			
PELECYPODA	Sphaeriidae	Sphaerium sp.	3
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Heptageniidae	Stenonema ithaca	2
	Leptohyphidae	Tricorythodes sp.	13
COLEOPTERA	Psephenidae	Ectopria nervosa	1
	Elmidae	Optioservus sp.	1
		Stenelmis crenata	20
MEGALOPTERA	Corydalidae	Nigronia serricornis	2
	Sialidae	Sialis sp.	1
TRICHOPTERA	Hydropsychidae	Cheumatopsyche sp.	24
		Hydropsyche betteni	3
		Hydropsyche bronta	9
DIPTERA	Tipulidae	Antocha sp.	12
	Chironomidae	Thienemannimyia gr. spp.	1
		Cricotopus bicinctus	1
		Cricotopus trifascia gr.	1
		Polypedilum flavum	2

SPECIES RICHNESS	19 (good)
BIOTIC INDEX	4.93 (good)
EPT RICHNESS	5 (poor)
MODEL AFFINITY	53 (good)
ASSESSMENT	slightly impacted

DESCRIPTION

The kick sample was taken at the Ferguson Rd. bridge, in Seneca Castle. The invertebrate fauna began to rebound from upstream impacts, resulting in a more balanced community with mayflies again making up a portion of the community. Water quality was assessed as slightly impacted.

STREAM SITE:	Flint Creek, Station 7
LOCATION:	Phelps, NY, 30 meters upstream of Griffith Road.
DATE:	16 July 2002
SAMPLE TYPE:	Kick sample
SUBSAMPLE:	100 individuals

PLATYHELMINTHES			
TURBELLARIA		Undetermined Turbellaria	2
MOLLUSCA			
GASTROPODA	Planorbidae	Undetermined Planorbidae	2
PELECYPODA	Sphaeriidae	Sphaerium sp.	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Isonychiidae	Isonychia bicolor	1
	Baetidae	Plauditus sp.	1
	Heptageniidae	Stenacron interpunctatum	2
		Stenonema sp.	1
	Leptohyphidae	Tricorythodes sp.	5
	Caenidae	Caenis sp.	1
COLEOPTERA	Psephenidae	Psephenus herricki	3
	Elmidae	Stenelmis crenata	5
MEGALOPTERA	Sialidae	Sialis sp.	1
TRICHOPTERA	Philopotamidae	Chimarra obscura	1
	Hydropsychidae	Cheumatopsyche sp.	12
		Hydropsyche sparna	8
DIPTERA	Tipulidae	Antocha sp.	1
	Empididae	Hemerodromia sp.	2
	Chironomidae	Thienemannimyia gr. spp.	3
		Corynoneura sp.	1
		Cricotopus bicinctus	3
		Cricotopus tremulus gr.	6
		Cricotopus trifascia gr.	4
		Cricotopus vierriensis	6
		Parametriocnemus lundbecki	3
		Tvetenia vitracies	1
		Polypedilum flavum	19
		Rheotanytarsus exiguus gr.	3
		Tanytarsus glabrescens gr.	2

SPECIES RICHNESS	28 (very good)
BIOTIC INDEX	5.62 (good)
EPT RICHNESS	9 (good)
MODEL AFFINITY	58 (good)
ASSESSMENT	slightly impacted

DESCRIPTION

This sample was collected 30 meters upstream of the Griffith Rd. bridge, in Phelps. Species diversity increased greatly compared to previous sites suggesting further recovery from upstream impacts. The fauna was balanced although stoneflies were still absent. Water quality was assessed as slightly impacted.

STREAM SITE: Nettle Valley Creek, Station A
LOCATION: Potter, NY, immediately downstream of Route 364.
DATE: 16 July 2002
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100 individuals

PLATYHELMINTHES			
TURBELLARIA		Undetermined Turbellaria	2
ANNELIDA			
OLIGOCHAETA			
LUMBRICIDA		Undetermined Lumbricina	1
TUBIFICIDA	Naididae	Nais behningi	11
MOLLUSCA			
PELECYPODA	Sphaeriidae	Undetermined Sphaeriidae	1
ARTHROPODA			
INSECTA			
EPHEMEROPTERA	Baetidae	Baetis flavistriga	4
		Baetis intercalaris	1
	Leptophlebiidae	Paraleptophlebia sp.	3
COLEOPTERA	Psephenidae	Psephenus herricki	3
	Elmidae	Optioservus sp.	4
		Promoresia elegans	1
TRICHOPTERA	Philopotamidae	Chimarra aterrima?	2
	Hydropsychidae	Cheumatopsyche sp.	13
		Hydropsyche bronta	1
		Hydropsyche slossonae	3
		Hydropsyche sp.	2
	Hydroptilidae	Hydroptila sp.	5
DIPTERA	Tipulidae	Antocha sp.	2
		Dicranota sp.	3
		Limonia sp.	1
		Tipula sp.	2
	Ceratopogonidae	Undetermined Ceratopogonidae	1
	Chironomidae	Thienemannimyia gr. spp.	10
		Corynoneura sp.	1
		Cricotopus tremulus gr.	2
		Parametriocnemus lundbecki	2
		Tvetenia bavarica gr.	2
		Polypedilum aviceps	5
		Xenochironomus xenolabis	1
		Cladotanytarsus nr. dispersopilosus	1
		Micropsectra sp.	2
		Rheotanytarsus exiguus gr.	8

SPECIES RICHNESS 31 (very good)
BIOTIC INDEX 4.99 (good)
EPT RICHNESS 9 (good)
MODEL AFFINITY 61 (good)
ASSESSMENT slightly impacted
DESCRIPTION The sample was taken on Nettle Valley Creek in Potter, immediately downstream of the Rte. 364 bridge. This site was very productive with a highly diverse invertebrate community. Water quality was slightly impacted.

FIELD DATA SUMMARY				
STREAM NAME: Flint Creek	**DATE SAMPLED: 07/16/02**			
REACH: Italy to Potter				
FIELD PERSONNEL INVOLVED: Smith, Novak				
STATION	01	02	03	A (Nettle Valley Crk.)
ARRIVAL TIME AT STATION	9:12	10:05	10:45	11:28
LOCATION	Italy	Italy	Potter	Potter
PHYSICAL CHARACTERISTICS				
Width (meters)	3	4	10	3
Depth (meters)	0.1	0.1	0.1	0.1
Current speed (cm per sec.)	56	45	40	20
Substrate (%)				
Rock (>25.4 cm, or bedrock)			10	20
Rubble (6.35 - 25.4 cm)	40	10	40	40
Gravel (0.2 – 6.35 cm)	30	50	20	10
Sand (0.06 – 2.0 mm)	20	10	10	10
Silt (0.004 – 0.06 mm)	10	30	20	20
Embeddedness (%)	25	10	10	10
CHEMICAL MEASUREMENTS				
Temperature (° C)	15.5	18.2	20.6	18.9
Specific Conductance (umhos)	178	163	203	199
Dissolved Oxygen (mg/l)	10.1	8.3	8.4	7.4
pH	8.1	7.7	7.6	7.8
BIOLOGICAL ATTRIBUTES				
Canopy (%)	40	60	20	59
Aquatic Vegetation				
algae – suspended				
algae – attached, filamentous			x	x
algae - diatoms				
macrophytes or moss				
Occurrence of Macroinvertebrates				
Ephemeroptera (mayflies)	x	x	x	x
Plecoptera (stoneflies)	x	x	x	
Trichoptera (caddisflies)	x	x	x	x
Coleoptera (beetles)			x	x
Megaloptera(dobsonflies,alderflies)	x	x		x
Odonata (dragonflies, damselflies)		x		
Chironomidae (midges)	x	x	x	x
Simuliidae (black flies)	x	x		
Decapoda (crayfish)	x	x	x	x
Gammaridae (scuds)				
Mollusca (snails, clams)			x	x
Oligochaeta (worms)			x	
Other			x	
FIELD ASSESSMENT	non	slight	slight	slight

FIELD DATA SUMMARY				
STREAM NAME: Flint Creek		DATE SAMPLED: 07/16/02		
REACH: Cole Corners to Phelps				
FIELD PERSONNEL INVOLVED: Smith, Novak				
STATION	04	05	06	07
ARRIVAL TIME AT STATION	12:20	1:45	2:35	3:17
LOCATION	Cole Corners	Stanley	Seneca Castle	Phelps
PHYSICAL CHARACTERISTICS				
Width (meters)	4	10	15	10
Depth (meters)	0.1	0.2	0.1	0.2
Current speed (cm per sec.)	91	71	67	30
Substrate (%)				
Rock (>25.4 cm, or bedrock)	10		10	10
Rubble (6.35 - 25.4 cm)	40	40	40	40
Gravel (0.2 – 6.35 cm)	20	30	20	20
Sand (0.06 – 2.0 mm)	10	10	10	10
Silt (0.004 – 0.06 mm)	20	20	20	20
Embeddedness (%)	40	15	40	40
CHEMICAL MEASUREMENTS				
Temperature (° C)	23.7	24.0	26.5	27.7
Specific Conductance (umhos)	318	301	272	248
Dissolved Oxygen (mg/l)	6.8	11.0	12.1	11.8
pH	7.5	8.1	8.4	8.6
BIOLOGICAL ATTRIBUTES				
Canopy (%)	0	60	10	63
Aquatic Vegetation				
algae – suspended				
algae – attached, filamentous		x	xx	xxx
algae - diatoms			x	x
macrophytes or moss				
Occurrence of Macroinvertebrates				
Ephemeroptera (mayflies)			x	x
Plecoptera (stoneflies)				
Trichoptera (caddisflies)	x	x	x	x
Coleoptera (beetles)	x	x	x	x
Megaloptera(dobsonflies,alderflies)			x	
Odonata (dragonflies, damselflies)	x		x	
Chironomidae (midges)	x	x	x	x
Simuliidae (black flies)	x	x		
Decapoda (crayfish)	x	x	x	x
Gammaridae (scuds)				x
Mollusca (snails, clams)		x		
Oligochaeta (worms)		x	x	
Other		x	x	x
FIELD ASSESSMENT	moderate	moderate	slight	moderate

LABORATORY DATA SUMMARY				
STREAM NAME: Flint Creek		**DRAINAGE: 07**		
DATE SAMPLED: 07/16/02		**COUNTY: Yates**		
SAMPLING METHOD: Traveling Kick				
STATION	01	02	03	A (Nettle Valley Crk.)
LOCATION	Italy	Italy	Potter	Potter
DOMINANT SPECIES/%CONTRIBUTION/TOLERANCE/COMMON NAME				
1.	Polypedilum aviceps 14 % facultative midge	Optioservus fastiditus 40 % intolerant beetle	Stenelmis crenata 27 % facultative beetle	Cheumatopsyche sp. 13 % facultative caddisfly
2. **Intolerant = not tolerant of poor water quality**	Dolophilodes sp. 13 % intolerant caddisfly	Micropsectra sp. 14 % facultative midge	Limnodrilus hoffmeisteri 14 % tolerant worm	Nais behningi 11 % facultative worm
3. **Facultative = occurring over a wide range of water quality**	Optioservus fastiditus 12 % intolerant beetle	Cheumatopsyche sp. 9 % facultative caddisfly	Thienemannimyia gr. spp. 12 % facultative midge	Thienemannimyia gr. spp. 10 % facultative midge
4. **Tolerant = tolerant of poor water quality**	Baetis brunneicolor 8 % intolerant mayfly	Thienemannimyia gr. spp. 6 % facultative midge	Cheumatopsyche sp. 9 % facultative caddisfly	Rheotanytarsus exiguus gr. 8 % facultative midge
5.	Hydropsyche sparna 7 % facultative caddisfly	Parametriocnems lundbecki 6 % facultative midge	Caecidotea racovitzai 6 % tolerant sowbug	Hydroptila sp. 5 % facultative caddisfly
% CONTRIBUTION OF MAJOR GROUPS (NUMBER OF TAXA IN PARENTHESES)				
Chironomidae (midges)	29.0 (6.0)	30.0 (6.0)	28.0 (8.0)	34.0 (10.0)
Trichoptera (caddisflies)	28.0 (6.0)	11.0 (2.0)	9.0 (1.0)	26.0 (6.0)
Ephemeroptera (mayflies)	15.0 (3.0)	2.0 (2.0)	4.0 (3.0)	8.0 (3.0)
Plecoptera (stoneflies)	5.0 (3.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Coleoptera (beetles)	12.0 (1.0)	43.0 (2.0)	34.0 (3.0)	8.0 (3.0)
Oligochaeta (worms)	0.0 (0.0)	3.0 (2.0)	15.0 (2.0)	12.0 (2.0)
Mollusca (clams and snails)	0.0 (0.0)	1.0 (1.0)	0.0 (0.0)	1.0 (1.0)
Crustacea (crayfish, scuds, sowbugs)	0.0 (0.0)	0.0 (0.0)	6.0 (1.0)	0.0 (0.0)
Other insects (odonates, diptera)	11.0 (4.0)	10.0 (5.0)	4.0 (2.0)	9.0 (5.0)
Other (Nemertea, Platyhelminthes)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	2.0 (1.0)
SPECIES RICHNESS	23	20	20	31
BIOTIC INDEX	3.71	5.04	6.3	4.99
EPT RICHNESS	12	4	4	9
PERCENT MODEL AFFINITY	70	55	58	61
FIELD ASSESSMENT	non	slight	slight	slight
OVERALL ASSESSMENT	non-impacted	slightly impacted	slightly impacted	slightly impacted

LABORATORY DATA SUMMARY

STREAM NAME: Flint Creek	**DRAINAGE: 07**
DATE SAMPLED: 07/16/02	**COUNTY: Yates**
SAMPLING METHOD: Traveling Kick	

STATION	04	05	06	07
LOCATION	Cole Corners	Stanley	Seneca Castle	Phelps
DOMINANT SPECIES/%CONTRIBUTION/TOLERANCE/COMMON NAME				
1.	Hydropsyche betteni 26 % facultative caddisfly	Cheumatopsyche sp. 35 % facultative caddisfly	Cheumatopsyche sp. 24 % facultative caddisfly	Polypedilum flavum 19 % facultative midge
Intolerant = not tolerant of poor water quality 2.	Cheumatopsyche sp. 18 % facultative caddisfly	Stenelmis crenata 25 % facultative beetle	Stenelmis crenata 20 % facultative beetle	Cheumatopsyche sp. 12 % facultative caddisfly
Facultative = occurring over a wide range of water quality 3.	Stenelmis crenata 17 % facultative beetle	Hydropsyche betteni 16 % facultative caddisfly	Tricorythodes sp. 13 % intolerant mayfly	Hydropsyche sparna 8 % facultative caddisfly
Tolerant = tolerant of poor water quality 4.	Cricotopus trifascia gr. 8 % facultative midge	Limnodrilus hoffmeisteri 6 % tolerant worm	Antocha sp. 12 % intolerant crane fly	Cricotopus tremulus gr. 6 % facultative midge
5.	Cricotopus tremulus gr. 7 % facultative midge	Sphaerium sp. 6 % facultative clam	Hydropsyche bronta 9 % facultative caddisfly	Cricotopus vierriensis 6 % facultative midge
% CONTRIBUTION OF MAJOR GROUPS (NUMBER OF TAXA IN PARENTHESES)				
Chironomidae (midges)	23.0 (5.0)	4.0 (3.0)	5.0 (4.0)	51.0 (11.0)
Trichoptera (caddisflies)	45.0 (3.0)	52.0 (3.0)	36.0 (3.0)	21.0 (3.0)
Ephemeroptera (mayflies)	0.0 (0.0)	0.0 (0.0)	15.0 (2.0)	11.0 (6.0)
Plecoptera (stoneflies)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Coleoptera (beetles)	20.0 (3.0)	26.0 (2.0)	22.0 (3.0)	8.0 (2.0)
Oligochaeta (worms)	4.0 (1.0)	7.0 (2.0)	3.0 (2.0)	0.0 (0.0)
Mollusca (clams and snails)	1.0 (1.0)	7.0 (2.0)	3.0 (1.0)	3.0 (2.0)
Crustacea (crayfish, scuds, sowbugs)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Other insects (odonates, diptera)	4.0 (3.0)	4.0 (2.0)	15.0 (3.0)	4.0 (3.0)
Other (Nemertea, Platyhelminthes)	3.0 (1.0)	0.0 (0.0)	1.0 (1.0)	2.0 (1.0)
SPECIES RICHNESS	17	14	19	28
BIOTIC INDEX	6.07	5.75	4.93	5.62
EPT RICHNESS	3	3	5	9
PERCENT MODEL AFFINITY	52	39	53	58
FIELD ASSESSMENT	moderate	moderate	slight	moderate
OVERALL ASSESSMENT	moderately impacted	moderately impacted	slightly impacted	slightly impacted

Appendix I. BIOLOGICAL METHODS FOR KICK SAMPLING

A. Rationale. The use of the standardized kick sampling method provides a biological assessment technique that lends itself to rapid assessments of stream water quality.

B. Site Selection. Sampling sites are selected based on these criteria: (1) The sampling location should be a riffle with a substrate of rubble, gravel, and sand. Depth should be one meter or less, and current speed should be at least 0.4 meters per second. (2) The site should have comparable current speed, substrate type, embeddedness, and canopy cover to both upstream and downstream sites to the degree possible. (3) Sites are chosen to have a safe and convenient access.

C. Sampling. Macroinvertebrates are sampled using the standardized traveling kick method. An aquatic net is positioned in the water at arms' length downstream and the stream bottom is disturbed by foot, so that the dislodged organisms are carried into the net. Sampling is continued for a specified time and for a specified distance in the stream. Rapid assessment sampling specifies sampling 5 minutes for a distance of 5 meters. The net contents are emptied into a pan of stream water. The contents are then examined, and the major groups of organisms are recorded, usually on the ordinal level (e.g., stoneflies, mayflies, caddisflies). Larger rocks, sticks, and plants may be removed from the sample if organisms are first removed from them. The contents of the pan are poured into a U.S. No. 30 sieve and transferred to a quart jar. The sample is then preserved by adding 95% ethyl alcohol.

D. Sample Sorting and Subsampling. In the laboratory the sample is rinsed with tap water in a U.S. No. 40 standard sieve to remove any fine particles left in the residues from field sieving. The sample is transferred to an enamel pan and distributed homogeneously over the bottom of the pan. A small amount of the sample is randomly removed with a spatula, rinsed with water, and placed in a petri dish. This portion is examined under a dissecting stereomicroscope and 100 organisms are randomly removed from the debris. As they are removed, they are sorted into major groups, placed in vials containing 70 percent alcohol, and counted. The total number of organisms in the sample is estimated by weighing the residue from the picked subsample and determining its proportion of the total sample weight.

E. Organism Identification. All organisms are identified to the species level whenever possible. Chironomids and oligochaetes are slide-mounted and viewed through a compound microscope; most other organisms are identified as whole specimens using a dissecting stereomicroscope. The number of individuals in each species, and the total number of individuals in the subsample is recorded on a data sheet. All organisms from the subsample are archived, either slide-mounted or preserved in alcohol. Following identification of a subsample, if the results are ambiguous, suspected of being spurious, or do not yield a clear water quality assessment, additional subsampling may be required.

Appendix II. MACROINVERTEBRATE COMMUNITY PARAMETERS

1. Species richness. This is the total number of species or taxa found in the sample. Expected ranges for 100-specimen subsamples of kick samples in most streams in New York State are: greater than 26, non-impacted; 19-26, slightly impacted; 11-18, moderately impacted; less than 11, severely impacted.

2. EPT value. EPT denotes the total number of species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) found in an average 100-organism subsample. These are considered to be mostly clean-water organisms, and their presence generally is correlated with good water quality (Lenat, 1987). Expected ranges from most streams in New York State are: greater than 10, non-impacted; 6-10, slightly impacted; 2-5, moderately impacted; and 0-1, severely impacted.

3. Biotic index. The Hilsenhoff Biotic Index is a measure of the tolerance of the organisms in the sample to organic pollution (sewage effluent, animal wastes) and low dissolved oxygen levels. It is calculated by multiplying the number of individuals of each species by its assigned tolerance value, summing these products, and dividing by the total number of individuals. On a 0-10 scale, tolerance values range from intolerant (0) to tolerant (10). For purposes of characterizing species' tolerance, intolerant = 0-4, facultative = 5-7, and tolerant = 8-10. Values are listed in Hilsenhoff (1987); additional values are assigned by the NYS Stream Biomonitoring Unit. The most recent values for each species are listed in the Quality Assurance document (Bode et al., 1996). Ranges for the levels of impact are: 0-4.50, non-impacted; 4.51-6.50, slightly impacted; 6.51-8.50, moderately impacted; and 8.51-10.00, severely impacted.

4. Percent Model Affinity is a measure of similarity to a model non-impacted community based on percent abundance in 7 major groups (Novak and Bode, 1992). Percentage similarity is used to measure similarity to a community of 40% Ephemeroptera, 5% Plecoptera, 10% Trichoptera, 10% Coleoptera, 20% Chironomidae, 5% Oligochaeta, and 10% Other. Ranges for the levels of impact are: >64, non-impacted; 50-64, slightly impacted; 35-49, moderately impacted; and <35, severely impacted.

Bode, R.W., M.A. Novak, and L.E. Abele. 1996. Quality assurance work plan for biological stream monitoring in New York State. NYS DEC technical report, 89 pp.

Hilsenhoff, W. L. 1987. An improved biotic index of organic stream pollution. The Great Lakes Entomologist 20(1): 31-39.

Lenat, D. R. 1987. Water quality assessment using a new qualitative collection method for freshwater benthic macroinvertebrates. North Carolina DEM Tech. Report. 12 pp.

Novak, M.A., and R.W. Bode. 1992. Percent model affinity: a new measure of macroinvertebrate community composition. J. N. Am. Benthol. Soc. 11(1):80-85.

Appendix III. LEVELS OF WATER QUALITY IMPACT IN STREAMS

The description of overall stream water quality based on biological parameters uses a four-tiered system of classification. Level of impact is assessed for each individual parameter, and then combined for all parameters to form a consensus determination. Four parameters are used: species richness, EPT value, biotic index, and percent model affinity. The consensus is based on the determination of the majority of the parameters; since parameters measure different aspects of the community, they cannot be expected to always form unanimous assessments. The ranges given for each parameter are based on 100-organism subsamples of macroinvertebrate riffle kick samples, and also apply to most multiplate samples, with the exception of percent model affinity.

1. <u>Non-impacted</u>

Indices reflect very good water quality. The macroinvertebrate community is diverse, usually with at least 27 species in riffle habitats. Mayflies, stoneflies, and caddisflies are well-represented; the EPT value is greater than 10. The biotic index value is 4.50 or less. Percent model affinity is greater than 64. Water quality should not be limiting to fish survival or propagation. This level of water quality includes both pristine habitats and those receiving discharges which minimally alter the biota.

2. <u>Slightly impacted</u>

Indices reflect good water quality. The macroinvertebrate community is slightly but significantly altered from the pristine state. Species richness usually is 19-26. Mayflies and stoneflies may be restricted, with EPT values of 6-10. The biotic index value is 4.51-6.50. Percent model affinity is 50-64. Water quality is usually not limiting to fish survival, but may be limiting to fish propagation.

3. <u>Moderately impacted</u>

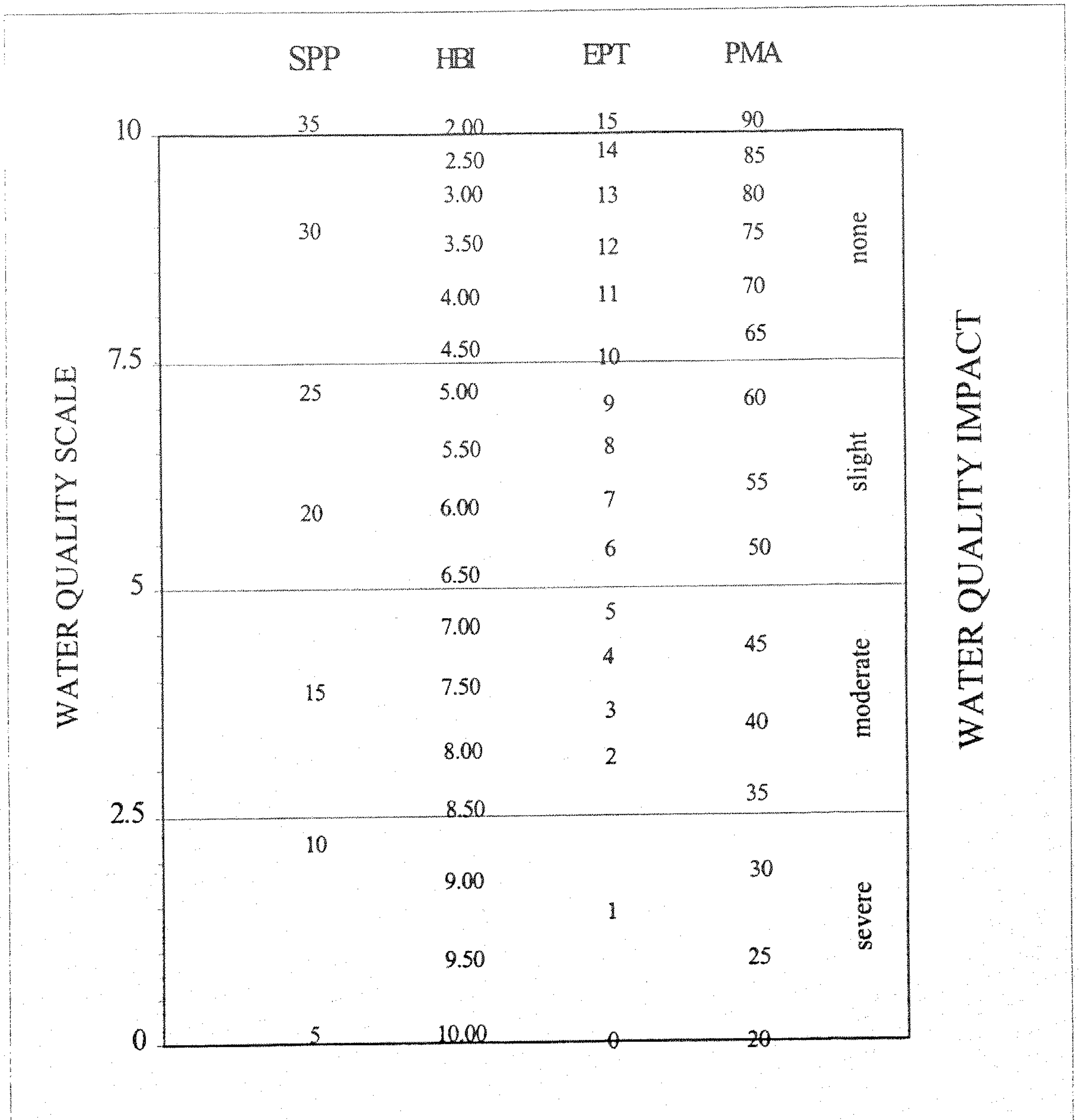
Indices reflect poor water quality. The macroinvertebrate community is altered to a large degree from the pristine state. Species richness usually is 11-18 species. Mayflies and stoneflies are rare or absent, and caddisflies are often restricted; the EPT value is 2-5. The biotic index value is 6.51-8.50. The percent model affinity value is 35-49. Water quality often is limiting to fish propagation, but usually not to fish survival.

4. <u>Severely impacted</u>

Indices reflect very poor water quality. The macroinvertebrate community is limited to a few tolerant species. Species richness is 10 or less. Mayflies, stoneflies, and caddisflies are rare or absent; EPT value is 0-1. The biotic index value is greater than 8.50. Percent model affinity is less than 35. The dominant species are almost all tolerant, and are usually midges and worms. Often 1-2 species are very abundant. Water quality is often limiting to both fish propagation and fish survival.

Appendix IV. BIOLOGICAL ASSESSMENT PROFILE OF INDEX VALUES

The Biological Assessment Profile of index values, developed by Mr. Phil O'Brien, Division of Water, NYS DEC, is a method of plotting biological index values on a common scale of water quality impact. Values from the four indices defined in Appendix II are converted to a common 0-10 scale as shown in the figure below.



To plot survey data, each site is positioned on the x-axis according to river miles from the mouth, and the scaled values for the four indices are plotted on the common scale. The mean scale value of the four indices represents the assessed impact for each site.

Appendix V.
WATER QUALITY ASSESSMENT CRITERIA

for non-navigable flowing waters

	Species Richness	Hilsenhoff Biotic Index	EPT Value	Percent Model Affinity#	Diversity*
Non-Impacted	>26	0.00-4.50	>10	>64	>4
Slightly Impacted	19-26	4.51-6.50	6-10	50-64	3.01-4.00
Moderately Impacted	11-18	6.51-8.50	2-5	35-49	2.01-3.00
Severely Impacted	0-10	8.51-10.00	0-1	<35	0.00-2.00

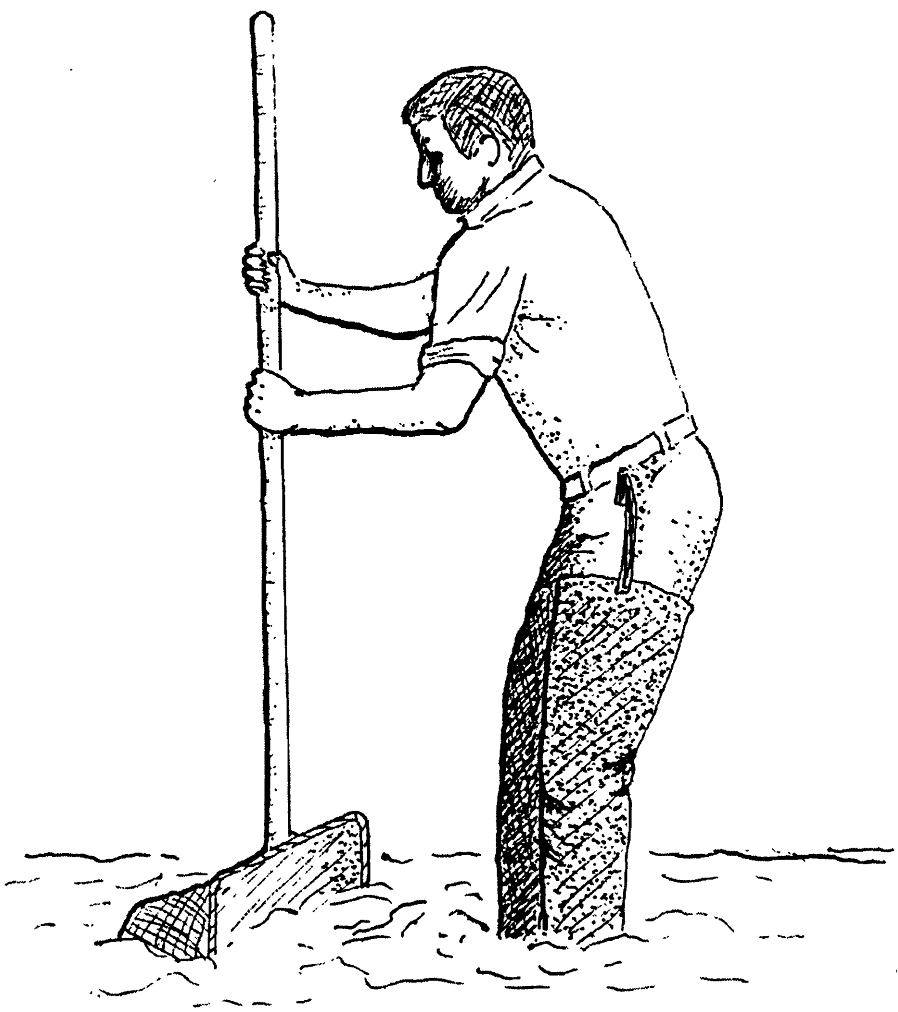
Percent model affinity criteria are used for traveling kick samples but not for multiplate samples.
* Diversity criteria are used for multiplate samples but not for traveling kick samples.

WATER QUALITY ASSESSMENT CRITERIA
for navigable flowing waters

	Species Richness	Hilsenhoff Biotic Index	EPT Value	Diversity
Non-Impacted	>21	0.00-7.00	>5	>3.00
Slightly Impacted	17-21	7.01-8.00	4-5	2.51-3.00
Moderately Impacted	12-16	8.01-9.00	2-3	2.01-2.50
Severely Impacted	0-11	9.01-10.00	0-1	0.00-2.00

Appendix VI.

THE TRAVELING KICK SAMPLE



← current

Rocks and sediment in the riffle are dislodged by foot upstream of a net; organisms dislodged are carried by the current into the net. Sampling is continued for five minutes, as the sampler gradually moves downstream to cover a distance of five meters.

Appendix VII. A.

AQUATIC MACROINVERTEBRATES THAT USUALLY INDICATE GOOD WATER QUALITY

Mayfly nymphs are often the most numerous organisms found in clean streams. They are sensitive to most types of pollution, including low dissolved oxygen (less than 5 ppm), chlorine, ammonia, metals, pesticides, and acidity. Most mayflies are found clinging to the undersides of rocks.

MAYFLIES

Stonefly nymphs are mostly limited to cool, well-oxygenated streams. They are sensitive to most of the same pollutants as mayflies, except acidity. They are usually much less numerous than mayflies. The presence of even a few stoneflies in a stream suggests that good water quality has been maintained for several months.

STONEFLIES

Caddisfly larvae often build a portable case of sand, stones, sticks, or other debris. Many caddisfly larvae are sensitive to pollution, although a few are tolerant. One family spins nets to catch drifting plankton, and is often numerous in nutrient-enriched stream segments.

CADDISFLIES

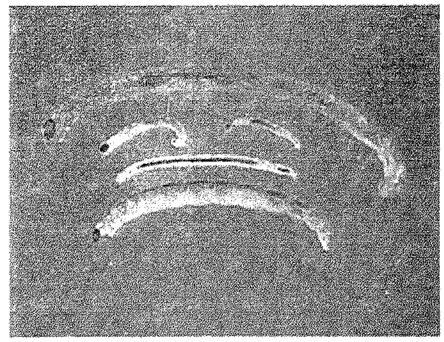
The most common beetles in streams are riffle beetles and water pennies. Most of these require a swift current and an adequate supply of oxygen, and are generally considered clean-water indicators.

BEETLES

Appendix VII. B.

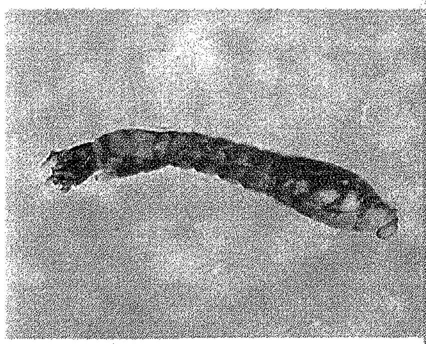
AQUATIC MACROINVERTEBRATES THAT USUALLY INDICATE POOR WATER QUALITY

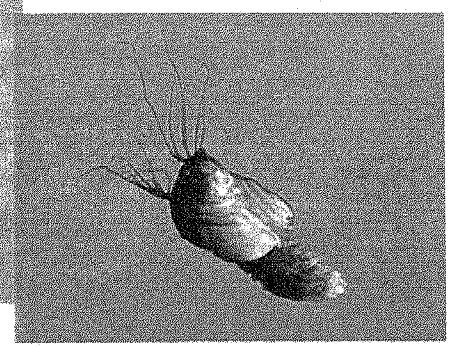
Midges are the most common aquatic flies. The larvae occur in almost any aquatic situation. Many species are very tolerant to pollution. Large, red midge larvae called "bloodworms" indicate organic enrichment. Other midge larvae filter plankton, indicating nutrient enrichment when numerous.



MIDGES

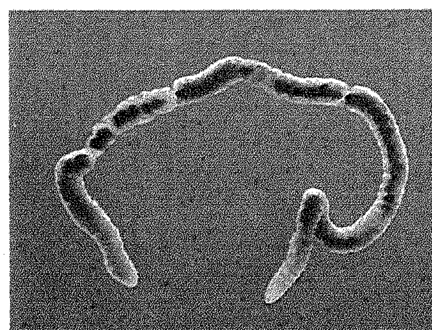
Black fly larvae have specialized structures for filtering plankton and bacteria from the water, and require a strong current. Some species are tolerant of organic enrichment and toxic contaminants, while others are intolerant of pollutants.

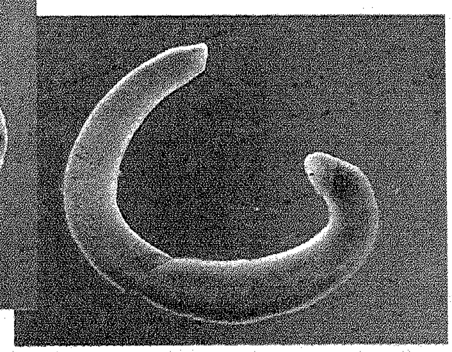




BLACK FLIES

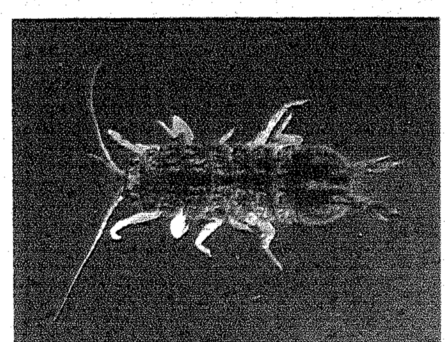
The segmented worms include the leeches and the small aquatic earthworms. The latter are more common, though usually unnoticed. They burrow in the substrate and feed on bacteria in the sediment. They can thrive under conditions of severe pollution and very low oxygen levels, and are thus valuable pollution indicators. Many leeches are also tolerant of poor water quality.





WORMS

Aquatic sowbugs are crustaceans that are often numerous in situations of high organic content and low oxygen levels. They are classic indicators of sewage pollution, and can also thrive in toxic situations.



SOWBUGS

Digital images by Larry Abele, New York State Department of Environmental Conservation, Stream Biomonitoring Unit.

APPENDIX VIII. THE RATIONALE OF BIOLOGICAL MONITORING

Biological monitoring as applied here refers to the use of resident benthic macroinvertebrate communities as indicators of water quality. Macroinvertebrates are larger-than-microscopic invertebrate animals that inhabit aquatic habitats; freshwater forms are primarily aquatic insects, worms, clams, snails, and crustaceans.

Concept

Nearly all streams are inhabited by a community of benthic macroinvertebrates. The species comprising the community each occupy a distinct niche defined and limited by a set of environmental requirements. The composition of the macroinvertebrate community is thus determined by many factors, including habitat, food source, flow regime, temperature, and water quality. The community is presumed to be controlled primarily by water quality if the other factors are determined to be constant or optimal. Community components which can change with water quality include species richness, diversity, balance, abundance, and presence/absence of tolerant or intolerant species. Various indices or metrics are used to measure these community changes. Assessments of water quality are based on metric values of the community, compared to expected metric values.

Advantages

The primary advantages to using macroinvertebrates as water quality indicators are:

1) they are sensitive to environmental impacts
2) they are less mobile than fish, and thus cannot avoid discharges
3) they can indicate effects of spills, intermittent discharges, and lapses in treatment
4) they are indicators of overall, integrated water quality, including synergistic effects and substances lower than detectable limits
5) they are abundant in most streams and are relatively easy and inexpensive to sample
6) they are able to detect non-chemical impacts to the habitat, e.g. siltation or thermal changes
7) they are vital components of the aquatic ecosystem and important as a food source for fish
8) they are more readily perceived by the public as tangible indicators of water quality
9) they can often provide an on-site estimate of water quality
10) they can often be used to identify specific stresses or sources of impairment
11) they can be preserved and archived for decades, allowing for direct comparison of specimens
12) they bioaccumulate many contaminants, so that analysis of their tissues is a good monitor of toxic substances in the aquatic food chain

Limitations

Biological monitoring is not intended to replace chemical sampling, toxicity testing, or fish surveys. Each of these measurements provides information not contained in the others. Similarly, assessments based on biological sampling should not be taken as being representative of chemical sampling. Some substances may be present in levels exceeding ambient water quality criteria, yet have no apparent adverse community impact.

APPENDIX IX. GLOSSARY

assessment: a diagnosis or evaluation of water quality

benthos: organisms occurring on or in the bottom substrate of a waterbody

biomonitoring: the use of biological indicators to measure water quality

community: a group of populations of organisms interacting in a habitat

drainage basin: an area in which all water drains to a particular waterbody; watershed

EPT value: the number of species of mayflies, stoneflies, and caddisflies in a sample

facultative: occurring over a wide range of water quality; neither tolerant nor intolerant of poor water quality

fauna: the animal life of a particular habitat

impact: a change in the physical, chemical, or biological condition of a waterbody

impairment: a detrimental effect caused by an impact

index: a number, metric, or parameter derived from sample data used as a measure of water quality

intolerant: unable to survive poor water quality

macroinvertebrate: a larger-than-microscopic invertebrate animal that lives at least part of its life in aquatic habitats

multiplate: multiple-plate sampler, a type of artificial substrate sampler of aquatic macroinvertebrates

organism: a living individual

rapid bioassessment: a biological diagnosis of water quality using field and laboratory analysis designed to allow assessment of water quality in a short turn-around time; usually involves kick sampling and laboratory subsampling of the sample

riffle: wadeable stretch of stream usually with a rubble bottom and sufficient current to have the water surface broken by the flow; rapids

species richness: the number of macroinvertebrate species in a sample or subsample

station: a sampling site on a waterbody

survey: a set of samplings conducted in succession along a stretch of stream

tolerant: able to survive poor water quality

APPENDIX X. METHODS FOR IMPACT SOURCE DETERMINATION

Definition Impact Source Determination (ISD) is the procedure for identifying types of impacts that exert deleterious effects on a waterbody. While the analysis of benthic macroinvertebrate communities has been shown to be an effective means of determining severity of water quality impacts, it has been less effective in determining what kind of pollution is causing the impact. Impact Source Determination uses community types or models to ascertain the primary factor influencing the fauna.

Development of methods The method found to be most useful in differentiating impacts in New York State streams was the use of community types, based on composition by family and genus. It may be seen as an elaboration of Percent Model Affinity (Novak and Bode, 1992), which is based on class and order. A large database of macroinvertebrate data was required to develop ISD methods. The database included several sites known or presumed to be impacted by specific impact types. The impact types were mostly known by chemical data or land use. These sites were grouped into the following general categories: agricultural nonpoint, toxic-stressed, sewage (domestic municipal), sewage/toxic, siltation, impoundment, and natural. Each group initially contained 20 sites. Cluster analysis was then performed within each group, using percent similarity at the family or genus level. Within each group four clusters were identified, each cluster usually composed of 4-5 sites with high biological similarity. From each cluster a hypothetical model was then formed to represent a model cluster community type; sites within the cluster had at least 50 percent similarity to this model. These community type models formed the basis for Impact Source Determination (see tables following). The method was tested by calculating percent similarity to all the models, and determining which model was the most similar to the test site. Some models were initially adjusted to achieve maximum representation of the impact type. New models are developed when similar communities are recognized from several streams.

Use of the ISD methods Impact Source Determination is based on similarity to existing models of community types (see tables following). The model that exhibits the highest similarity to the test data denotes the likely impact source type, or may indicate "natural", lacking an impact. In the graphic representation of ISD, only the highest similarity of each source type is identified. If no model exhibits a similarity to the test data of greater than 50%, the determination is inconclusive. The determination of impact source type is used in conjunction with assessment of severity of water quality impact to provide an overall assessment of water quality.

Limitations These methods were developed for data derived from 100-organism subsamples of traveling kick samples from riffles of New York State streams. Application of the methods for data derived from other sampling methods, habitats, or geographical areas would likely require modification of the models.

	NATURAL												
	A	B	C	D	E	F	G	H	I	J	K	L	M
PLATYHELMINTHES	-	-	-	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETA	-	-	5	-	5	-	5	5	-	-	-	5	5
HIRUDINEA -	-	-	-	-	-	-	-	-	-	-	-	-	
GASTROPODA	-	-	-	-	-	-	-	-	-	-	-	-	-
SPHAERIIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-
ASELLIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-
GAMMARIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-
Isonychia	5	5	-	5	20	-	-	-	-	-	-	-	-
BAETIDAE	20	10	10	10	10	5	10	10	10	10	5	15	40
HEPTAGENIIDAE	5	10	5	20	10	5	5	5	5	10	10	5	5
LEPTOPHLEBIIDAE	5	5	-	-	-	-	-	-	5	-	-	25	5
EPHEMERELLIDAE	5	5	5	10	-	10	10	30	-	5	-	10	5
Caenis/Tricorythodes -	-	-	-	-	-	-	-	-	-	-	-	-	
PLECOPTERA	-	-	-	5	5	-	5	5	15	5	5	5	5
Psephenus	5	-	-	-	-	-	-	-	-	-	-	-	-
Optioservus	5	-	20	5	5	-	5	5	5	5	-	-	-
Promoresia	5	-	-	-	-	-	25	-	-	-	-	-	-
Stenelmis	10	5	10	10	5	-	-	-	10	-	-	-	5
PHILOPOTAMIDAE	5	20	5	5	5	5	5	-	5	5	5	5	5
HYDROPSYCHIDAE	10	5	15	15	10	10	5	5	10	15	5	5	10
HELICOPSYCHIDAE/ BRACHYCENTRIDAE/ RHYACOPHILIDAE	5	5	-	-	-	20	-	5	5	5	5	5	-
SIMULIIDAE	-	-	-	5	5	-	-	-	-	5	-	-	-
Simulium vittatum	-	-	-	-	-	-	-	-	-	-	-	-	-
EMPIDIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-
TIPULIDAE	-	-	-	-	-	-	-	-	5	-	-	-	-
CHIRONOMIDAE													
Tanypodinae	-	5	-	-	-	-	-	-	5	-	-	-	-
Diamesinae	-	-	-	-	-	-	5	-	-	-	-	-	-
Cardiocladius -	5	-	-	-	-	-	-	-	-	-	-	-	
Cricotopus/ Orthocladius 5	5	-	-	10	-	-	5	-	-	5	5	5	
Eukiefferiella/ Tvetenia	5	5	10	-	-	5	5	5	-	5	-	5	5
Parametriocnemus	-	-	-	-	-	-	-	5	-	-	-	-	-
Chironomus	-	-	-	-	-	-	-	-	-	-	-	-	-
Polypedilum aviceps	-	-	-	-	-	20	-	-	10	20	20	5	-
Polypedilum (all others)	5	5	5	5	5	-	5	5	-	-	-	-	-
Tanytarsini	-	5	10	5	5	20	10	10	10	10	40	5	5
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100

NONPOINT NUTRIENTS, PESTICIDES

	A	B	C	D	E	F	G	H	I	J
PLATYHELMINTHES	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETA	-	-	-	5	-	-	-	-	-	15
HIRUDINEA -	-	-	-	-	-	-	-	-	-	
[illegible]OPODA	-	-	-	-	-	-	-	-	-	-
[illegible]RIIDAE	-	-	-	5	-	-	-	-	-	-
ASELLIDAE	-	-	-	-	-	-	-	-	-	-
GAMMARIDAE	-	-	-	5	-	-	-	-	-	-
Isonychia	-	-	-	-	-	-	-	5	-	-
BAETIDAE	5	15	20	5	20	10	10	5	10	5
HEPTAGENIIDAE	-	-	-	-	5	5	5	5	-	5
LEPTOPHLEBIIDAE	-	-	-	-	-	-	-	-	-	-
EPHEMERELLIDAE	-	-	-	-	-	-	-	5	-	-
Caenis/Tricorythodes -	-	-	-	5	-	-	5	-	5	
PLECOPTERA	-	-	-	-	-	-	-	-	-	-
Psephenus	5	-	-	5	-	5	5	-	-	-
Optioservus	10	-	-	5	-	-	15	5	-	5
Promoresia	-	-	-	-	-	-	-	-	-	-
Stenelmis	15	15	-	10	15	5	25	5	10	5
PHILOPOTAMIDAE	15	5	10	5	-	25	5	-	-	-
HYDROPSYCHIDAE	15	15	15	25	10	35	20	45	20	10
HELICOPSYCHIDAE/ BRACHYCENTRIDAE/ RHYACOPHILIDAE	-	-	-	-	-	-	-	-	-	-
SIMULIIDAE	5	-	15	5	5	-	-	-	40	-
Simulium vittatum	-	-	-	-	-	-	-	-	5	-
EMPIDIDAE	-	-	-	-	-	-	-	-	-	-
TIPULIDAE	-	-	-	-	-	-	-	-	-	5
CHIRONOMIDAE										
Tanypodinae	-	-	-	-	-	-	5	-	-	5
Cardiocladius -	-	-	-	-	-	-	-	-	-	
Cricotopus/ Orthocladius 10	15	10	5	-	-	-	-	5	5	
Eukiefferiella/ Tvetenia	-	15	10	5	-	-	-	-	5	-
Parametriocnemus	-	-	-	-	-	-	-	-	-	-
Microtendipes	-	-	-	-	-	-	-	-	-	20
Polypedilum aviceps	-	-	-	-	-	-	-	-	-	-
Polypedilum (all others)	10	10	10	10	20	10	5	10	5	5
Tanytarsini	10	10	10	5	20	5	5	10	-	10
TOTAL	100	100	100	100	100	100	100	100	100	100

	MUNICIPAL/INDUSTRIAL								TOXIC					
	A	B	C	D	E	F	G	H	A	B	C	D	E	F
PLATYHELMINTHES	-	40	-	-	-	5	-	-	-	-	-	-	5	-
OLIGOCHAETA	20	20	70	10	-	20	-	-	-	10	20	5	5	15
HIRUDINEA	-	5	-	-	-	-	-	-	-	-	-	-	-	-
GASTROPODA	-	-	-	-	-	5	-	-	-	5	-	-	-	5
SPHAERIIDAE	-	5	-	-	-	-	-	-	-	-	-	-	-	-
ASELLIDAE	10	5	10	10	15	5	-	-	10	10	-	20	10	5
GAMMARIDAE	40	-	-	-	15	-	5	5	5	-	-	-	5	5
Isonychia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BAETIDAE	5	-	-	-	5	-	10	10	15	10	20	-	-	5
HEPTAGENIIDAE	5	-	-	-	-	-	-	-	-	-	-	-	-	-
LEPTOPHLEBIIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPHEMERELLIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caenis/Tricorythodes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PLECOPTERA	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psephenus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optioservus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Promoresia	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stenelmis	5	-	-	10	5	-	5	5	10	15	-	40	35	5
PHILOPOTAMIDAE	-	-	-	-	-	-	-	40	10	-	-	-	-	-
HYDROPSYCHIDAE	10	-	-	50	20	-	40	20	20	10	15	10	35	10
HELICOPSYCHIDAE/ BRACHYCENTRIDAE/ RHYACOPHILIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SIMULIIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simulium vittatum	-	-	-	-	-	-	20	10	-	20	-	-	-	5
EMPIDIDAE	-	5	-	-	-	-	-	-	-	-	-	-	-	-
CHIRONOMIDAE														
Tanypodinae	-	10	-	-	5	15	-	-	5	10	-	-	-	25
Cardiocladius	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cricotopus/ Orthocladius	5	10	20	-	5	10	5	5	15	10	25	10	5	10
Eukiefferiella/ Tvetenia	-	-	-	-	-	-	-	-	-	-	20	10	-	-
Parametriocnemus	-	-	-	-	-	-	-	-	-	-	-	5	-	-
Chironomus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polypedilum aviceps	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polypedilum (all others)	-	-	-	10	20	40	10	5	10	-	-	-	-	5
Tanytarsini	-	-	-	10	10	-	5	-	-	-	-	-	-	5
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100

SEWAGE EFFLUENT, ANIMAL WASTES

	A	B	C	D	E	F	G	H	I	J
PLATYHELMINTHES	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETA	5	35	15	10	10	35	40	10	20	15
HIRUDINEA -	-	-	-	-	-	-	-	-	-	
GASTROPODA	-	-	-	-	-	-	-	-	-	-
SPHAERIIDAE	-	-	-	10	-	-	-	-	-	-
ASELLIDAE	5	10	-	10	10	10	10	50	-	5
GAMMARIDAE	-	-	-	-	-	10	-	10	-	-
Isonychia	-	-	-	-	-	-	-	-	-	-
BAETIDAE	-	10	10	5	-	-	-	-	5	-
HEPTAGENIIDAE	10	10	10	-	-	-	-	-	-	-
LEPTOPHLEBIIDAE	-	-	-	-	-	-	-	-	-	-
EPHEMERELLIDAE	-	-	-	-	-	-	-	-	5	-
Caenis/Tricorythodes -	-	-	-	-	-	-	-	-	-	
PLECOPTERA	-	-	-	-	-	-	-	-	-	-
Psephenus	-	-	-	-	-	-	-	-	-	-
Optioservus	-	-	-	-	-	-	-	-	5	-
Promoresia	-	-	-	-	-	-	-	-	-	-
Stenelmis	15	-	10	10	-	-	-	-	-	-
PHILOPOTAMIDAE	-	-	-	-	-	-	-	-	-	-
HYDROPSYCHIDAE	45	-	10	10	10	-	-	10	5	-
HELICOPSYCHIDAE/ BRACHYCENTRIDAE/ RHYACOPHILIDAE	-	-	-	-	-	-	-	-	-	-
SIMULIIDAE	-	-	-	-	-	-	-	-	-	-
Simulium vittatum	-	-	-	25	10	35	-	-	5	5
EMPIDIDAE	-	-	-	-	-	-	-	-	-	-
CHIRONOMIDAE										
Tanypodinae	-	5	-	-	-	-	-	-	5	5
Cardiocladius -	-	-	-	-	-	-	-	-	-	
Cricotopus/ Orthocladius -	10	15	-	-	10	10	-	5	5	
Eukiefferiella/ Tvetenia	-	-	10	-	-	-	-	-	-	-
Parametriocnemus	-	-	-	-	-	-	-	-	-	-
Chironomus	-	-	-	-	-	-	10	-	-	60
Polypedilum aviceps	-	-	-	-	-	-	-	-	-	-
Polypedilum (all others)	10	10	10	10	60	-	30	10	5	5
Tanytarsini	10	10	10	10	-	-	-	10	40	-
TOTAL	100	100	100	100	100	100	100	100	100	100

	SILTATION					IMPOUNDMENT									
	A	B	C	D	E	A	B	C	D	E	F	G	H	I	J
PLATYHELMINTHES	-	-	-	-	-	-	10	-	10	-	5	-	50	10	-
OLIGOCHAETA	5	-	20	10	5	5	-	40	5	10	5	10	5	5	-
HIRUDINEA -	-	-	-	-	-	-	-	-	5	-	-	-	-	-	
GASTROPODA	-	-	-	-	-	-	-	10	-	5	5	-	-	-	-
SPHAERIIDAE	-	-	-	5	-	-	-	-	-	-	-	-	5	25	-
ASELLIDAE	-	-	-	-	-	-	5	5	-	10	5	5	5	-	-
GAMMARIDAE	-	-	-	10	-	-	-	10	-	10	50	-	5	10	-
Isonychia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BAETIDAE	-	10	20	5	-	-	5	-	5	-	-	5	-	-	5
HEPTAGENIIDAE	5	10	-	20	5	5	5	-	5	5	5	5	-	5	5
LEPTOPHLEBIIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPHEMERELLIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caenis/Tricorythodes 5	20	10	5	15	-	-	-	-	-	-	-	-	-	-	
PLECOPTERA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Psephenus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Optioservus	5	10	-	-	-	-	-	-	-	-	-	-	-	5	-
Promoresia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stenelmis	5	10	10	5	20	5	5	10	10	-	5	35	-	5	10
PHILOPOTAMIDAE	-	-	-	-	-	5	-	-	5	-	-	-	-	-	30
HYDROPSYCHIDAE	25	10	-	20	30	50	15	10	10	10	10	20	5	15	20
HELICOPSYCHIDAE/ BRACHYCENTRIDAE/ RHYACOPHILIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-
SIMULIIDAE	5	10	-	-	5	5	-	5	-	35	10	5	-	-	15
EMPIDIDAE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CHIRONOMIDAE															
Tanypodinae	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-
Cardiocladius -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cricotopus/ Orthocladius 25	-	10	5	5	5	25	5	-	10	-	5	10	-	-	
Eukiefferiella/ Tvetenia	-	-	10	-	5	5	15	-	-	-	-	-	-	-	-
Parametriocnemus	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-
Chironomus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polypedilum aviceps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polypedilum (all others)	10	10	10	5	5	5	-	-	20	-	-	5	5	5	5
Tanytarsini	10	10	10	10	5	5	10	5	30	-	-	5	10	10	5
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

APPENDIX XI. CHARACTERISTICS OF HEADWATER STREAM SITES

Headwater stream sites are defined as first-order or second-order stream locations close to the stream source, usually less than three miles. The natural characteristics of headwaters may sometimes result in an erroneous assessment of impacted water quality.

1) Headwater sites have reduced upstream recruitment resource populations to provide colonization by drift, and may have reduced species richness.

2) Headwater sites usually are nutrient-poor, lower in food resources, and less productive.

3) The reduced, simplified fauna of headwater sites may result in a community in which a few intolerant species may be very abundant. For 100-organism subsamples, this can affect many community indices: species richness, EPT richness, and percent model affinity. The dominant species averages 37% of the total fauna, and is an intolerant mayfly (e.g., Epeorus, Paraleptophlebia, Stenonema), stonefly (e.g., Leuctridae or Capniidae), caddisfly (e.g., Brachycentrus, Dolophilodes, or Chimarra), or riffle beetle (e.g., Optioservus or Promoresia).

4) Although headwater stream invertebrate communities are dominated by intolerant species, many community indices are low. Average index values are: species richness - 19, EPT richness - 8, Hilsenhoff biotic index - 3.05, and percent model affinity - 57. These indices are based on headwaters of a number of streams across New York State.

5) Recommended corrective action for non-representative indices from headwater sites: a correction factor of 1.5 may be applied to species richness, EPT richness, and percent model affinity. Criteria for the use of the correction factor are: the headwater location is as described above, the community is dominated by intolerant species, and the above indices (species richness, EPT richness, and percent model affinity) are judged to be non-representative of actual water quality. Alternatively, index values may be maintained, and the overall assessment may be adjusted up to non-impacted if the above criteria are met.

APPENDIX XII. EFFECTS OF LAKE OUTLETS AND IMPOUNDMENTS ON AQUATIC INVERTEBRATE COMMUNITIES

Lakes, ponds, and impoundments have pronounced effects on the invertebrate faunas of their outflows. Although each outflow is dependent on the characteristics of the lake, most outflows share the following traits:

1. Species richness is nearly always lower below lake outlets. Due primarily to the lack of upstream communities to provide a resource for colonization and drift, lake outlet communities often have only about 60% of the number of species found in comparable non-impacted segments. EPT richness is often only 30% of that found at non-impacted sites. Biotic index values and percent model affinity values are also depressed (see below).

2. Several types of invertebrate communities are found downstream of impoundments. Invertebrates which are commonly numerous below lake outlets include Simulium (black fly larvae), Cheumatopsyche or Hydropsyche (filter-feeding caddisflies), Nais (worms), Gammarus (crustacean), Rheotanytarsus (midges), Stenelmis (riffle beetles) Sphaerium (fingernail clams), or Platyhelminthes (flatworms). To date, 8 community types have been identified from streams in New York State.

3. A marked succession of species often occurs over a short distance. Productivity may be initially high below the lake, but usually decreases a short distance downstream. Plankton carried downstream from the lake increases the biomass immediately downstream, primarily of organisms which feed by filtering plankton, such as certain caddisflies, black flies, and midges. This enriching effect does not persist very far downstream, as the plankton is diminished, and communities below this may have very low productivity.

4. Lakes with cold-water hypolimnion releases limit the fauna additionally by interference with life cycles of aquatic insects such as mayflies, stoneflies, and caddisflies. Because the temperature of hypolimnetic releases is usually very cold, the downstream communities are often limited to midges, worms, black flies, snails, and sowbugs.

5. Water quality assessments of impoundment-affected sites usually indicate slight or moderate impact. Of 25 lake-affected stream sites across New York State, the following index means and ranges were obtained: species richness: 17 (7-24); EPT richness: 4 (0-12); Hilsenhoff biotic index: 5.83 (4.48-8.22); Percent Model Affinity: 45 (24-67). Correct interpretation of these assessments should reflect that although the resident fauna is affected, the impact is usually not a pollutional impairment. However, faunal effects caused by hypolimnion releases should be considered temperature-related and anthropogenic.

6. Corrective action for data judged to be affected by lake outlets is the adjustment of the water quality assessment up one category (e.g., slightly impacted to non-impacted) to reflect genuine water quality.

APPENDIX XIII. THE 1996 PRIORITY WATERBODIES LIST FOR THE OSWEGO-SENECA-ONEIDA RIVER BASIN, FLINT CREEK.

FLINT CREEK 0704-0006

Location Information

Basin:	Oswego-Seneca-Oneida (07)	**Resolution Potential:**	Medium
Sub-Basin:	Clyde River (04)		
Seg Type:	River	**Stream Class:**	A
Reg/County:	8 / Yates (62)	**7Q10 Flow:**	20-150 cfs
USGS Quad:	POTTER (K-12-1)		
Seg Size:	5.0 Miles		
Description:	Hamlet of Potter North to Ontario Co. line		

Problem Information

(* indicates the PRIMARY Use Impairment/Pollutant/Source)

Use Impairment(s)	Severity	Documentation
Water Supply *	Threatened	Poor
Fish Propagation	Threatened	Poor
Fish Survival	Threatened	Poor

Type of Pollutant(s)

Pesticides *	Unknown Toxicity	Nutrients
Silt (Sediment)		

Source(s) of Pollutant(s)

Agriculture *	Land Disposal	On-site Systems
Hydromodification	Streambank Erosion	Roadbank Erosion

Resolvability

Condition Needs Verification

Further Details

Use Impairment - The use of this water for water supply, fish propagation and fish survival is threatened due to the extensive use of pesticides in the watershed.

The Potter muck is 2500 acres of drained land that is all used for intensive cropping. Pesticides and nutrients from agricultural runoff is the primary concern.

Fisheries report that there are wild rainbow and brown trout in the reaches of the stream above Potter.

The Potter landfill is in this watershed. It is a potential source of unknown toxics.