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New York State

DEC

#809

Division of Water

HOOSIC RIVER

Biological Assessment

2004 Survey

New York State
Department of Environmental Conservation

George E. Pataki, *Governor*

Denise M. Sheehan, Acting Commissioner

HOOSIC RIVER
BIOLOGICAL ASSESSMENT

Upper Hudson River Basin
Rensselaer County, New York

Survey date: April, July, and December 2004
Report date: May 25, 2005

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CONTENTS

Stream: Hoosic River, Rensselaer County, New York

Reach: Williamstown, Massachusetts to Eagle Bridge, New York

Drainage basin: Upper Hudson River

Background:

The Stream Biomonitoring Unit sampled the Hoosic River in Rensselaer County, New York, during three periods in 2004: April, July, and December. The purpose of the sampling was to assess overall water quality and compare to previous results. The study was also part of a larger study correlating nutrient levels with macroinvertebrate communities, which will be reported separately. One traveling kick sample for macroinvertebrates was taken in a riffle area at each of the six sites 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 subsample from each site. Macroinvertebrate community parameters used in the determination of water quality included species richness, biotic index, EPT richness, and percent model affinity (see Appendices II and III). Expected variability of results is stated in Smith and Bode (2004). 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 raw macroinvertebrate data from each site.

Results and Conclusions:

1. Water quality in the Hoosic River was assessed as slightly impacted at all sites. Nutrient enrichment was the primary stressor causing the impact.

2. Compared to results of a 2001 survey of the Hoosic River, water quality appears improved at sites downstream of the 2001 spill of copper sulfate into the river. Compared to 1986 results, water quality appears improved at all sites, although still within the category of slight impact.

3. Examining seasonal trends, water quality assessments were usually highest in the spring samples and lowest in the fall samples, with the metrics acting independently of each other. The results of the seasonal comparisons did not provide any justification for altering the current summer sampling regime (July-September) as defined in the Quality Control document (Bode, et al., 2002).

Discussion

The Hoosic River originates as the outflow of the Cheshire Reservoir in Berkshire County, Massachusetts. It flows in a generally northwestern direction, through the towns of North Adams and Williamstown (Massachusetts), Pownal and North Pownal (Vermont), and Hoosick Falls, Eagle Bridge, Buskirk, Johnsonville, and Schaghticoke (New York) before entering the upper Hudson River across from Stillwater, approximately 64 stream miles from its origin. The river in New York State is mostly classified as B, except for the reach from the Vermont border to Route 7 at Hoosick, and the reach including the Village of Hoosick Falls to the confluence of the Walloomsac River, which are both classified as C.

Multi-site surveys of the river by the Stream Biomonitoring Unit were conducted in 1984, 1985, and 1986. Of these, the 1984 and 1985 samplings were conducted in June, and are considered less comparable to samplings in the July-September period. The 1986 data (unpublished) are used here to compare to results of the 2004 sampling.

The Hoosic River was most recently sampled by the Stream Biomonitoring Unit in 2001 (Bode, et al., 2001). In that study four sites were sampled from above Hoosick Falls to Eagle Bridge (Stations 7-10) to assess impacts from a recent copper sulfate spill in Hoosick Falls. Water quality ranged from non-impacted upstream of Hoosick Falls to slightly impacted from Hoosick Falls to Eagle Bridge. Most impacts were assigned to the copper spill and corroborated with elevated levels of copper in the resident macroinvertebrates. The upstream site (Station 7) appeared better in 2001 than 2004, possibly due to higher flows in 2004, which would have resulted in more runoff and nonpoint source inputs.

In the present study, all sites were assessed as slightly impacted, based on averages of the three-month sampling (Figure 1, Table 1). High levels of embeddedness were recorded at the upstream site in Massachusetts (Station 4). Embeddedness is the degree to which large substrate particles (boulder, rubble, or gravel) are surrounded or covered by fine sediments (sand, silt, or clay). It is not known to what extent the embeddedness contributes to the impact at this site. The site was not sampled by the Stream Biomonitoring Unit since 1986, and embeddedness was not measured at that time. Most of the remaining sites were affected by nonpoint source nutrient enrichment, although all sites maintained high similarities to natural community models (Table 2). Compared to 1986 results, water quality appears improved all at sites, although still within the category of slight impact.

The present study allows the examination of seasonal differences in water quality assessments for the river, with samples collected at each site in April, July, and December. Overall, assessments were highest in the spring samples and lowest in the fall samples, as evidenced by the Biological Assessment Profile scores. Examining individual metrics, biotic index values were highest (poorest) in the summer and lowest (best) in the fall; EPT richness was highest (best) in the spring and lowest in the fall; PMA values were highest (best) in the summer and lowest (poorest) in the fall; species richness values were highest (best) in the spring and lowest (poorest) in the summer, but differences were small. Overall, the metrics acted independently of each other with regard to seasonal differences, similar to two streams in the lower Hudson River basin that were sampled monthly to measure seasonal effects (Bode, et al., 1990). The results of the seasonal comparisons did not provide justification for altering the current summer sampling regime (July-September) as defined in the Quality Control document (Bode, et al., 2002).

Table 1. Hoosic River Metric Values, 2004.

	SPP	HBI	EPT	PMA	BAP
HOOS-04	19 20 29 **23**	4.54 4.78 3.10 **4.14**	10 10 9 **10**	72 94 59 **75**	7.07 8.19 6.98 **7.41**
HOOS-06	19 15 19 **18**	4.56 4.70 3.67 **4.31**	12 10 10 **11**	55 67 46 **56**	6.80 6.57 6.64 **6.67**
HOOS-07	27 20 18 **22**	4.42 5.02 3.34 **4.26**	15 8 11 **11**	69 71 46 **62**	8.34 6.74 6.49 **7.19**
HOOS-08	18 21 18 **19**	3.08 4.94 3.23 **3.75**	11 9 10 **10**	65 56 59 **60**	7.34 6.45 6.88 **6.89**
HOOS-09	22 23 18 **21**	4.14 4.73 3.96 **4.28**	14 11 9 **11**	50 82 54 **62**	7.18 7.73 6.38 **7.10**
HOOS-10	24 16 19 **20**	4.09 5.15 4.32 **4.52**	12 10 6 **9**	66 69 60 **65**	7.72 6.55 6.30 **6.86**
AVERAGE	22 19 20 **21**	4.14 4.89 3.60 **4.21**	12 10 9 **10**	63 73 54 **63**	7.40 7.04 6.61 **7.02**

*Cell contents: spring (upper left), summer (upper right), fall (lower left), average (lower right)

Literature Cited:

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

Bode, R.W., M.A. Novak, L.E. Abele, D.L. Heitzman, and A.J. Smith. 2001. Hoosic River biological assessment. New York State Department of Environmental Conservation, Technical Report, 35 pages.

Bode, R.W., M.A. Novak, and L.E. Abele. 1990. Biological impairment criteria for flowing waters in New York State. New York State Department of Environmental Conservation, Technical Report, 110 pages.

Smith, A.J., and R.W. Bode. 2004. Analysis of variability in New York State benthic macroinvertebrate samples. New York State Department of Environmental Conservation, Technical Report, 43 pages.

Overview of Field Data

Based on the July sampling, the Hoosic River at the sites sampled was 50-60 meters wide, 0.2-0.4 meters deep, and had current speeds of 100-200 cm/sec in riffles. Dissolved oxygen was 8.9-10.4 mg/l, specific conductance was 314-365 μmhos, pH was 7.9-8.2, and the temperature was 20.6-22.5 °C (69-73 °F). Measurements for each site (July sampling) are found on the field data summary sheets.

Figures 1. Biological Assessment Profile of index values, Hoosic River, 2004. 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.

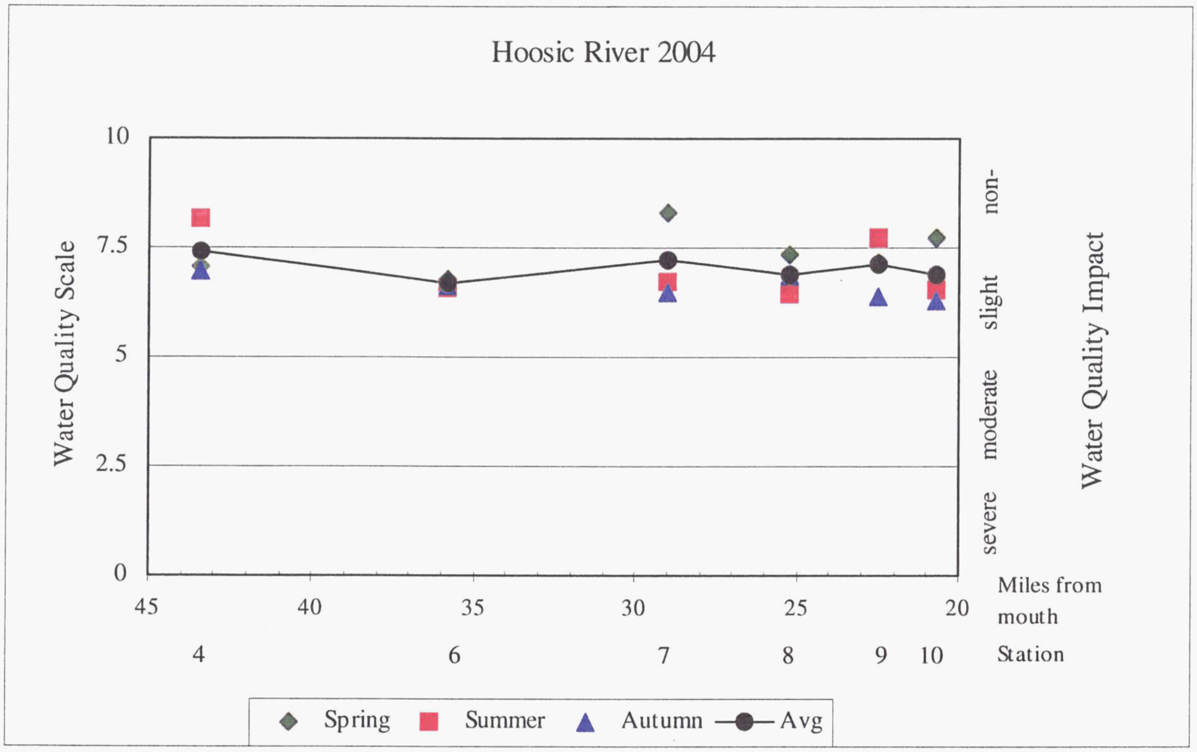


Figure 2. Biological Assessment Profile of index values, Hoosic River, 1986, 2001 & 2004.

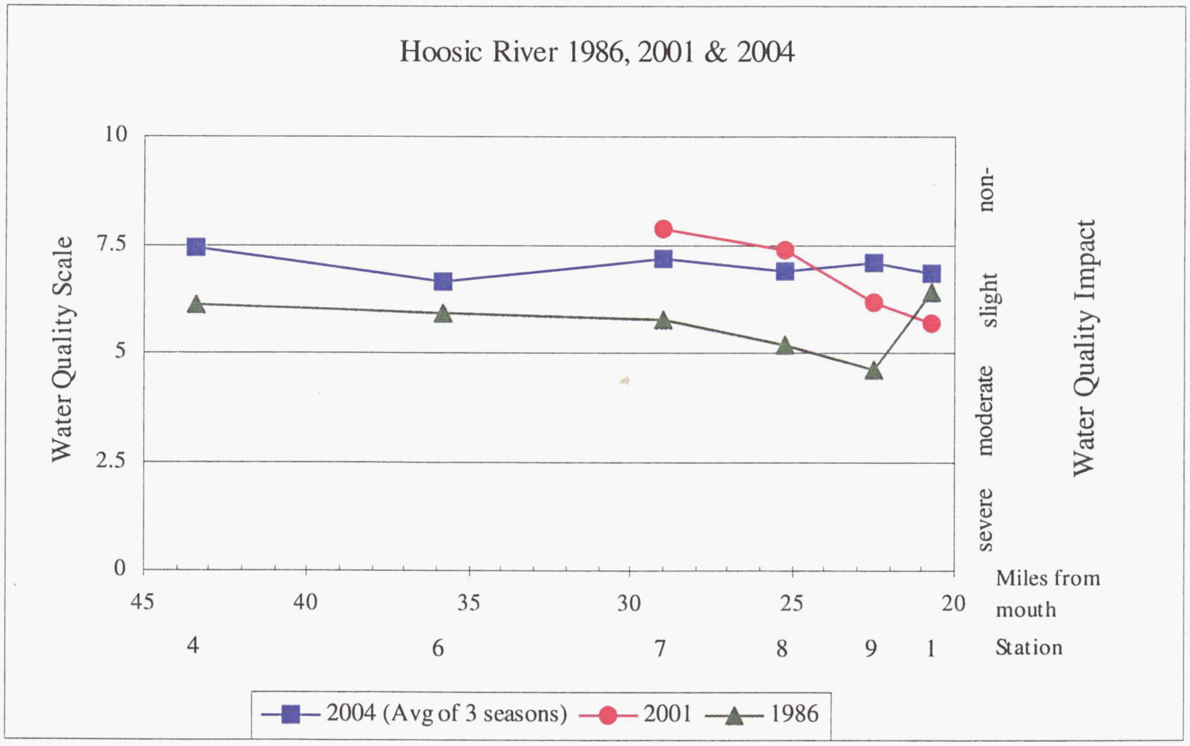


Table 2. Impact Source Determination, Hoosic River, 2004. Numbers represent similarity to community type models for each impact category for spring, summer, fall, and average.* The highest average similarities at each station are shaded. Similarities under 50% are less conclusive. Highest numbers represent probable type of impact. See Appendix X for further explanation.

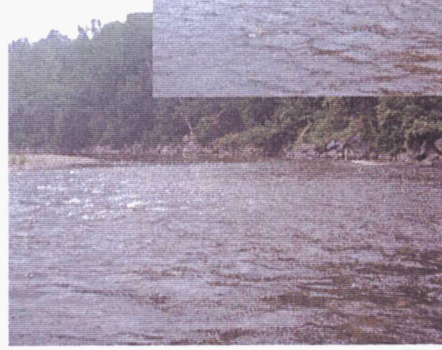
	STATION					
Community Type	HOOS-4	HOOS-6	HOOS-7	HOOS-8	HOOS-9	HOOS-10
Natural: minimal human impacts	57 66 43 **55**	46 60 37 **48**	56 57 33 **49**	54 55 37 **49**	44 56 32 **44**	41 49 38 **43**
Nutrient additions; mostly nonpoint, agricultural	47 42 34 **41**	39 44 39 **41**	44 55 39 **46**	34 62 26 **41**	62 47 32 **47**	37 60 40 **46**
Toxic: industrial, municipal, or urban runoff	52 44 37 **44**	50 38 35 **41**	44 51 38 **44**	32 53 31 **39**	43 47 18 **36**	29 52 33 **38**
Organic: sewage effluent, animal wastes	53 36 20 **36**	49 25 32 **35**	44 43 23 **37**	24 53 23 **33**	37 38 14 **30**	27 48 34 **36**
Complex: municipal/industrial	47 29 20 **32**	43 33 32 **36**	43 54 20 **39**	28 53 13 **31**	34 38 13 **28**	29 54 29 **37**
Siltation	49 38 29 **39**	36 34 34 **35**	36 54 20 **37**	32 56 17 **35**	42 44 19 **35**	33 53 34 **41**
Impoundment	50 28 22 **33**	50 29 20 **37**	43 47 20 **37**	32 52 17 **34**	49 38 15 **34**	31 47 30 **36**

STATION	COMMUNITY TYPE
HOOS-04	Natural
HOOS-06	Natural
HOOS-07	Natural, Nutrients
HOOS-08	Natural
HOOS-09	Natural, Nutrients
HOOS-10	Natural, Nutrients, Siltation

*Cell contents: spring (upper left), summer (upper right), fall (lower left), average (lower right)

Table 3. Station Locations for the Hoosic River, Rensselaer County, New York

STATION	LOCATION
04	Williamstown, MA Off Route 7, behind Steiner Film, Inc. 43.4 river miles from mouth latitude/longitude: 42°44'26"; 73°12'48"
06	North Petersburg, NY Route 346, 50 meters above bridge 35.8 river miles from mouth latitude/longitude: 42°48'32"; 73°17'10"
07	Hoosick, NY Rte. 22, 200 meters below Rte. 7 bridge 29.0 river miles above mouth latitude/longitude: 42°51'40"; 73°20'28"
08	Hoosick Falls, NY 200m below Church St. bridge 25.2 river miles above mouth latitude/longitude: 42°54'10"; 73°20'59"
09	Hoosick Junction, NY at end of Marker Rd. 22.5 river miles above mouth latitude/longitude: 42°55'57"; 73°22'20"
10	Eagle Bridge, NY 100 meters above Rte. 67 bridge 20.7 river miles above mouth latitude/longitude: 42°57'05"; 73°23'28"



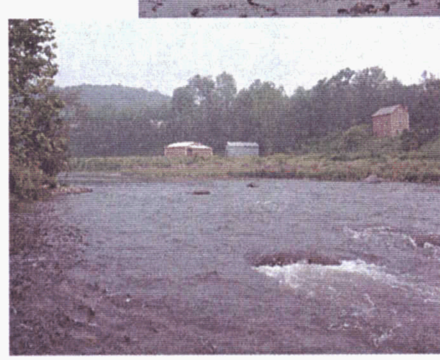


Figure 3	Site Overview Map	Hoosic River

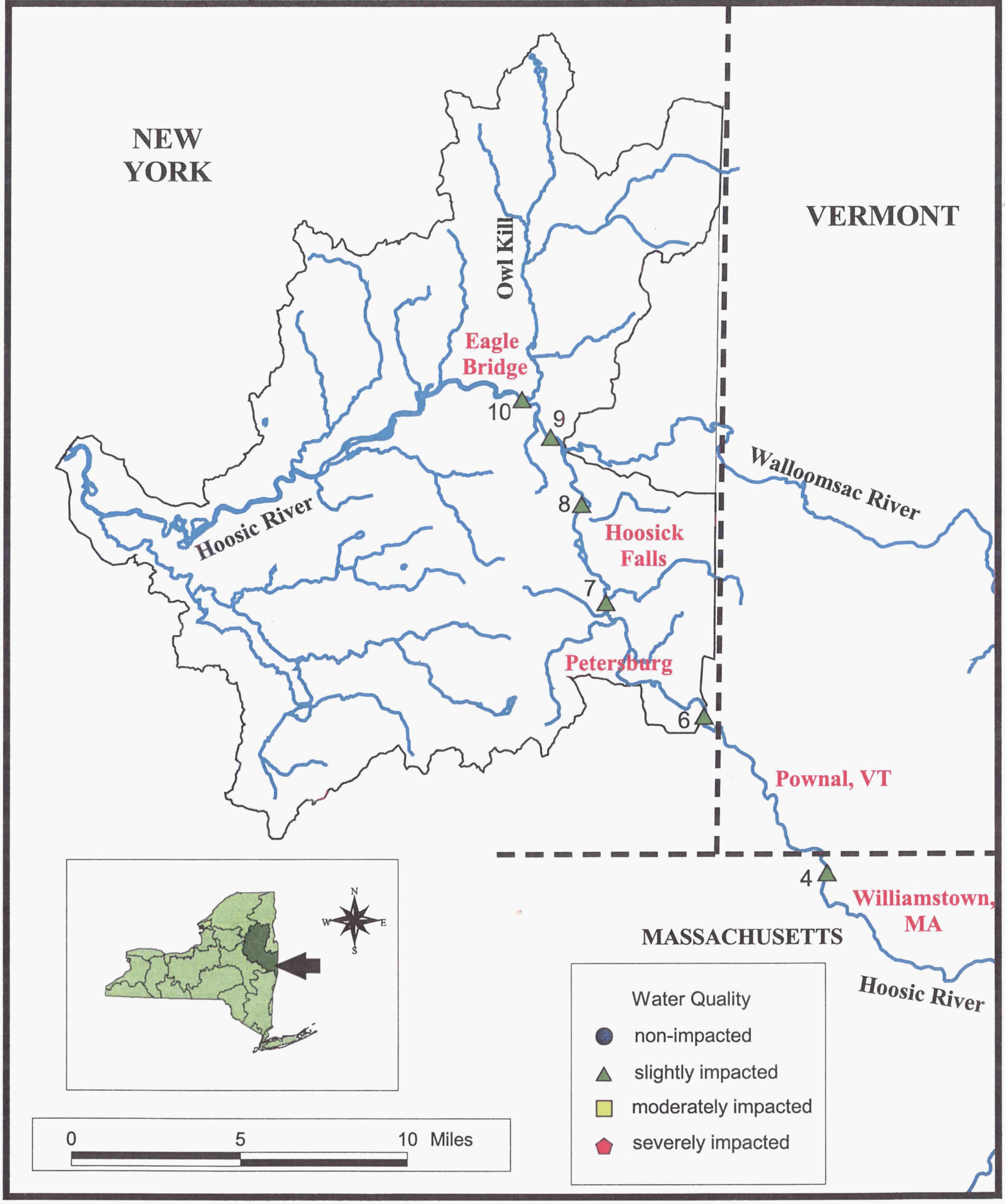


Figure 4a | Site Location Map | Hoosic River

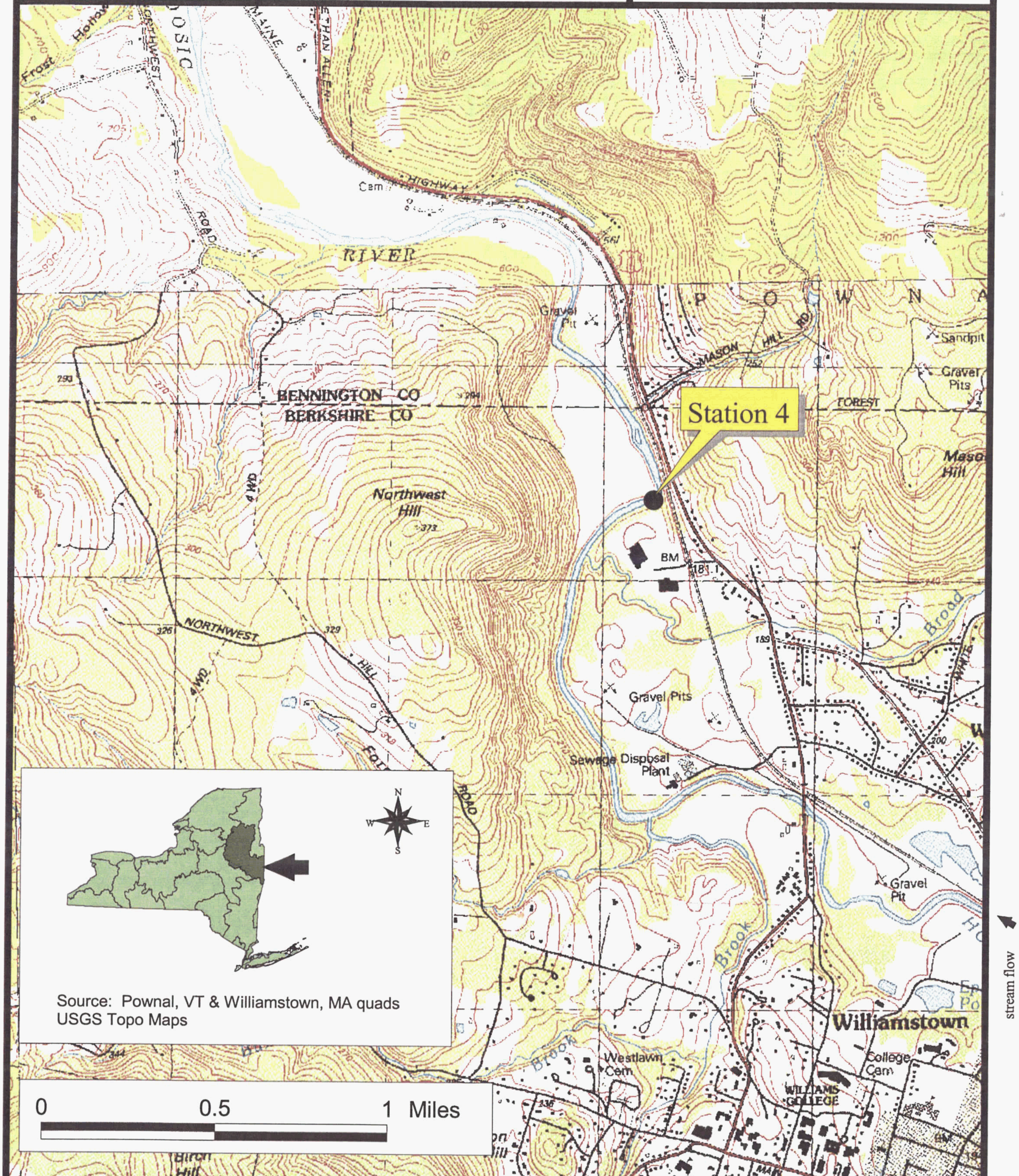


Figure 4b	Site Location Map	Hoosic River

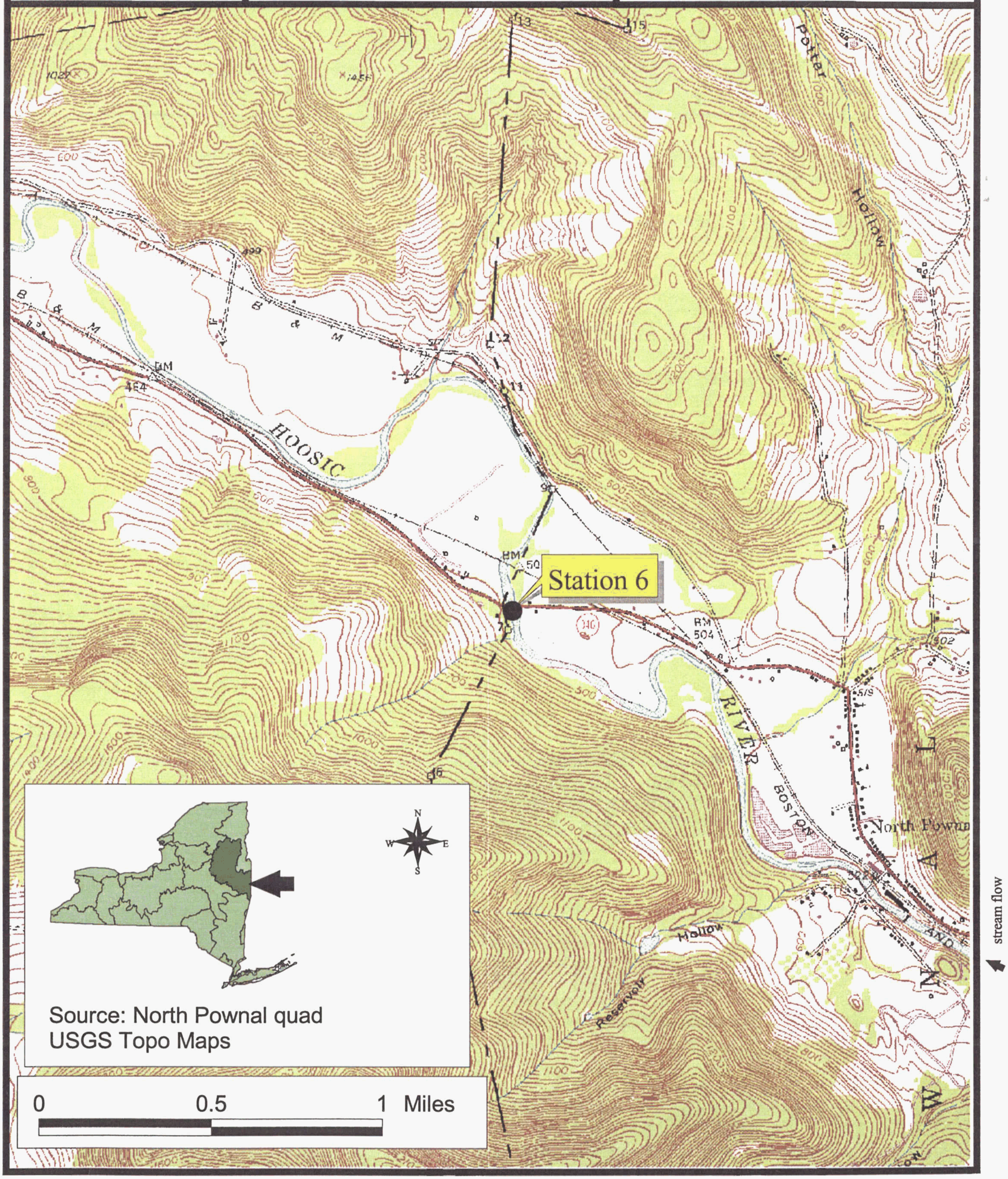
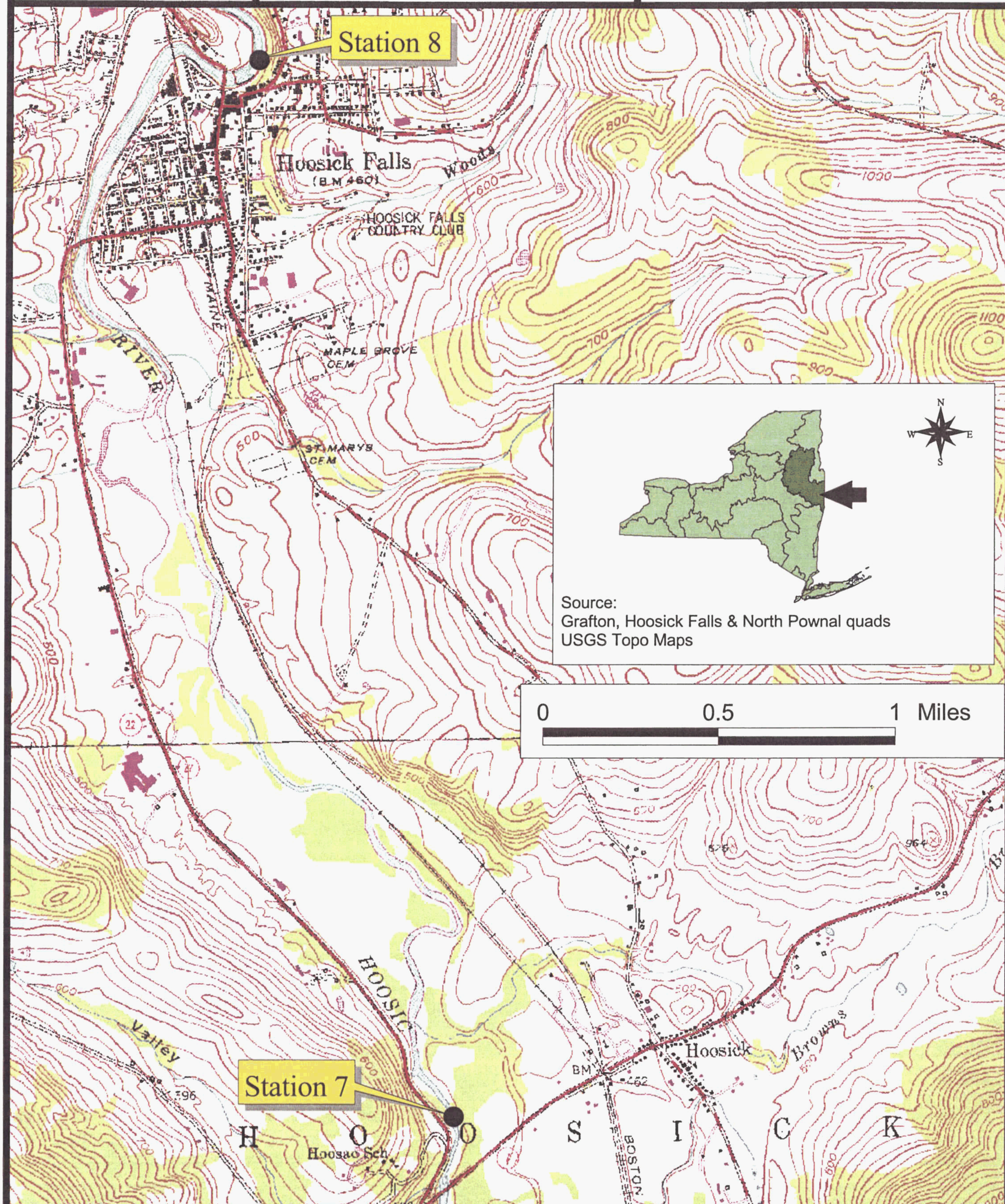
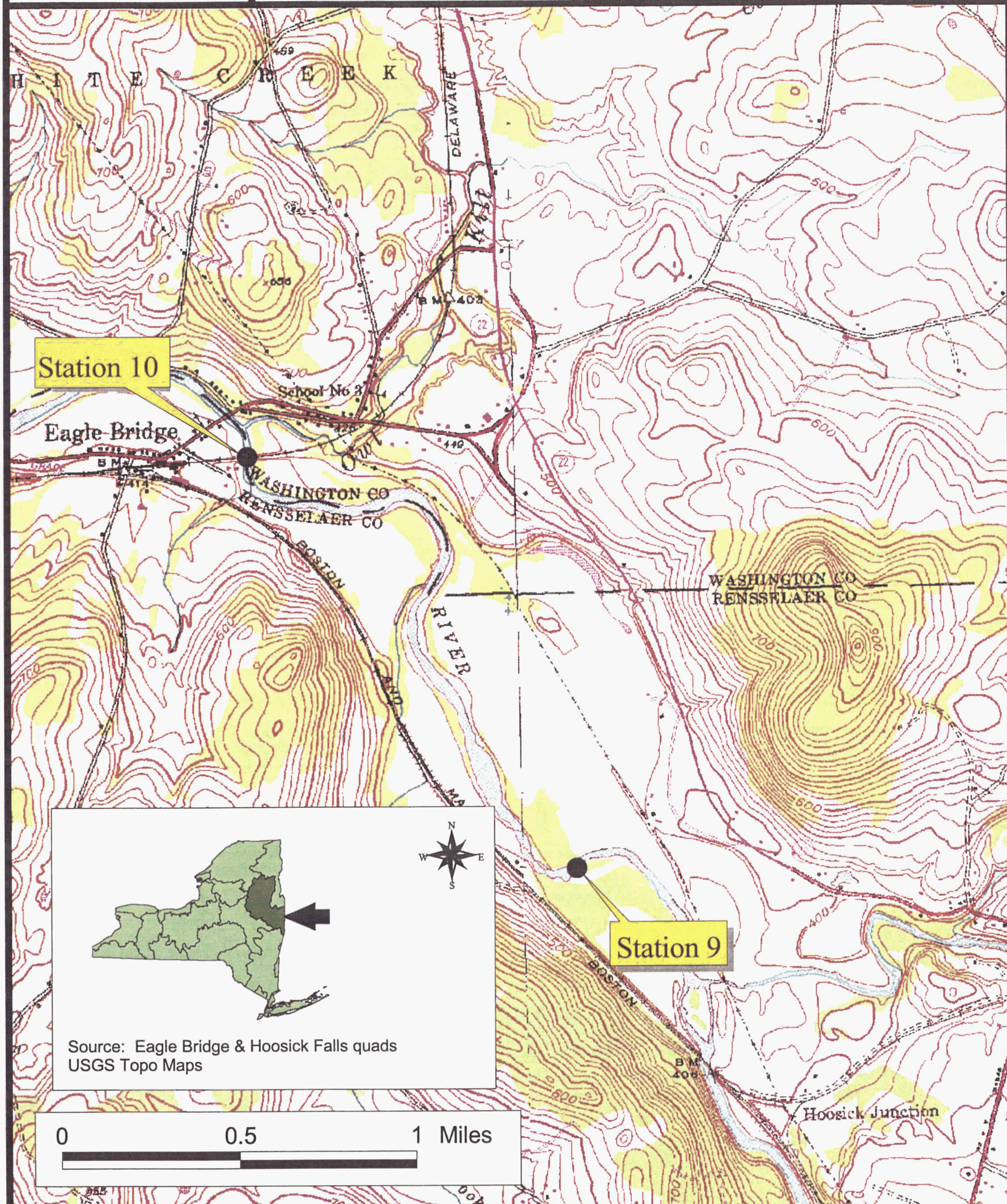


Figure 4c	Site Location Map	Hoosic River



stream flow

Figure 4d	Site Location Map	Hoosic River



stream flow

Table 4. Macroinvertebrate Species Collected in the Hoosic River, Rensselaer County, New York, 2004

NEMERTEA
Tetrastemmatidae
Prostoma graecense
PLATYHELMINTHES
Turbellaria
Undetermined Turbellaria
ANNELIDA
OLIGOCHAETA
Lumbriculidae
Stylodrilus heringianus
Undetermined Lumbriculidae
Tubificidae
Limnodrilus claparedeianus
Undet. Tubificidae w/o cap. setae
Naididae
Nais bretscheri
MOLLUSCA
GASTROPODA
Ancylidae
Ferrissia sp.
ARTHROPODA
INSECTA
EPHEMEROPTERA
Isonychiidae
Isonychia bicolor
Baetidae
Acentrella sp.
Baetis brunneicolor
Baetis flavistriga
Baetis intercalaris
Baetis sp.
Heptageniidae
Epeorus (Iron) sp.
Rhithrogena sp.
Stenonema terminatum
Stenonema vicarium
Undet. Heptageniidae
Leptophlebiidae
Undet. Leptophlebiidae
Ephemerellidae
Ephemerella subvaria
Ephemerella sp.
Serratella sp.
Undet. Ephemerellidae
Caenidae
Caenis sp.
Potamanthidae
Anthopotamus sp.
PLECOPTERA
Capniidae
Undetermined Capniidae
Leuctridae
Undetermined Leuctridae
Nemouridae
Shipsa rotunda
Taeniopterygidae
Taenionema sp.
Taeniopteryx sp.
Perlidae
Agnetina capitata
Paragnetina sp.
Undetermined Perlidae
Perlodidae
Isogenoides hansoni
Isoperla sp.
MEGALOPTERA
Corydalidae
Nigronia sp.
COLEOPTERA
Psephenidae
Ectopria nervosa
Psephenus herricki
Elmidae
Dubiraphia sp.
Optioservus fastiditus
Optioservus trivittatus
Optioservus sp.
Promoresia tardella
Promoresia sp.
Stenelmis crenata
Stenelmis sp.
TRICHOPTERA
Philopotamidae
Chimarra aterrima?
Chimarra obscura
Chimarra socia
Chimarra sp.
Polycentropodidae
Neureclipsis sp.
Psychomyiidae
Psychomyia flavida
Hydropsychidae
Cheumatopsyche sp.
Hydropsyche bronta
Hydropsyche morosa
Hydropsyche scalaris
Hydropsyche slossonae
Hydropsyche sparna
Hydropsyche sp.
Glossosomatidae
Glossosoma sp.
Rhyacophilidae
Rhyacophila mainensis
Rhyacophila sp.

Table 4, continued

Hydroptilidae
Leucotrichia sp.
Brachycentridae
Brachycentrus appalachia
Lepidostomatidae
Lepidostoma sp.
Leptoceridae
Mystacides sp.
Setodes sp.
DIPTERA
Athericidae
Atherix sp.
Tipulidae
Antocha sp.
Simuliidae
Prosimulium arvum
Prosimulium hirtipes
Simulium jenningsi
Tabanidae
Undetermined Tabanidae
Empididae
Hemerodromia sp.
Undetermined Empididae
Chironomidae
Hayesomyia senata
Diamesa sp.
Pagastia orthogonia
Brillia flavifrons
Cardiocladius obscurus
Cricotopus bicinctus
Cricotopus trifascia gr.
Cricotopus vierriensis
Eukiefferiella devonica gr.
Orthocladius nr. dentifer
Orthocladius dubitatus
Orthocladius (Euorth.) luteipes
Orthocladius (Euorth.) rivicola
Orthocladius obumbratus
Orthocladius sp.
Parachaetocladius sp.
Parakiefferiella sp.
Parametriocnemus lundbecki
Tvetenia bavarica gr.
Tvetenia vitracies
Undet. Orthocladiinae
Cryptochironomus sp.
Microtendipes pedellus gr.
Nilothauma sp.
Polypedilum aviceps
Polypedilum fallax gr.
Polypedilum flavum
Polypedilum halterale gr.
Cladotanytarsus sp.
Sublettea coffmani

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: Hoosic River, Station HOOS-04
LOCATION: Downstream of Williamstown, MA
DATE: 13 April 2004, 23 July 2004, 14 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

			Apr	Jul	Dec
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	*Stylodrilus heringianus*	1	.	.
		Undetermined Lumbriculidae	31	4	2
	Naididae	*Nais bretscheri*	.	1	.
MOLLUSCA					
GASTROPODA	Ancylidae	*Ferrissia sp.*	.	1	.
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Baetidae	*Acentrella sp.*	.	1	.
		Baetis brunneicolor	.	4	3
		Baetis flavistriga	.	9	.
		Baetis intercalaris	.	25	.
		Baetis sp.	24	.	.
	Heptageniidae	*Epeorus (Iron) sp.*	8	.	.
		Rhithrogena sp.	.	.	2
		Stenonema vicarium	.	.	2
	Ephemerellidae	*Ephemerella sp.*	4	.	.
		Ephemerella subvaria	.	.	6
		Serratella sp.	2	3	.
PLECOPTERA	Leuctridae	Undetermined Leuctridae	.	.	1
	Taeniopterygidae	*Taeniopteryx sp.*	.	.	2
		Taenionema sp.	.	.	33
	Perlidae	*Paragnetina sp.*	.	1	.
	Perlodidae	*Isoperla sp.*	1	.	.
MEGALOPTERA	Corydalidae	*Nigronia sp.*	.	1	.
COLEOPTERA	Psephenidae	*Ectopria nervosa*	.	1	.
		Psephenus herricki	1	.	1
	Elmidae	*Optioservus fastiditus*	.	.	15
		Optioservus trivittatus	3	5	.
		Promoresia tardella	.	1	.
		Stenelmis sp.	6	2	4
TRICHOPTERA	Hydropsychidae	*Cheumatopsyche sp.*	1	1	.
		Hydropsyche bronta	5	1	.
		Hydropsyche morosa	.	9	7
		Hydropsyche sparna	3	.	.
	Rhyacophilidae	*Rhyacophila mainensis*	1	.	.
	Hydroptilidae	*Leucotrichia sp.*	1	2	.
	Lepidostomatidae	*Lepidostoma sp.*	.	.	1
DIPTERA	Athericidae	*Atherix sp.*	.	7	1
	Tipulidae	*Antocha sp.*	2	.	7
	Simuliidae	*Prosimulium arvum*	2	.	1
	Empididae	*Hemerodromia sp.*	1	.	.
	Chironomidae	*Hayesomyia senata*	.	1	.
		Diamesa sp.	.	.	6
		Brillia flavifrons	.	.	2

Cardiocladius obscurus	.	7	.
Cricotopus trifascia gr.	.	2	.
Cricotopus vierriensis	.	1	.
Orthocladius dubitatus	.	4	.
Orthocladius (Euorth.) luteipes	3	.	.
Parachaetocladius sp.	.	.	2
Parametriocnemus lundbecki	.	1	.
Tvetenia bavarica gr.	.	1	.
Polypedilum aviceps	.	2	.
Polypedilum flavum	.	1	.
Sublettea coffmani	.	1	.

SPECIES RICHNESS: (ave = 23, good)	19	20	29
BIOTIC INDEX: (ave = 4.14, very good)	4.54	4.78	3.10
EPT RICHNESS: (ave = 10, good)	10	10	9
MODEL AFFINITY: (ave = 75, very good)	72	94	59

ASSESSMENT: slightly impacted

DESCRIPTION The sampling site was accessed behind the Steiner Film Company, off Route 7, east of Williamstown, MA. The stream substrate contained rubble, gravel, and sand, but the rocks were heavily embedded. The macroinvertebrate community contained many mayflies, stoneflies, and caddisflies. Overall water quality was assessed as slightly impacted.

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: HOOS 06
LOCATION: North Petersburg, NY, above Route 346 bridge
DATE: 13 April 2004, 23 July 2004, 14 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

			Apr	Jul	Dec
PLATYHELMINTHES	Turbellaria	Undetermined Turbellaria	.	.	1
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	*Stylodrilus heringianus*	3	.	1
		Undetermined Lumbriculidae	40	3	3
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Isonychiidae	*Isonychia bicolor*	1	.	.
	Baetidae	*Acentrella sp.*	.	9	.
		Baetis brunneicolor	1	.	.
		Baetis flavistriga	.	3	.
		Baetis intercalaris	.	40	.
	Ephemerellidae	*Baetis sp.*	14	.	.
	Heptageniidae	*Epeorus (Iron) sp.*	2	.	.
		Stenonema vicarium	1	.	.
	Ephemerellidae	*Ephemerella subvaria*	9	.	9
		Serratella sp.	.	3	.
	Caenidae	*Caenis sp.*	.	2	.
	Potamanthidae	*Anthopotamus sp.*	.	.	1
PLECOPTERA	Capniidae	Undetermined Capniidae	.	.	1
	Leuctridae	Undetermined Leuctridae	.	.	3
	Nemouridae	*Shipsa rotunda*	1	.	.
	Taeniopterygidae	*Taenionema sp.*	1	.	25
		Taeniopteryx sp.	.	.	1
COLEOPTERA	Psephenidae	*Psephenus herricki*	1	.	.
	Elmidae	*Optioservus trivittatus*	5	11	12
		Stenelmis sp.	.	2	.
TRICHOPTERA	Philopotamidae	*Chimarra socia*	.	2	.
		Chimarra sp.	.	.	1
	Psychomyiidae	*Psychomyia flavida*	1	.	.
	Hydropsychidae	*Cheumatopsyche sp.*	.	3	6
		Hydropsyche bronta	7	2	18
		Hydropsyche morosa	5	14	5
		Hydropsyche sparna	4	.	.
	Rhyacophilidae	*Rhyacophila sp.*	.	2	.
DIPTERA	Tipulidae	*Antocha sp.*	.	1	7
	Simuliidae	*Prosimulium hirtipes*	2	.	.
	Chironomidae	*Diamesa sp.*	.	.	3
		Cardiocladius obscurus	.	3	.
		Orthocladius obumbratus	.	.	1
		Parakiefferiella sp.	1	.	.
		Parametriocnemus lundbecki	.	.	1
		Tvetenia vitracies	.	.	1
		Microtendipes pedellus gr.	.	.	1
		Polypedilum halterale gr.	1	.	.

SPECIES RICHNESS: (ave = 18, poor)	19	15	19
BIOTIC INDEX: (ave = 4.31, very good)	4.56	4.70	3.67
EPT RICHNESS: (ave = 11, very good)	12	10	10
MODEL AFFINITY: (ave = 56, good)	55	67	46
ASSESSMENT: slightly impacted			

DESCRIPTION The sample was taken upstream of the Route 346 bridge at the New York/ Vermont border. The stream substrate appeared somewhat less embedded than at Station 4. The macroinvertebrate community was dominated by mayflies, but species richness was lower than the expected level for a non-impacted stream. Overall water quality was assessed as slightly impacted.

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: HOOS 07
LOCATION: Hoosick, NY, Route 22, below Route 7 bridge
DATE: 13 April 2004, 23 July 2004, 14 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

			Apr	Jul	Dec
NEMERTEA	Tetrastemmatidae	*Prostoma graecense*	.	1	.
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	17	4	9
TUBIFICIDA	Tubificidae	Undet. Tubificidae w/o cap. setae	12	.	1
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Isonychiidae	*Isonychia bicolor*	1	2	.
	Baetidae	*Baetis brunneicolor*	.	.	1
		Baetis flavistriga	.	5	.
		Baetis intercalaris	.	16	.
		Baetis sp.	8	.	.
	Heptageniidae	*Epeorus (Iron) sp.*	2	.	.
		Stenonema vicarium	2	.	.
		Stenonema sp.	.	.	1
	Leptophlebiidae	Undetermined Leptophlebiidae	1	.	.
	Ephemerellidae	*Ephemerella subvaria*	3	.	3
		Ephemerella sp.	15	.	.
		Undet. Ephemerellidae	.	2	.
PLECOPTERA	Capniidae	Undetermined Capniidae	.	.	11
	Nemouridae	*Shipsa rotunda*	2	.	.
	Taeniopterygidae	*Taenionema sp.*	.	.	40
		Taeniopteryx sp.	.	.	2
	Perlidae	*Agnetina capitata*		2	..
		Undetermined Perlidae	.	1	.
	Perlodidae	*Isogenoides hansoni*	1	.	.
		Isoperla sp.	5	.	1
COLEOPTERA	Psephenidae	*Psephenus herricki*	.	.	1
	Elmidae	*Optioservus trivittatus*	.	16	.
		Optioservus sp.	4	.	3
		Stenelmis crenata	.	5	.
		Stenelmis sp.	1	.	.
TRICHOPTERA	Psychomyiidae	*Psychomyia flavida*	1	.	.
	Hydropsychidae	*Cheumatopsyche sp.*	3	6	1
		Hydropsyche bronta	6	2	3
		Hydropsyche morosa	.	20	3
		Hydropsyche sparna	2	.	.
	Brachycentridae	*Brachycentrus appalachia*	.	.	1
DIPTERA	Tipulidae	*Antocha sp.*	2	.	7
	Chironomidae	*Cardiocladius obscurus*	.	3	.
		Cricotopus bicinctus	.	3	.
		Cricotopus trifascia gr.	.	1	.
		Cricotopus sp.	.	1	.
		Orthocladius obumbratus	1	.	1
		Orthocladius sp.	2	.	.
		Parakiefferiella sp.	2	.	.
		Tvetenia bavarica gr.	1	.	.
		Tvetenia vitracies	1	.	.

Undet. Orthocladiinae	.	1	.
Cryptochironomus sp.	1	.	.
Microtendipes pedellus gr.	.	1	11
Polypedilum aviceps	2	4	.
Polypedilum flavum	.	6	.

SPECIES RICHNESS: (ave = 22, good)	27	20	18
BIOTIC INDEX: (ave = 4.26, very good)	4.42	5.02	3.34
EPT RICHNESS: (ave = 11, very good)	15	8	11
MODEL AFFINITY: (ave = 62, good)	69	71	46

ASSESSMENT: slightly impacted

DESCRIPTION The sampling site location was downstream of the Route 7 bridge in Hoosick, accessed from a Route 7 pulloff. Most of the streambed rocks were coated with brown algae. The habitat appeared adequate, but mayfly numbers were reduced from upstream levels. Overall water quality was assessed as slightly impacted.

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: Hoosic River, Station HOOS-08
LOCATION: Hoosick Falls, NY, below Church Street bridge
DATE: 13 April 2004, 23 July 2004, 14 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

			Apr	Jul	Dec
NEMERTEA	Tetrastemmatidae	*Prostoma graecense*	.	2	.
PLATYHELMINTHES	Turbellaria	Undetermined Turbellaria	.	2	.
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	Undetermined Lumbriculidae	11	4	6
TUBIFICIDA	Tubificidae	*Limnodrilus claparedeianus*	1	.	.
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Isonychiidae	*Isonychia bicolor*	.	.	1
	Baetidae	*Acentrella sp.*	.	1	.
		Baetis flavistriga	.	2	.
		Baetis intercalaris	.	2	.
		Baetis sp.	3	.	.
	Heptageniidae	*Stenonema terminatum*	1	.	.
	Ephemerellidae	*Ephemerella subvaria*	29	.	14
	Potamanthidae	*Anthopotamus sp.*	.	.	2
PLECOPTERA	Capniidae	Undetermined Capniidae	.	.	2
	Taeniopterygidae	*Taenionema sp.*	.	.	22
	Perlidae	*Agnetina capitata*	2	.	.
	Perlodidae	*Isogenoides hansoni*	1	.	.
		Isoperla sp.	22	.	1
COLEOPTERA	Elmidae	*Optioservus trivittatus*	.	11	.
		Optioservus sp.	6	.	30
		Stenelmis crenata	.	15	.
TRICHOPTERA	Philopotamidae	*Chimarra obscura*	.	8	.
	Psychomyiidae	*Psychomyia flavida*	.	.	1
	Hydropsychidae	*Cheumatopsyche sp.*	6	10	1
		Hydropsyche bronta	8	2	4
		Hydropsyche morosa	2	11	1
		Hydropsyche slossonae	1	.	.
		Hydropsyche sparna	1	.	.
		Hydropsyche sp.	.	6	.
	Rhyacophilidae	*Rhyacophila sp.*	.	1	.
DIPTERA	Tipulidae	*Antocha sp.*	2	2	9
	Simuliidae	*Prosimulium hirtipes*	2	.	.
	Empididae	Undetermined Empididae	.	1	.
	Chironomidae	*Cardiocladius obscurus*	.	11	.
		Cricotopus trifascia gr.	.	1	.
		Eukiefferiella devonica gr.	1	.	.
		Orthocladius nr. dentifer	.	2	.
		Orthocladius obumbratus	.	.	1
		Parakiefferiella sp.	.	.	1
		Undet. Orthocladiinae	.	1	.
		Microtendipes pedellus gr .	1	.	2
		Polypedilum flavum	.	5	.
		Polypedilum fallax gr.	.	.	1
		Cladotanytarsus sp.	.	.	1

SPECIES RICHNESS: (ave = 19, good)	18	21	18
BIOTIC INDEX: (ave = 3.75, very good)	3.08	4.94	3.23
EPT RICHNESS: (ave = 10, good)	11	9	10
MODEL AFFINITY: (ave = 60, good)	65	56	59
ASSESSMENT: slightly impacted			

DESCRIPTION The sampling site was located 200 meters downstream of the Church Street bridge in Hoosick Falls. The riffle habitat was considered adequate, and the macroinvertebrate community contained many mayflies, stoneflies, and caddisflies. Overall water quality was assessed as slightly impacted.

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: Hoosic River, Station HOOS-09
LOCATION: Below Hoosick Falls, NY, off Marker Road
DATE: 13 April 2004, 23 July 2004, 22 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100

			Apr	Jul	Dec
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	*Stylodrilus heringianus*	2	.	.
		Undetermined Lumbriculidae	5	6	.
MOLLUSCA					
GASTROPODA	Ancylidae	*Ferrissia sp.*	.	.	2
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Isonychiidae	*Isonychia bicolor*	2	1	.
	Baetidae	*Baetis flavistriga*	1	7	.
		Baetis intercalaris	2	17	.
		Baetis sp.	1	.	.
	Heptageniidae	*Stenonema vicarium*	.	.	1
	Ephemerellidae	*Ephemerella subvaria*	7	.	.
		Serratella sp.	.	2	.
	Caenidae	*Caenis sp.*	.	5	.
	Potamanthidae	*Anthopotamus sp.*	1	1	.
PLECOPTERA	Capniidae	Undetermined Capniidae	.	.	2
	Nemouridae	*Shipsa rotunda*	1	.	.
	Taeniopterygidae	*Taenionema sp.*	.	.	8
		Taeniopteryx sp.	.	.	1
	Perlidae	*Agnetina capitata*	.	1	.
	Perlodidae	*Isoperla sp.*	.	.	2
COLEOPTERA	Psephenidae	*Psephenus herricki*	6	1	6
	Elmidae	*Optioservus trivittatus*	18	7	.
		Optioservus sp.	.	.	31
		Promoresia sp.	.	6	.
		Stenelmis crenata	21	.	.
TRICHOPTERA	Psychomyiidae	*Psychomyia flavida*	.	.	1
	Hydropsychidae	*Cheumatopsyche sp.*	4	3	5
		Hydropsyche bronta	7	.	.
		Hydropsyche morosa	3	13	2
		Hydropsyche scalaris	2	.	1
		Hydropsyche sparna	1	.	.
		Hydropsyche sp.	.	1	.
	Glossosomatidae	*Glossosoma sp.*	1	.	.
	Rhyacophilidae	*Rhyacophila sp.*	.	2	.
	Leptoceridae	*Setodes sp.*	5	.	.
DIPTERA	Tipulidae	*Antocha sp.*	5	3	19
	Chironomidae	*Hayesomyia senata*	.	1	.
		Diamesa sp.	.	.	4
		Brillia flavifrons	.	.	1
		Cardiocladius obscurus	.	10	1
		Cricotopus bicinctus	.	2	.
		Cricotopus trifascia gr.	.	1	.
		Orthocladius nr. dentifer	.	3	.
		Orthocladius obumbratus	.	.	4
		Parakiefferiella sp.	2	.	.

Microtendipes pedellus gr.	3	1	9
Polypedilum flavum	.	6	.

SPECIES RICHNESS: (ave = 21, good)	22	23	18
BIOTIC INDEX: (ave = 4.28, very good)	4.14	4.73	3.96
EPT RICHNESS: (ave = 11, very good)	14	11	9
MODEL AFFINITY: (ave = 62, good)	50	82	54
ASSESSMENT: slightly impacted			

DESCRIPTION The site was accessed through the Beaverkill Club, off Marker Road near North Hoosick. The macroinvertebrate community was dominated by riffle beetles, mayflies, midges, and caddisflies. Overall water quality was assessed as slightly impacted.

Macroinvertebrate Data Reports: Raw Data

STREAM SITE: Hoosic River, Station HOOS-10
LOCATION: Eagle Bridge, NY, above Route 67 bridge
DATE: 13 April 2004, 23 July 2004, 14 December 2004
SAMPLE TYPE: Kick sample
SUBSAMPLE: 100 (April sample, entire)

			Apr	Jul	Dec
ANNELIDA					
OLIGOCHAETA					
LUMBRICULIDA	Lumbriculidae	*Stylodrilus heringianus*	1	.	.
		Undetermined Lumbriculidae	2	2	10
ARTHROPODA					
INSECTA					
EPHEMEROPTERA	Isonychiidae	*Isonychia sp.*	.	1	.
	Baetidae	*Acentrella sp.*	.	4	.
		Baetis brunneicolor	.	2	.
		Baetis flavistriga	.	3	.
		Baetis intercalaris	2	11	.
		Baetis sp.	1	.	.
	Heptageniidae	Undet. Heptageniidae	.	1	.
	Ephemerellidae	*Ephemerella subvaria*	11	.	1
	Caenidae	*Caenis sp.*	.	1	.
PLECOPTERA	Capniidae	Undetermined Capniidae	.	.	1
	Taeniopterygidae	*Taenionema sp.*	.	.	6
	Perlidae	*Agnetina capitata*	1	.	.
	Perlodidae	*Isoperla sp.*	1	.	.
COLEOPTERA	Psephenidae	*Psephenus herricki*	.	.	3
	Elmidae	*Dubiraphia sp.*	.	.	1
		Optioservus trivittatus	7	8	.
		Optioservus sp.	.	.	29
		Stenelmis crenata	.	6	4
		Stenelmis sp.	5	.	.
TRICHOPTERA	Philopotamidae	*Chimarra aterrima?*	1	.	.
		Chimarra socia	.	1	.
	Polycentropodidae	*Neureclipsis* sp.	1	.	.
	Hydropsychidae	*Cheumatopsyche* sp.	1	4	2
		Hydropsyche bronta	11	.	.
		Hydropsyche morosa	4	25	9
		Hydropsyche scalaris	1	.	.
		Hydropsyche sparna	2	.	.
	Leptoceridae	*Mystacides sp.*	.	.	2
DIPTERA	Tipulidae	*Antocha sp.*	3	.	13
	Simuliidae	*Prosimulium hirtipes*	4	.	.
		Simulium jenningsi	.	4	.
	Tabanidae	Undetermined Tabanidae	2	.	.
	Chironomidae	*Diamesa sp.*	.	.	3
		Pagastia orthogonia	.	.	1
		Cardiocladius obscurus	.	9	3
		Orthocladius obumbratus	.	.	9
		Orthocladius (Euortho.) rivicola	1	.	.
		Parachaetocladius sp.	1	.	.
		Parakiefferiella sp.	1	.	.
		Tvetenia vitracies	.	.	1
		Microtendipes pedellus gr.	1	.	1
		Nilothauma sp.	1	.	.

Polypedilum flavum	.	18	.
Cladotanytarsus sp.	.	.	1

SPECIES RICHNESS: (ave = 20, good)	24	16	19
BIOTIC INDEX: (ave = 4.52, good)	4.09	5.15	4.32
EPT RICHNESS: (ave = 9, good)	12	10	6
MODEL AFFINITY: (ave = 65, very good)	66	69	60
ASSESSMENT: slightly impacted			

DESCRIPTION The sampling site was located in Eagle Bridge, upstream of the confluence with the Owl Kill, and upstream of a railroad trestle. The stream was deep at this point, and kick sampling was conducted close to shore, rather than in midstream. The macroinvertebrate community was dominated by riffle beetles, mayflies, and caddisflies. Overall water quality was assessed as slightly impacted.

Field Data Summary				
STREAM NAME: Hoosic River		DATE SAMPLED: 7/23/2004		
REACH: Williamstown to Eagle Bridge				
FIELD PERSONNEL INVOLVED: Smith, Bode, Magee				
STATION	04	06	07	08
ARRIVAL TIME AT STATION	9:15	10:05	10:55	11:45
LOCATION	Off Rte. 7 Williamstown, MA	Rte. 346 Petersburg, NY	Rte. 22, Above Hoosick Falls	Church Rd. bridge Hoosick Falls
PHYSICAL CHARACTERISTICS				
Width (meters)	60	50	50	50
Depth (meters)	0.2	0.2	0.2	0.3
Current speed (cm per sec.)	100	150	150	150
Substrate (%)				
Rock (>25.4 cm or bedrock)	10	10	10	10
Rubble (6.35 - 25.4 cm)	40	40	40	40
Gravel (0.2 – 6.35 cm)	20	20	20	20
Sand (0.06 – 2.0 mm)	10	10	10	10
Silt (0.004 – 0.06 mm)	20	20	20	20
Embeddedness (%)	50	30	30	30
CHEMICAL MEASUREMENTS				
Temperature (° C)	20.6	22.1	22.5	22.3
Specific Conductance (umhos)	365	364	327	325
Dissolved Oxygen (mg/l)	8.9	10.0	10.4	8.9
pH	7.9	8.2	8.2	7.9
BIOLOGICAL ATTRIBUTES				
Canopy (%)	20	20	10	20
Aquatic Vegetation				
algae – suspended				
algae – attached, filamentous		X	X	X
algae - diatoms		X	X	X
macrophytes or moss		X		
Occurrence of Macroinvertebrates				
Ephemeroptera (mayflies)	X	X	X	X
Plecoptera (stoneflies)	X	X	X	X
Trichoptera (caddisflies)	X	X	X	X
Coleoptera (beetles)	X	X		X
Megaloptera (dobsonflies, alderflies)	X	X		X
Odonata (dragonflies, damselflies)				
Chironomidae (midges)	X	X		X
Simuliidae (black flies)		X		X
Decapoda (crayfish)	X	X	X	
Gammaridae (scuds)				
Mollusca (snails, clams)				
Oligochaeta (worms)	X		X	X
Other				
FAUNAL CONDITION	Very good	Very good	Good	Good

Field Data Summary				
STREAM NAME: Hoosic River		DATE SAMPLED: 7/23/2004		
REACH: Williamstown to Eagle Bridge				
FIELD PERSONNEL INVOLVED: Smith, Bode, Magee				
STATION	09	10		
ARRIVAL TIME AT STATION	1:00	2:15		
LOCATION	Below Hoosick Falls	Rte. 67 bridge Eagle Bridge		
PHYSICAL CHARACTERISTICS				
Width (meters)	50	50		
Depth (meters)	0.3	0.4		
Current speed (cm per sec.)	100	200		
Substrate (%)				
Rock (>25.4 cm or bedrock)		10		
Rubble (6.35 - 25.4 cm)	20	40		
Gravel (0.2 – 6.35 cm)	30	20		
Sand (0.06 – 2.0 mm)	30	10		
Silt (0.004 – 0.06 mm)	20	20		
Embeddedness (%)	50	30		
CHEMICAL MEASUREMENTS				
Temperature (° C)	22.3	22.5		
Specific Conductance (umhos)	319	314		
Dissolved Oxygen (mg/l)	9.1	9.5		
pH	7.9	8.1		
BIOLOGICAL ATTRIBUTES				
Canopy (%)	10	10		
Aquatic Vegetation				
algae – suspended				
algae – attached, filamentous				
algae - diatoms		X		
macrophytes or moss	X			
Occurrence of Macroinvertebrates				
Ephemeroptera (mayflies)	X	X		
Plecoptera (stoneflies)	X	X		
Trichoptera (caddisflies)	X	X		
Coleoptera (beetles)	X	X		
Megaloptera (dobsonflies, alderflies)	X	X		
Odonata (dragonflies, damselflies)				
Chironomidae (midges)		X		
Simuliidae (black flies)		X		
Decapoda (crayfish)				
Gammaridae (scuds)	X			
Mollusca (snails, clams)				
Oligochaeta (worms)	X	X		
Other				
FAUNAL CONDITION	Good	Good		

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 organisms are dislodged and carried into the net. Sampling is continued for a specified time and distance in the stream. Rapid-assessment sampling specifies sampling for five minutes over a distance of five meters. The contents of the net 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 US 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 US 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 are recorded on a data sheet. All organisms from the subsample are archived (either slide-mounted or preserved in alcohol). If the results of the identification process 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. For subsamples of 100 organisms each that are taken from kick samples, expected ranges in most New York State streams are: greater than 26, non-impacted; 19-26, slightly impacted; 11-18, moderately impacted, less than 11, severely impacted.

2. EPT Richness. 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 clean-water organisms, and their presence is generally correlated with good water quality (Lenat, 1987). Expected assessment ranges from most New York State streams are: greater than 10, non-impacted; 6-10, slightly impacted; 2-5, moderately impacted, and 0-1, severely impacted.

3. Hilsenhoff Biotic Index. The Hilsenhoff Biotic Index is a measure of the tolerance of organisms in a 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 the purpose of characterizing species' tolerance, intolerant = 0-4, facultative = 5-7, and tolerant = 8-10. Tolerance 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). Impact ranges 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 seven major macroinvertebrate groups (Novak and Bode, 1992). Percent abundances in the model community are: 40% Ephemeroptera; 5% Plecoptera; 10% Trichoptera; 10% Coleoptera; 20% Chironomidae; 5% Oligochaeta, and 10% Other. Impact ranges are: greater than 64, non-impacted; 50-64, slightly impacted; 35-49, moderately impacted; and less than 35, severely impacted

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Bode, R.W., M.A. Novak, and L.E. Abele. 1996. Quality assurance work plan for biological stream monitoring in New York State. NYSDEC Technical Report, 89 pages.

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 Division of Environmental Management Technical Report, 12 pages.

Novak, M.A., and R.W. Bode. 1992. Percent model affinity: a new measure of macroinvertebrate community composition. Journal N. Amer. 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 richness, biotic index, and percent model affinity (see Appendix II). The consensus is based on the determination of the majority of the parameters. Because parameters measure different aspects of the macroinvertebrate community, they cannot be expected to always form unanimous assessments. The assessment ranges given for each parameter are based on subsamples of 100 organisms each that are taken from macroinvertebrate riffle kick samples. These assessments also apply to most multiplate samples, with the exception of percent model affinity.

1. *Non-impacted* 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 richness 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.

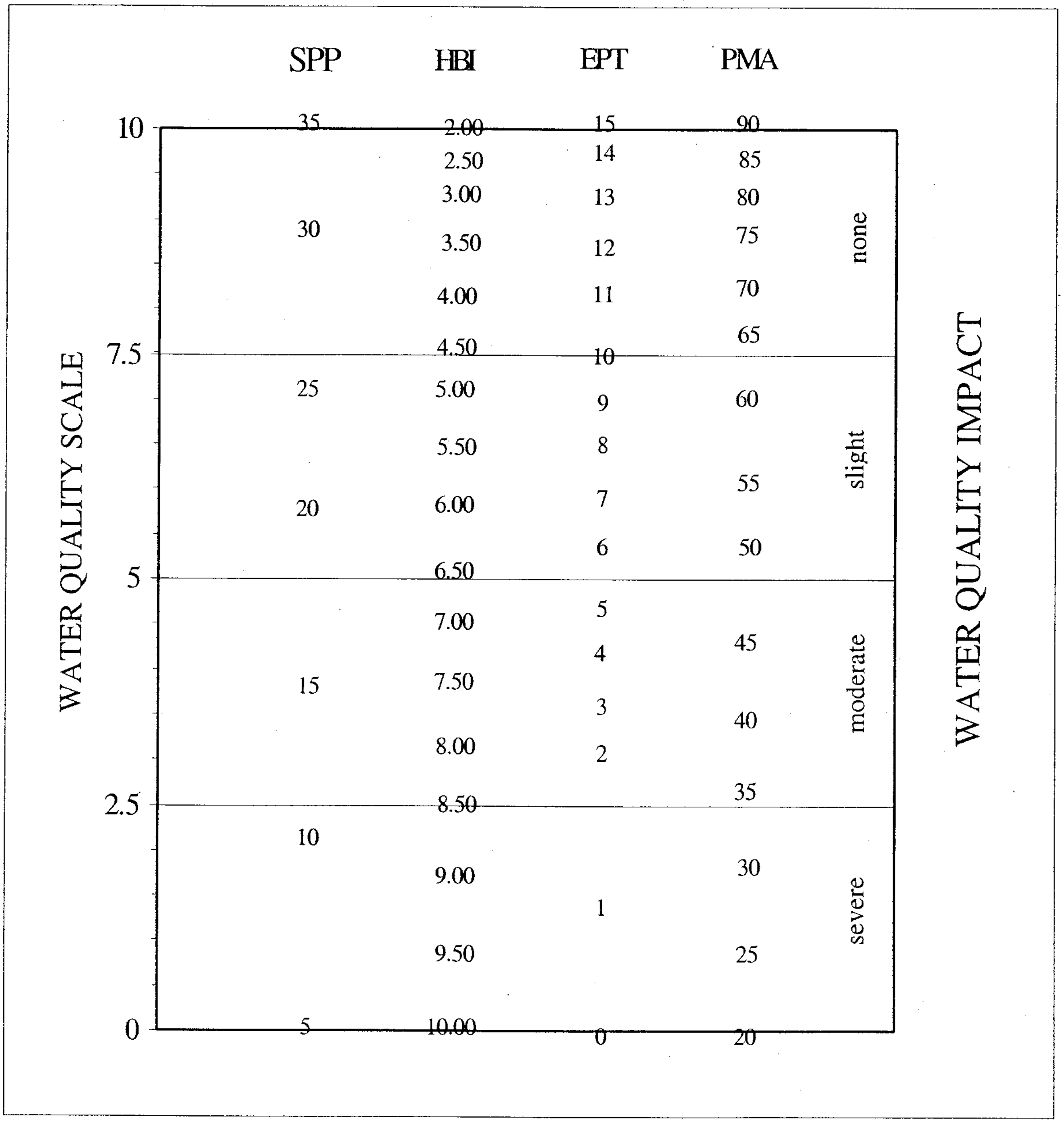
2. *Slightly impacted* Indices reflect good water quality. The macroinvertebrate community is slightly but significantly altered from the pristine state. Species richness usually is 19-26. Mayflies and stoneflies may be restricted, with EPT richness values of 6-10. The biotic index value is 4.51-6.50.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

3. *Moderately impacted* Indices reflect poor water quality. The macroinvertebrate community is altered to a large degree from the pristine state. Species richness usually is 11-18. Mayflies and stoneflies are rare or absent, and caddisflies are often restricted; the EPT richness 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. *Severely impacted* Indices reflect very poor water quality. The macroinvertebrate community is limited to a few tolerant species. Species richness is 10 or fewer. Mayflies, stoneflies, and caddisflies are rare or absent; EPT richness 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-A. Biological Assessment Profile: Conversion of Index Values to Common 10-Scale

The Biological Assessment Profile of index values, developed by Phil O'Brien, Division of Water, NYSDEC, 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 using the formulae in the Quality Assurance document (Bode, et al., 2002) and as shown in the figure below.



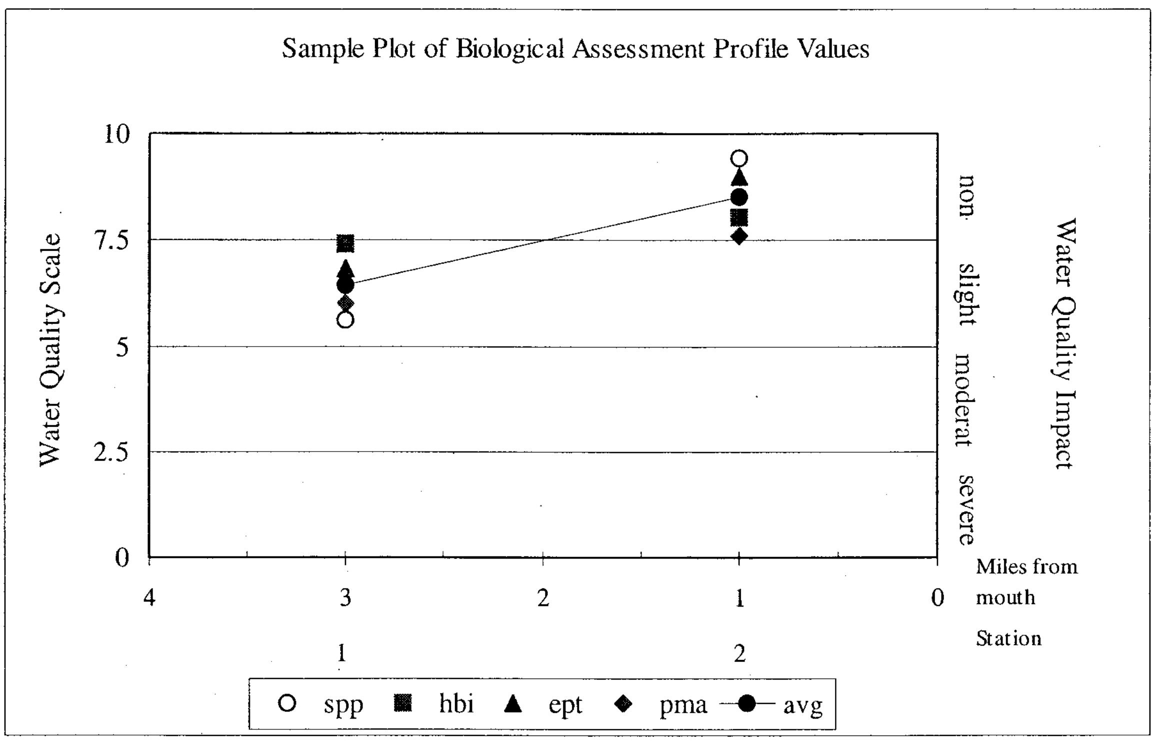
Appendix IV-B. Biological Assessment Profile: Plotting Values

To plot survey data:
1. Position each site on the x-axis according to miles or tenths of a mile upstream of the mouth.
2. Plot the values of the four indices for each site as indicated by the common scale.
3. Calculate the mean of the four values and plot the result. This represents the assessed impact for each site.

Example data:

	Station 1		Station 2	
	metric value	10-scale value	metric value	10-scale value
Species richness	20	5.59	33	9.44
Hilsenhoff biotic index	5.00	7.40	4.00	8.00
EPT richness	9	6.80	13	9.00
Percent model affinity	55	5.97	65	7.60
Average		6.44 (slight)		8.51 (non-)

Table IV-B. Sample Plot of Biological Assessment Profile values



Appendix V. Water Quality Assessment Criteria

Water Quality Assessment Criteria for Non-Navigable Flowing Waters

	Species Richness	Hilsenhoff Biotic Index	EPT Richness	Percent Model Affinity#	Species 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

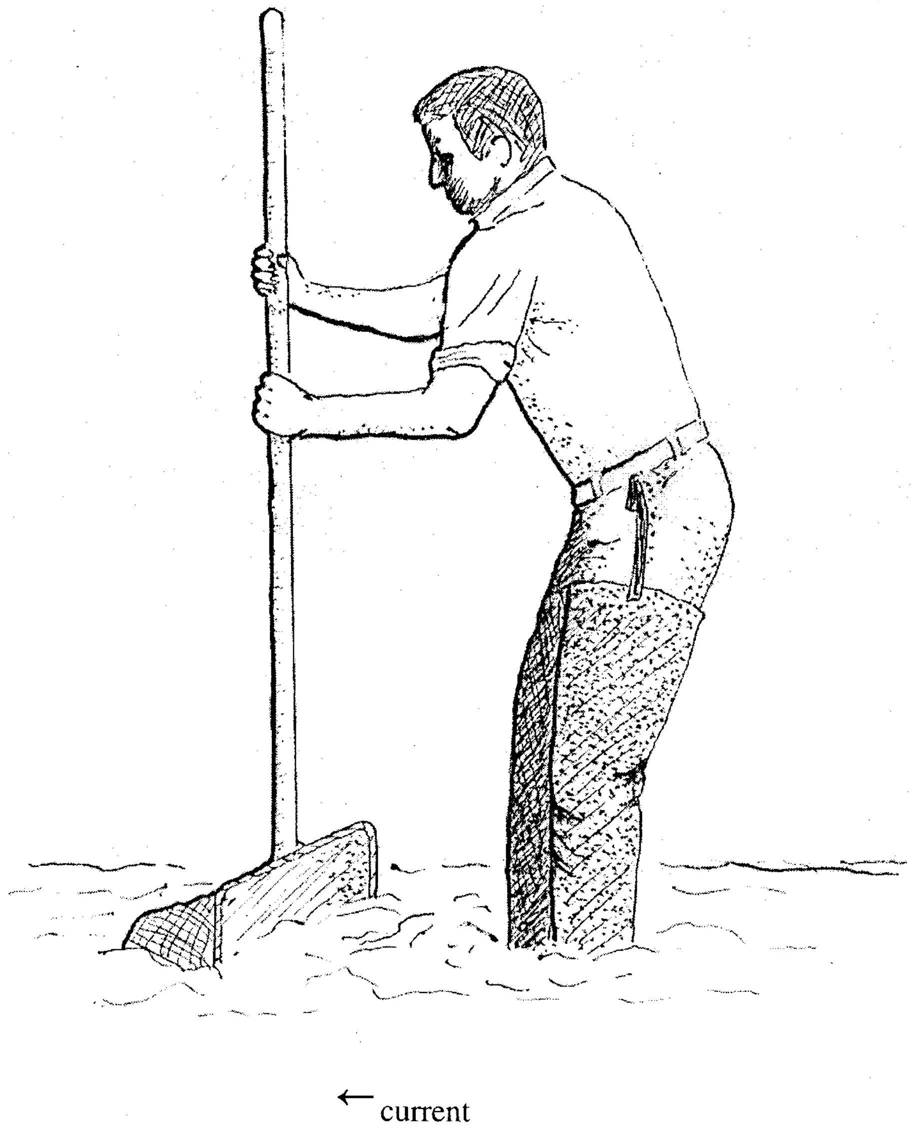
Percent model affinity criteria are used for traveling kick samples but not for multiplate samples.
* Diversity criteria are used for multiplate samples but not for traveling kick samples.

Water Quality Assessment Criteria for Navigable Flowing Waters

	Species Richness	Hilsenhoff Biotic Index	EPT Richness	Species 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.

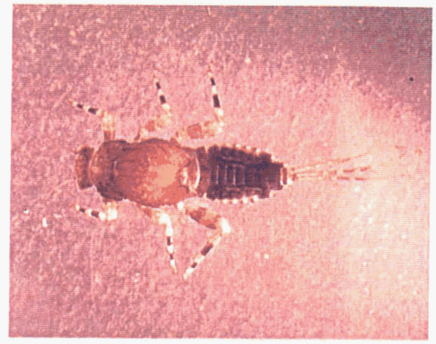
The Traveling Kick Sample



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

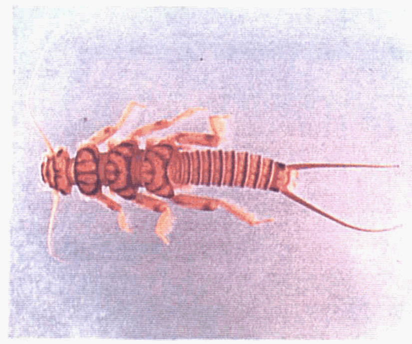
Appendix VII. A.
Aquatic Macroinvertebrates that Usually Indicate Good Water Quality

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.



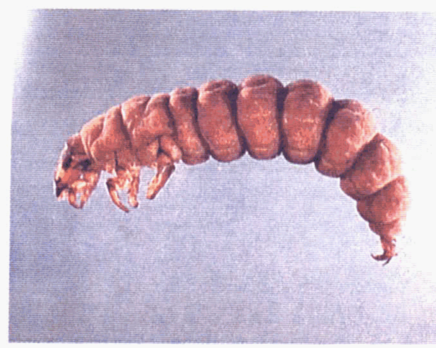
MAYFLIES

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 (adult and larva pictured) and water pennies. Most of these require a swift current and an adequate supply of oxygen, and are generally considered to be clean-water indicators.

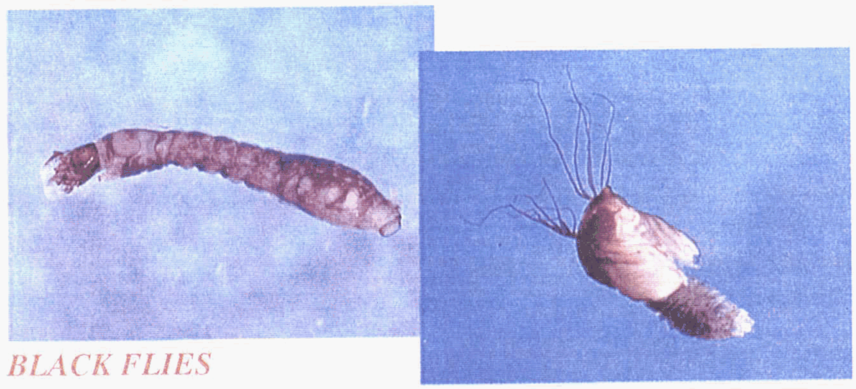
BEETLES

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, and indicate 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.

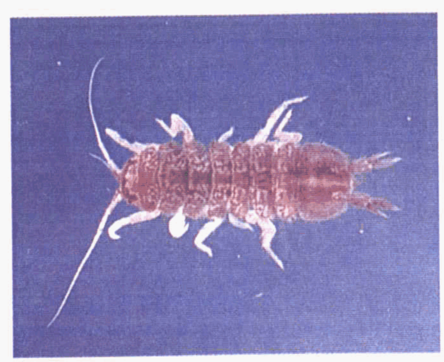


BLACK FLIES

The segmented worms include the leeches and the small aquatic worms. 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 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. Each species comprising the community occupies 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 that they:

- are sensitive to environmental impacts
- are less mobile than fish, and thus cannot avoid discharges
- can indicate effects of spills, intermittent discharges, and lapses in treatment
- are indicators of overall, integrated water quality, including synergistic effects
- are abundant in most streams and are relatively easy and inexpensive to sample
- are able to detect non-chemical impacts to the habitat, e.g., siltation or thermal changes
- are vital components of the aquatic ecosystem and important as a food source for fish
- are more readily perceived by the public as tangible indicators of water quality
- can often provide an on-site estimate of water quality
- can often be used to identify specific stresses or sources of impairment
- can be preserved and archived for decades, allowing for direct comparison of specimens
- bioaccumulate many contaminants, making analysis of their tissues 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

anthropogenic: caused by human actions

assessment: a diagnosis or evaluation of water quality

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

bioaccumulate: accumulate contaminants in the tissues of an organism

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 richness: the number of species of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) in a sample or subsample

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

longitudinal trends: upstream-downstream changes in water quality in a river or stream

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

PAHs: Polycyclic Aromatic Hydrocarbons, a class of organic compounds that are often toxic or carcinogenic

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

riffle: wadeable stretch of stream usually having a rubble bottom and sufficient current to break the water surface; 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

synergistic effect: an effect produced by the combination of two factors that is greater than the sum of the two factors

tolerant: able to survive poor water quality

Appendix X. Impact Source Determination: Methods and Community Models

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. ISD 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 affected 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 was 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 ISD (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 percent, 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 subsamples of 100 organisms taken from traveling kick samples from New York State streams. Application of these methods to data derived from other sampling methods, habitats, or geographical areas would likely require modification of the models.

ISD MODELS TABLE
NATURAL MACROINVERTEBRATE COMMUNITY TYPE

	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

ISD MODELS TABLE (cont.)
NONPOINT NUTRIENT ENRICHMENT IMPACTED MACROINVERTEBRATE COMMUNITY TYPE

	A	B	C	D	E	F	G	H	I	J
PLATYHELMINTHES	-	-	-	-	-	-	-	-	-	-
OLIGOCHAETA	-	-	-	5	-	-	-	-	-	15
HIRUDINEA	-	-	-	-	-	-	-	-	-	-
GASTROPODA	-	-	-	-	-	-	-	-	-	-
SPHAERIIDAE	-	-	-	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

ISD MODELS TABLE (cont.)
MACROINVERTEBRATE COMMUNITY TYPES

	MUNICIPAL/INDUSTRIAL WASTES IMPACTED								TOXICS IMPACTED					
	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

ISD MODELS TABLE (cont.)
SEWAGE EFFLUENT, ANIMAL WASTES IMPACTED MACROINVERTEBRATE COMMUNITY TYPE

	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

ISD MODELS TABLE (cont.)
MACROINVERTEBRATE COMMUNITY TYPES

	SILTATION IMPACTED					IMPOUNDMENT IMPACTED									
	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