2002 ONONDAGA LAKE TRIBUTARIES MACROINVERTEBRATE MONITORING

Significant Findings and Data Summaries

PREPARED FOR:

ONONDAGA COUNTY
DEPARTMENT OF WATER ENVIRONMENT PROTECTION

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Table of Contents

List of Tables

List of Figures

Introduction

This document presents the significant findings and data summaries of the 2002 Onondaga Lake Tributary macroinvertebrate monitoring program. Results are presented in both tables and figures, and are statistically compared on a site by site basis to 2000 data and where appropriate 1999 data. Since this program is designed as a long term monitoring study, significant findings, at this point, are limited to comparisons of individual sites between years. As the monitoring program progresses, trends will begin to emerge, at which point more in depth analysis and interpretation can occur. The standardized methods used for this program are included as Appendix A and the 2002 dataset as Appendix B.

Macroinvertebrate sampling is among the requirements of the Amended Consent Judgment signed in January 1998. Onondaga County is required to assess the macroinvertebrate communities of selected Onondaga Lake tributaries (Appendix D, III. 5 ".... Sample the stream's macroinvertebrate communities and calculate the NYSDEC rapid Field Biotic Index throughout the tributaries' length....") and the Lake (Appendix D, IV 4 "Complement the chemical monitoring program with a biological monitoring effort to assess the densities and species composition of phytoplankton, zooplankton, macrophytes, macrobenthos, and fish"). Beginning in the year 2000 sampling in the tributaries is conducted every two years, and sampling in the lake's littoral zone is conducted every five years through the 15 years of the County's AMP. The objectives of monitoring this element of the aquatic ecosystem are to:

- Characterize the existence and severity of use impairment, and
- Evaluate the effectiveness of control actions (improvements to wastewater collection and treatment, both at Metro and the CSOs).

The design of the current program was finalized following a 1999 investigation to determine sampling locations, methodologies and the number of replicates. Although much of the program was revised after the 1999 investigation, two sites continued to be sampled at the same location and with the same methodology. The results from 1999 of these two sites (Onondaga Creek, Site 3 Dorwin Ave and Harbor Brook, Site 1 Velasko Road) have been included in this data summary.

Significant Findings

The macroinvertebrate communities of Onondaga Creek, Ley Creek and Harbor Brook show varying levels of impact. Based on NYSDEC assessment scores sites in Harbor Brook and Ley Creek tend to be more severely impacted than sites in Onondaga Creek. The combination of habitat degradation, non-point source pollution, and CSO discharges plays an extensive role in structuring the macroinvertebrate communities of the three streams.

Sites on Onondaga Creek show a wide range of conditions in 2002, with a trend towards increasing impact as one moves downstream. Site 1 at Tully Farms Road is a “Natural”, non-impacted stream according to NYSDEC impact source determination and impact assessment. Site 2, Webster Road, is designated as slightly impacted and shows possible non-point source organic waste impacts from a nearby dairy operation as determined from HBI scores and the percent of oligochaetes. This is further corroborated by the impact source determination of “Sewage Effluent/Animal Waste” at this location, well upstream of any CSO discharges. Mudboil discharges upstream of Site 2 may also affect the macroinvertebrate community here, but differentiation of these impacts from those of organic waste is not possible with these data. Site 3 at Dorwin Ave. shows a slightly greater impact than Webster Road. The dredged and straightened sections upstream of this site may cause the “Siltation” impact source determination calculated for this site, and may be responsible for the overall decrease in the NYSDEC assessment score form Webster Road. The most downstream site (downstream of all but one CSO), Site 4 at Spencer Street, is considered to be moderately impacted, but is at the lower range of this categorization. A drop in HBI score from Dorwin Ave. indicates some of this increased impact is due to organic pollution, probably from a combination of urban runoff and CSO discharges. However, severe habitat degradation upstream of this site also likely influences the macroinvertebrate community here.

Ley Creek was severely impacted at all sites in 2002. HBI scores and the percent of oligochaetes indicate much of this impact is likely from organic pollution. With the mid-section site at 7th North Street showing the greatest impact in 2002. Impact source determination indicates a “Municipal/Industrial” origin of pollution impacts at all sites.

Harbor Brook was moderately impacted at its most upstream site at Velasko Road, and borderline moderately/severely impacted at its two downstream locations at Hiawatha Blvd. and Rt. 690. HBI scores and the percent of oligochaetes indicate increasing impact from organic pollution at the two downstream locations. This is likely caused by a combination of CSO discharges and urban runoff. NYSDEC impact source determination points towards “Municipal/Industrial” cause of the observed impacts at all sites.

Comparisons of the 2002 to data collected in 2000 by the County shows some significant differences. Sites in Onondaga Creek remained mostly unchanged with the most profound differences being significant decreases in the percent contribution of oligochaetes at Webster Rd and Spencer Street. This could be indicative of changing water quality or habits conditions or may just as well be normal variability inherent of natural populations. All sites in Ley Creek showed a dramatic decrease in NYSDEC assessment scores going from “Moderately Impacted” in 2000 to “Severely Impacted in 2002”. HBI scores decreased and the percent contribution of oligochaetes increased at all site suggesting that the greater overall impact observed at these sites may be largely due to increased organic pollution. The origin of pollution is not known since only the Park Street site is downstream of CSO’s. Harbor Brook showed increases in NYSDEC assessment at all sites in 2002, although the increase at Rt. 690 was minor and both the Rt. 690 and Hiawatha Blvd site were both still borderline “Severely Impacted”. The most profound change of any of the study sites in this study occurred at the Velasko Road site in Harbor Brook. This site showed a dramatic and statistically significant improvement from 2000 that corresponded well with preliminary data collected in 1999 at this location. This seems to indicate that an unknown event occurred at this site in 2000 that caused a degradation of the macroinvertebrate community and then subsequent recovery by 2002.

Tables

Table 1. Water quality results for each Onondaga Lake tributary site in the 2002 monitoring program.

Site	Temperature °C	Dissolved Oxygen (mg/L)	Specific Conductance (µS)	PH
Onondaga Creek				
Site 1 – Tully Farms Rd.	13.7	10.4	467	8.4
Site 2 – Webster Rd.	15.2	9.6	1933	8.1
Site 3 – Dorwin Ave.	20.0	11.1	1270	8.3
Site 4 – Spencer Street	16.0	8.5	1530	7.8
Ley Creek				
Site 1 – Townline Road	22.8	12.5	1515	8.1
Site 2 – 7th North Street	22.9	10.0	1566	7.8
Site 3 – Park Street	19.6	7.2	1580	7.6
Harbor Brook				
Site 1 – Velasko Road	16.5	10.7	2244	7.8
Site 2 – Hiawatha Blvd.	15.6	12.4	2143	8.1
Site 3 – Rt. 690	16.0	8.8	2295	8.65

Table 2. Mean index value and corresponding mean NYSDEC water quality scale value from kick samples from monitoring sites in Onondaga Creek in 2002.

Index	Site 1 Tully Farms Road		Site 2 Webster Road		Site 3 Dorwin Ave.		Site 4 Spencer Street	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	23	6.5	28	8.0	21	5.9	14	3.7
EPT Richness	12	8.2	5	4.7	6	5.3	0	0
HBI	3.4	8.6	5.0	6.8	5.3	6.6	6.2	5.4
PMA	70	7.9	49	5.0	47	4.6	33	2.1
NYSDEC Mean Water Quality Value	**7.8**		**6.1**		**5.6**		**2.8**	
State of Impact	**None**		**Slight**		**Slight**		**Moderate**	

Table 3. NYSDEC Impact Source Determination for Onondaga Creek sites in 2002 and 2000.

Year	Site 1 Tully Farms Road	Site 2 Webster Road	Site 3 Dorwin Ave.	Site 4 Spencer Street
2002	*Natural*	*Sewage effluent/animal waste*	*Tie between; Siltation & Toxic*	*Sewage effluent/animal waste*
2000	*Natural*	*Sewage effluent/animal waste*	*Siltation*	*Inconclusive*

Table 4. Mean index value and corresponding NYSDEC water quality value from jab samples from sites in Ley Creek in 2002.

Index	Site 1 Townline Road		Site 2 7th North Street		Site 3 Park Street	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	15	4.5	7.8	0.4	11	2.1
EPT Richness	0	0	0	0	0.25	0.4
HBI	9.1	1.4	9.9	0.2	9.1	1.5
NCO	4.5	4.0	1.3	1.9	2.8	3.0
NYSDEC Mean Water Quality Value	**2.4**		**0.6**		**1.7**	
State of Impact	**Severe**		**Severe**		**Severe**	

Table 5. NYSDEC Impact Source Determination for Ley Creek sites in 2002 and 2000. *Note that NYSDEC ISD was devised using kick samples. Samples in Ley Creek were collected with jab samples so these results should be viewed with caution.

Year	Site 1 Townline Road	Site 2 7th North Street	Site 3 Park Street
2002	*Municipal/ Industrial**	*Municipal/ Industrial**	*Municipal/ Industrial**
2000	*Municipal/ Industrial**	*Sewage Effluent/ Animal Waste**	*Municipal/ Industrial**

Table 6. Mean index value and corresponding NYSDEC water quality value from kick and jab samples from sites in Harbor Brook in 2002.

Index	**Site 1 Velasko Road**		**Site 2 Hiawatha Blvd**		**Site 3 Rt. 690**	
	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean	Index Mean	NYDEC WQ Scale Mean
Species Richness	19	5.2	15	4.0	17	4.5
EPT Richness	2.3	2.9	0.3	0.3	0	0
HBI	5.1	6.7	7.9	7.9	8.4	2.5
PMA	42	3.8	30	30	-	-
NCO	-	-	-	-	3	3.5
NYSDEC Mean Water Quality Value	**4.6**		**2.3**		**2.6**	
State of Impact	**Moderate**		**Severe**		**Moderate**	

Table 7. NYSDEC Impact Source Determination for Ley Creek sites in 2002 and 2000. *Note that NYSDEC ISD was devised using kick samples. Samples at Site 3 in Harbor Brook were collected with jab samples so that result should be viewed with caution.

Year	**Site 1 Velasko Road**	**Site 2 Hiawatha Blvd**	**Site 3 Rt. 690**
2002	*Municipal/ Industrial*	*Municipal/ Industrial*	*Municipal/ Industrial**
2000	*Municipal/ Industrial*	*Municipal/ Industrial*	*Municipal/ Industrial**

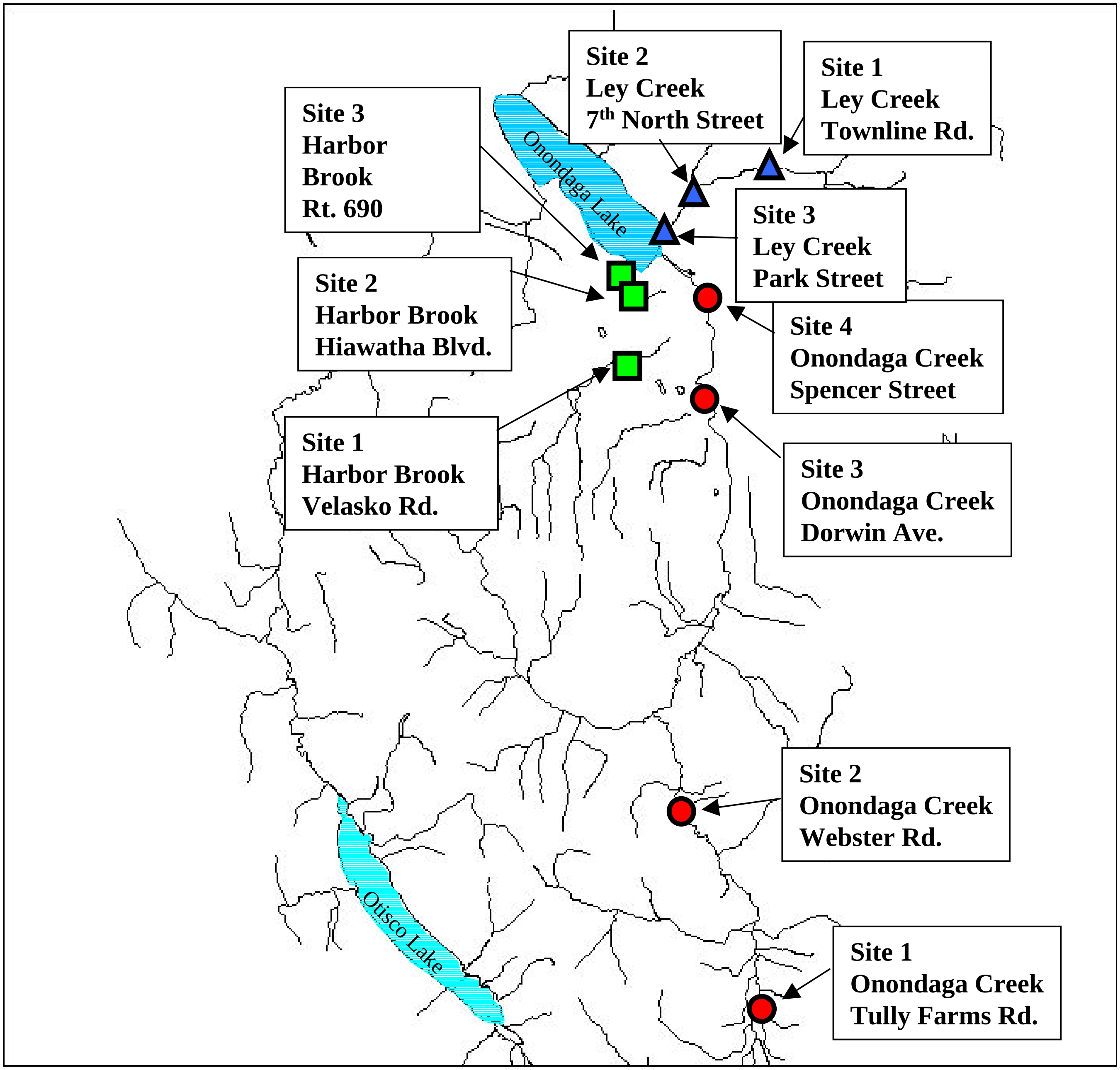
Table 8. 2002 Data

	Facility code	3187	3188	3189	3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226
	Trib	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
	Site	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	1	1	1	1	2	2	2	2	3	3	3	3	1	1	1	1	2	2	2	2	3	3	3	3
	Replicate	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Nematoda	Planariidae															6	3											24													
Oligochaeta	Enchytraeidae													1		4																1		4	2	8	8	2	5		
Oligochaeta	Lumbricidae															1																									
Oligochaeta	Lumbriculidae		1																																						
Oligochaeta	*Nais variabilis*																													1		1						1			
Oligochaeta	*Ophidonais serpentina*							1						1			2																	15	34	16	17				
Oligochaeta	*Aulodrilus pigueti*																											1													
Oligochaeta	*Ilyodrilus templetoni*																									1															
Oligochaeta	*Limnodrilus*																	4	6	3	1	13	1	8	16	7	8		3												
Oligochaeta	*Limnodrilus cervix*																	2	1	2	1	6		12	12	6	15	2	2												
Oligochaeta	*Limnodrilus hoffmeisteri*								2							1		6	6	13	20	5	4	13	21	6	16	3	1		3		1	3	5	2		1	7	7	17
Oligochaeta	*Limnodrilus udekemianus*																		1	2		1					3														
Oligochaeta	*Potamothrix bavaricus*																						1			1					2				1						
Oligochaeta	*Tubifex tubifex*		1																																1	5	1		1	1	1
Oligochaeta	Tubificid immature: bifids		1				2	3	3					1	1			67	32	55	51	48	75	59	49	66	37	25	68		3			24	11	11	15			13	7
Oligochaeta	Tubificid immature: h+p						3		6									3		1	2	2		4	2	2			2		2			24	14	11	5		1		
Hirudinea	*Mooreobdella*													24		19	24				1																				
Hirudinea	*Piscicola*																		1																						
Hydrachnidia	Acariformes (deuteronymph)								1																																
Amphipoda	Amphipoda																		2																						
Amphipoda	*Gammarus fasciatus*									11									4	4	1	6				3	6	31	13	1	16	1	6						3	2	2
Amphipoda	*Gammarus pseudolimnaeus*	5		3					2		1	1	1					5												27	26	15	55		1	1		4			
Amphipoda	*Gammarus* (immature/damaged)					1													16		2																				
Isopoda	*Caecidotea* (immature/female)													11	4	3	18		1							1		6									4	4	1	13	1
Isopoda	*Caecidotea racovitzai*													5		2	11		2		1							1									2	3	1	10	3
Ephemeroptera	Baetidae																																	1							
Ephemeroptera	*Baetis*	25	10	15	17				2		1		1															1		1		4	2								
Ephemeroptera	*Dannella*		1																																						
Ephemeroptera	*Epeorus*		1		2																																				
Ephemeroptera	*Heptagenia*	1	2	2	1																																				
Ephemeroptera	*Paraleptophlebia*	5	4	2	5																																				
Ephemeroptera	*Tricorythodes*									1	3	3	1																												
Odonata	*Coenagrion/Enallagma*																				1																				
Plecoptera	Chloroperlidae		1																																						
Plecoptera	*Alloperla*		4	2																																					
Plecoptera	*Sweltsa*		2	1																																					
Plecoptera	Leuctridae	2	6		5		1																																		
Plecoptera	*Leuctra*	12	4	6	13																									9	4	7	8								
Plecoptera	Perlidae		1																																						
Plecoptera	*Acroneuria*			1					1																																
Plecoptera	*Agnetina*	6	2	9	6																																				
Plecoptera	Perlodidae			1																																					
Plecoptera	*Pteronarcys*			1	1																																				
Megaloptera	*Nigronia serricornis*	1			1		1	1	1																																
Megaloptera	*Sialis*					1																																			
Hemiptera	Corixidae																		7									1													
Hemiptera	*Hesperocorixa*																		2																						
Hemiptera	*Trichocorixa*																		5			2	1																		
Hemiptera	*Rhagovelia*									1																															
Trichoptera	*Helicopsyche borealis*									1																															
Trichoptera	Hydropsychidae pupae									3																															
Trichoptera	*Cheumatopsyche*		1				1	1	2	1	3		1																												
Trichoptera	*Hydropsyche* (early instar)	5	3	7	4	1	2	2	7	1			4																												
Trichoptera	*Hydropsyche betteni*									2	1																														
Trichoptera	*Hydropsyche bronta*					3	17	4	12	25	22	28	36																												
Trichoptera	*Hydropsyche slossonae*		2	4	10		2	1	1																							1	2								
Trichoptera	*Hydropsyche sparna*						1		2	5	6	3	5																												
Trichoptera	*Ceraclea*		2																																						
Trichoptera	*Oecetis (Pseudosetodes) avara* grp.									1																															
Trichoptera	*Dolophilodes*				2																																				
Trichoptera	*Rhyacophila*			1																																					
Coleoptera	Dytiscidae																																1								
Coleoptera	*Agabus*																													1											
Coleoptera	*Dubiraphia*					11	4	4	5	1		2	1				1																								
Coleoptera	*Optioservus*	10	10	15	3	34	16	32	17	1	1	1	1																		2	5	2								
Coleoptera	*Promoresia*										1	1																													
Coleoptera	*Stenelmis*					7	1	3	3	15	15	15	6																												
Coleoptera	*Dineutus*																									1															
Coleoptera	*Tropisternus*																				1																				
Coleoptera	*Ectopria*						1																																		
Coleoptera	*Psephenus herricki*			2																																					
Diptera	*Atherix*					1	1	2	4																																

	Facility code	3187	3188	3189	3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202
	Trib	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC	OC
	Site	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
	Replicate	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Chironomidae	Chironomidae pupae	2				1	2	2	3	4	1		3		12	1	
Chironomidae	*Alotanypus*																
Chironomidae	*Chironomus*																
Chironomidae	*Cladotanytarsus*					1											
Chironomidae	*Cricotopus*																
Chironomidae	*Cricotopus bicinctus*	1			1		2	5	1	1				7	7	11	2
Chironomidae	*Cricotopus sylvestris* grp.															1	
Chironomidae	*Cricotopus* cf. *triannulatus*							1	1						1		
Chironomidae	*Cricotopus trifascia*					1	2	2	2	4	7	1	5	13	18	11	3
Chironomidae	*Cricotopus* cf. *vierriensis*						1		2					1			
Chironomidae	*Cricotopus/Orthocladius*					1											
Chironomidae	*Cryptochironomus*					2			3	1	1	2					
Chironomidae	*Diamesa*					2	2	2	1	1		1					
Chironomidae	Diamesinae																
Chironomidae	*Dicrotendipes*																
Chironomidae	*Dicrotendipes fumidus*																
Chironomidae	*Dicrotendipes modestus*																
Chironomidae	*Eukiefferiella brehmi* grp.									1							
Chironomidae	*Eukiefferiella claripennis* grp.																
Chironomidae	*Eukiefferiella devonica* grp.						1	1	1	1	3		2				
Chironomidae	*Heleniella*		1														
Chironomidae	*Micropsectra*		5	1			1							1			
Chironomidae	*Microtendipes pedellus* grp.		3			24	6	16	3		6	5	4				
Chironomidae	*Microtendipes rydalensis* grp.					1											
Chironomidae	*Natarsia*																
Chironomidae	*Orthocladius*					1	4	4	4				1	1	1	2	
Chironomidae	*Pagastia*		1	3			3	2		3	4	6	1	1	1		2
Chironomidae	*Paracladopelma*																
Chironomidae	*Parakiefferiella*																
Chironomidae	*Parametriocnemus*																
Chironomidae	*Phaenopsectra obediens* grp.					1		1						1			
Chironomidae	*Polypedilum aviceps*	9	1	1	2												
Chironomidae	*Polypedilum fallax*										3						
Chironomidae	*Polypedilum flavum*	1				1	1		1	2	1	2	3	1		1	1
Chironomidae	*Polypedilum halterale* grp.					1											
Chironomidae	*Polypedilum illinoense* grp.																
Chironomidae	*Polypedilum laetum*					1	1	1	2			6	3				
Chironomidae	*Polypedilum scalaenum* grp.					1			1								
Chironomidae	*Polypedilum tritum*																
Chironomidae	*Potthastia gaedii* grp.			2													
Chironomidae	*Procladius*																
Chironomidae	*Prodiamesa*																
Chironomidae	*Psectrotanypus*																
Chironomidae	*Rheocricotopus*														1		
Chironomidae	*Stempellinella*		5														
Chironomidae	*Stictochironomus*							2									
Chironomidae	*Sublettea*		2						1								
Chironomidae	*Tanypus*																
Chironomidae	*Tanytarsus*				2				1								
Chironomidae	*Thienemanniella*													1			
Chironomidae	*Thienemannimyia* grp.	6	8	5	1	1	1	3	2				2				
Chironomidae	*Tvetenia paucunca*						1										
Chironomidae	*Tvetenia vitracies*						1	2		9	16	23	15	21	38	25	14
Chironomidae	*Zavrelimyia*																
Diptera	Psychodidae pupae															1	
Diptera	*Psychoda*													3			
Diptera	*Simulium*				2					4	2		1	6	16	11	19
Diptera	*Caloparyphus*																
Diptera	*Stratiomys*																
Diptera	*Chrysops*		1														
Diptera	*Antocha*						18	2			2		3				
Diptera	*Dicranota*		4	1	1												
Diptera	*Gonomyia*		1														
Diptera	*Hexatoma*	9	10	15	21	1											
Bivalvia	*Pisidium*																
Bivalvia	*Sphaerium*																
Gastropoda	*Physa*																
	Total number of individuals sorted	100	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	Facility code	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213	3214
	Trib	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC	LC
	Site	1	1	1	1	2	2	2	2	3	3	3	3
	Replicate	1	2	3	4	1	2	3	4	1	2	3	4
Chironomidae	Chironomidae pupae				1								
Chironomidae	*Alotanypus*												
Chironomidae	*Chironomus*	9	5	2		16	14	1		2	13	1	5
Chironomidae	*Cladotanytarsus*												
Chironomidae	*Cricotopus*												
Chironomidae	*Cricotopus bicinctus*			1									
Chironomidae	*Cricotopus sylvestris* grp.												
Chironomidae	*Cricotopus* cf. *triannulatus*												
Chironomidae	*Cricotopus trifascia*												
Chironomidae	*Cricotopus* cf. *vierriensis*												
Chironomidae	*Cricotopus/Orthocladius*												
Chironomidae	*Cryptochironomus*		1	5	1					1			
Chironomidae	*Diamesa*												
Chironomidae	Diamesinae												
Chironomidae	*Dicrotendipes*												
Chironomidae	*Dicrotendipes fumidus*												
Chironomidae	*Dicrotendipes modestus*			1						2	1	1	2
Chironomidae	*Eukiefferiella brehmi* grp.												
Chironomidae	*Eukiefferiella claripennis* grp.												
Chironomidae	*Eukiefferiella devonica* grp.												
Chironomidae	*Heleniella*												
Chironomidae	*Micropsectra*												
Chironomidae	*Microtendipes pedellus* grp.												
Chironomidae	*Microtendipes rydalensis* grp.												
Chironomidae	*Natarsia*		3										
Chironomidae	*Orthocladius*			1									
Chironomidae	*Pagastia*												
Chironomidae	*Paracladopelma*												
Chironomidae	*Parakiefferiella*												
Chironomidae	*Parametriocnemus*												
Chironomidae	*Phaenopsectra obediens* grp.												
Chironomidae	*Polypedilum aviceps*												
Chironomidae	*Polypedilum fallax*												
Chironomidae	*Polypedilum flavum*												
Chironomidae	*Polypedilum halterale* grp.												
Chironomidae	*Polypedilum illinoense* grp.	1		1									
Chironomidae	*Polypedilum laetum*												
Chironomidae	*Polypedilum scalaenum* grp.	1		8									
Chironomidae	*Polypedilum tritum*												
Chironomidae	*Potthastia gaedii* grp.												
Chironomidae	*Procladius*	1	2		1	1	3			1		3	3
Chironomidae	*Prodiamesa*										1		
Chironomidae	*Psectrotanypus*												
Chironomidae	*Rheocricotopus*												
Chironomidae	*Stempellinella*												
Chironomidae	*Stictochironomus*	1	2										
Chironomidae	*Sublettea*												
Chironomidae	*Tanypus*						1						
Chironomidae	*Tanytarsus*												
Chironomidae	*Thienemanniella*												
Chironomidae	*Thienemannimyia* grp.			1	1								
Chironomidae	*Tvetenia paucunca*												
Chironomidae	*Tvetenia vitracies*												
Chironomidae	*Zavrelimyia*												
Diptera	Psychodidae pupae												
Diptera	*Psychoda*												
Diptera	*Simulium*												
Diptera	*Caloparyphus*												
Diptera	*Stratiomys*												
Diptera	*Chrysops*												
Diptera	*Antocha*												
Diptera	*Dicranota*												
Diptera	*Gonomyia*												
Diptera	*Hexatoma*												
Bivalvia	*Pisidium*							1					
Bivalvia	*Sphaerium*							2					
Gastropoda	*Physa*		1										
	Total number of individuals sorted	100	100	100	86	100	100	100	100	100	100	100	99

	Facility code	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226
	Trib	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
	Site	1	1	1	1	2	2	2	2	3	3	3	3
	Replicate	1	2	3	4	1	2	3	4	1	2	3	4
Chironomidae	Chironomidae pupae	9		5	1	3		5		5			
Chironomidae	*Alotanypus*		2										
Chironomidae	*Chironomus*					2	5	2	1	24	23	39	36
Chironomidae	*Cladotanytarsus*												
Chironomidae	*Cricotopus*									14	19		9
Chironomidae	*Cricotopus bicinctus*	22	13	25	7	5	2	17	16	14	12	2	3
Chironomidae	*Cricotopus sylvestris* grp.							1		4	1		1
Chironomidae	*Cricotopus* cf. *triannulatus*	11	10	15	3		2		2	4	9	3	9
Chironomidae	*Cricotopus trifascia*				1				1				
Chironomidae	*Cricotopus* cf. *vierriensis*			1									
Chironomidae	*Cricotopus/Orthocladius*	1	1				1				1		
Chironomidae	*Cryptochironomus*							1			2		
Chironomidae	*Diamesa*				1								
Chironomidae	Diamesinae				1								
Chironomidae	*Dicrotendipes*											1	
Chironomidae	*Dicrotendipes fumidus*									1	4		
Chironomidae	*Dicrotendipes modestus*											1	
Chironomidae	*Eukiefferiella brehmi* grp.												
Chironomidae	*Eukiefferiella claripennis* grp.				1		1		3				
Chironomidae	*Eukiefferiella devonica* grp.	1							2				
Chironomidae	*Heleniella*												
Chironomidae	*Micropsectra*	1	3	2	1	14	10	12	7	8	3	6	5
Chironomidae	*Microtendipes pedellus* grp.												
Chironomidae	*Microtendipes rydalensis* grp.												
Chironomidae	*Natarsia*												
Chironomidae	*Orthocladius*	5	1							6	3		1
Chironomidae	*Pagastia*	1		1	1								
Chironomidae	*Paracladopelma*												1
Chironomidae	*Parakiefferiella*												1
Chironomidae	*Parametriocnemus*	1		3									
Chironomidae	*Phaenopsectra obediens* grp.												
Chironomidae	*Polypedilum aviceps*												
Chironomidae	*Polypedilum fallax*												
Chironomidae	*Polypedilum flavum*												
Chironomidae	*Polypedilum halterale* grp.												
Chironomidae	*Polypedilum illinoense* grp.												
Chironomidae	*Polypedilum laetum*												
Chironomidae	*Polypedilum scalaenum* grp.												
Chironomidae	*Polypedilum tritum*	2											
Chironomidae	*Potthastia gaedii* grp.												
Chironomidae	*Procladius*										2		1
Chironomidae	*Prodiamesa*		4						1	1			
Chironomidae	*Psectrotanypus*									1			
Chironomidae	*Rheocricotopus*												
Chironomidae	*Stempellinella*												
Chironomidae	*Stictochironomus*												
Chironomidae	*Sublettea*												
Chironomidae	*Tanypus*												
Chironomidae	*Tanytarsus*												
Chironomidae	*Thienemanniella*												
Chironomidae	*Thienemannimyia* grp.	4	4		1	4	5	5	4	3	2		1
Chironomidae	*Tvetenia paucunca*	1		3					1				
Chironomidae	*Tvetenia vitracies*												
Chironomidae	*Zavrelimyia*												1
Diptera	Psychodidae pupae												
Diptera	*Psychoda*												
Diptera	*Simulium*			6		2	5	1	10				
Diptera	*Caloparyphus*	1											
Diptera	*Stratiomys*		1										
Diptera	*Chrysops*												
Diptera	*Antocha*												
Diptera	*Dicranota*				1								
Diptera	*Gonomyia*												
Diptera	*Hexatoma*		3	3	3								
Bivalvia	*Pisidium*												
Bivalvia	*Sphaerium*												
Gastropoda	*Physa*												
	Total number of individuals sorted	100	100	99	99	101	100	98	100	100	100	98	100



<u>Legend</u>

Legend	
Onondaga Creek sites	
Harbor Brook sites	
Ley Creek sites	

Figure 1. Onondaga Lake tributary macroinvertebrate monitoring locations.

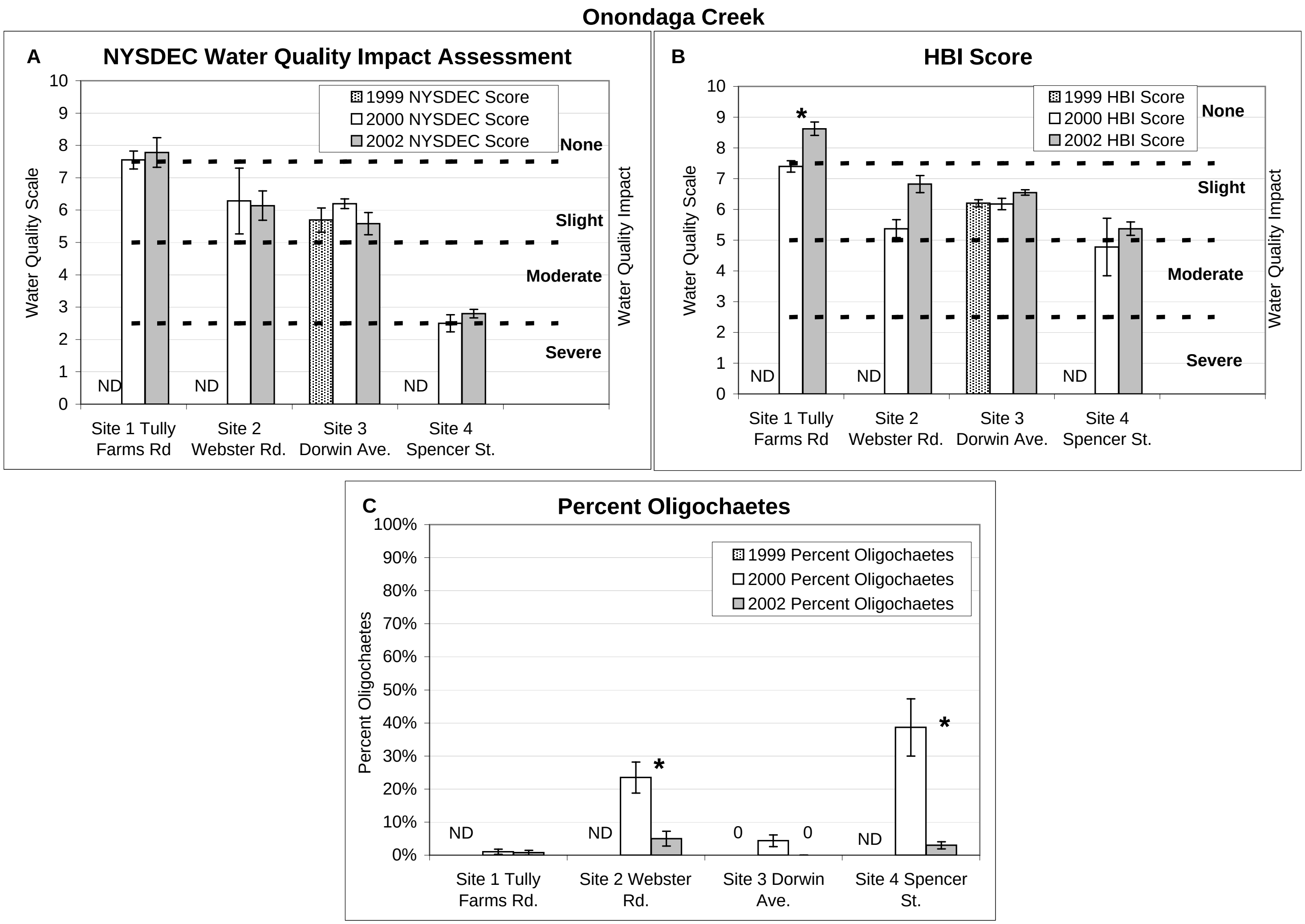


Figure 2. NYSDEC water quality scores (A), NYSDEC HBI scores (B), and percent oligochaetes (C) results at monitoring sites in Onondaga Creek collected in 1999, 2000, and 2002. Because of program changes after 1999, Site 3 Dorwin Ave. is the only site where comparable data was collected in that year. Error bars are standard error. ND indicates that no data for that site. * indicates a statistically significant ($p<0.05$) difference between 2000 and 2002 data. 1999 results at Dorwin Ave. were not significantly different from either 2000 or 2002 data.

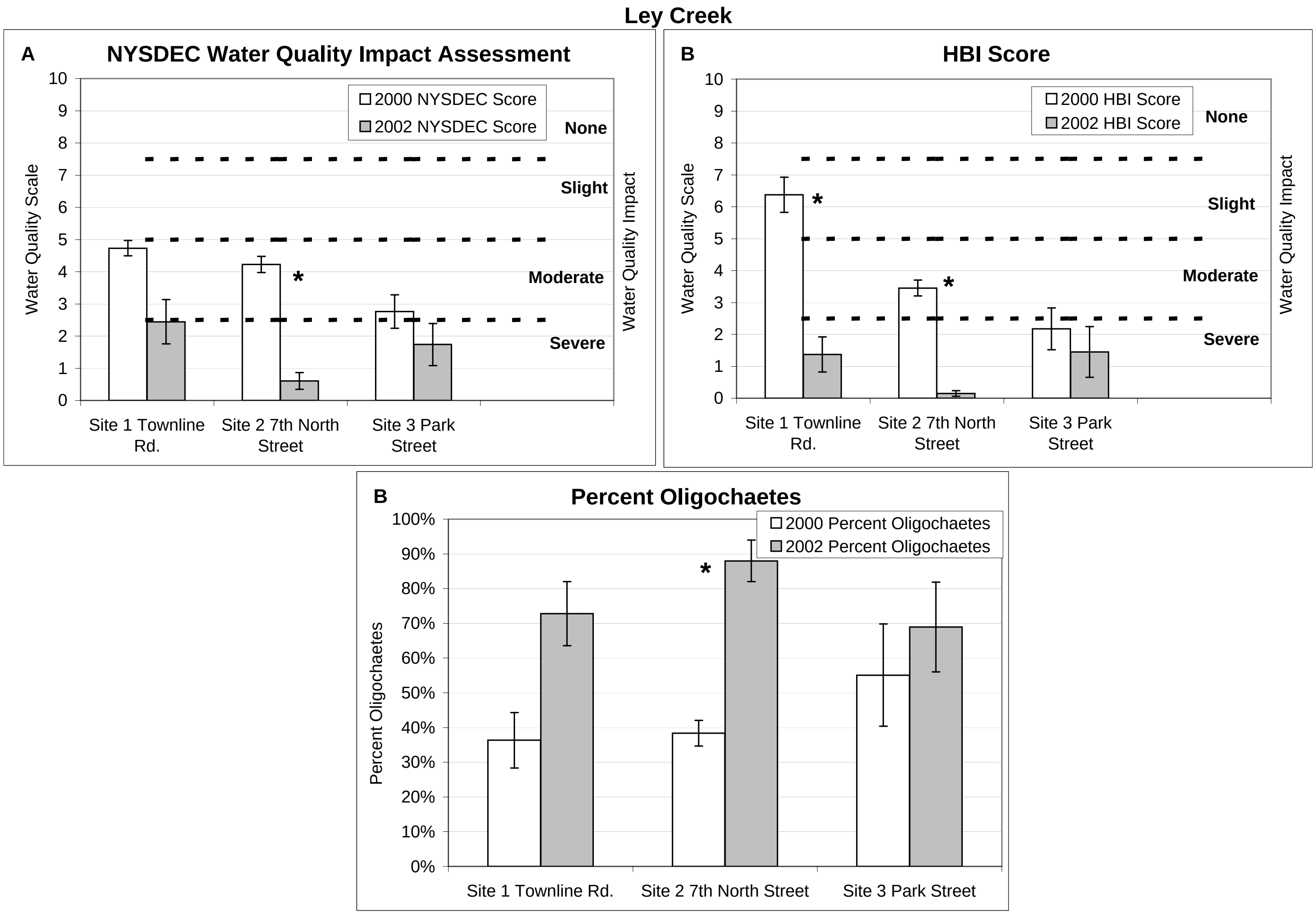


Figure 3. NYSDEC water quality scores (A), NYSDEC HBI scores (B), and percent oligochaetes (C) results at monitoring sites in Ley Creek collected in 2000, and 2002. Because of program changes after 1999, no sites were comparable from that year. Error bars are standard error. ND indicates that no data for that site. * indicates a statistically significant ($p<0.05$) difference between 2000 and 2002 data.

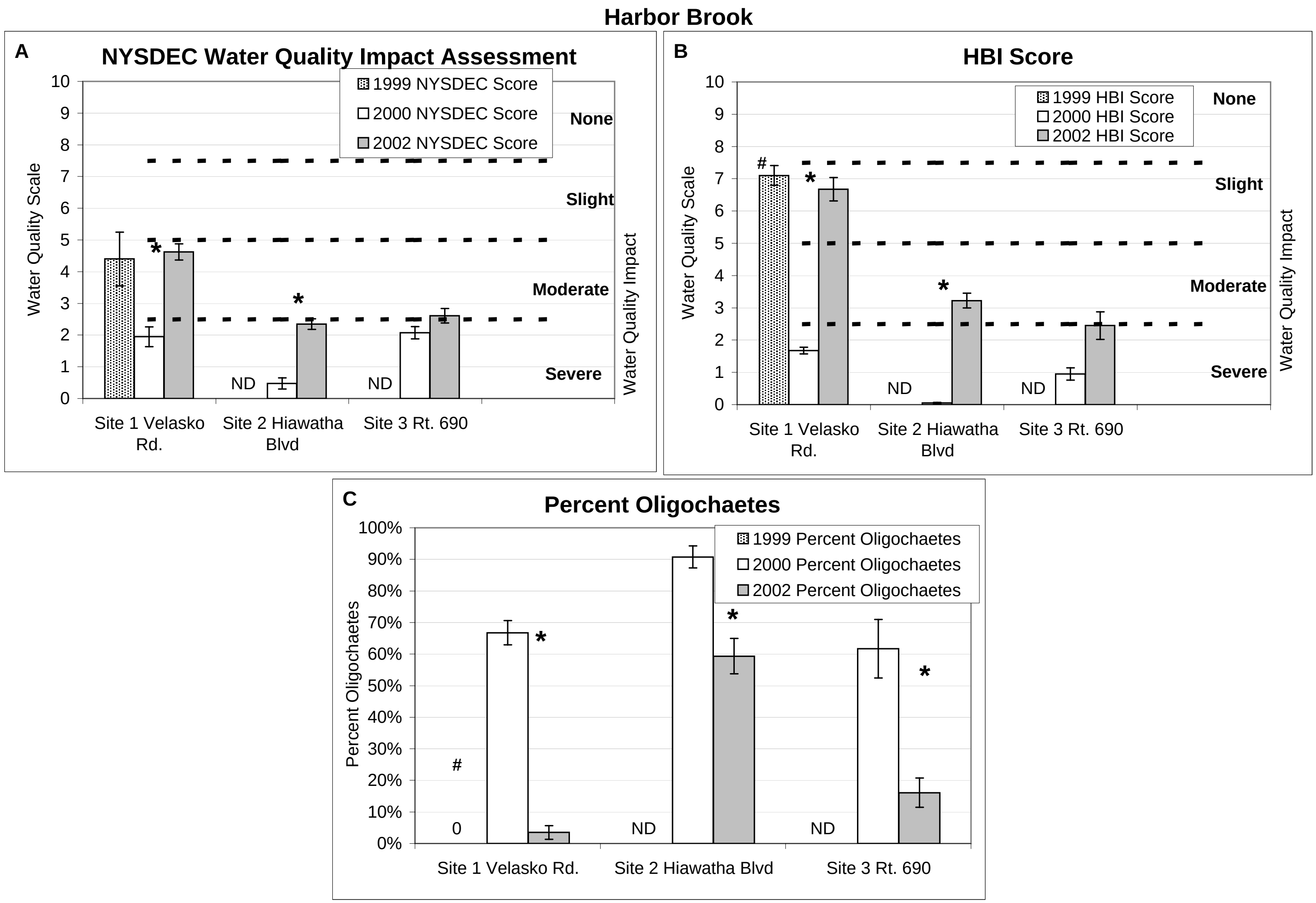


Figure 4. NYSDEC water quality scores (A), NYSDEC HBI scores (B), and percent oligochaetes (C) results at monitoring sites in Harbor Brook collected in 1999, 2000, and 2002. Because of program changes after 1999, Site 1 Velasko Road is the only site where comparable data was collected in that year. Error bars are standard error. ND indicates that no data for that site. * indicates a statistically significant ($p<0.05$) difference between 2000 and 2002 data. # indicates a statistically significant ($p<0.05$) difference between 1999 and 2000 data.

Appendix A. Methods

A-1. Field Methods

A total of 10 sites were sampled in the tributary system of Onondaga Lake between July 10 and July 15, 2002 by Onondaga County Department of Water Environment Protection (OCDWEP) technicians.; four (4) sites in Onondaga Creek, three (3) sites in Ley Creek; and three (3) sites in Harbor Brook (refer to Figure 1). D-frame kick nets were used as the primary sampling gear at each site. Kick sampling was carried out in Onondaga Creek and two of the three sites in Harbor Brook. Jab samples were used in Ley Creek and one site in Harbor Brook. The timing of sampling (second week of July) is the same as past years.

Following is a summary of sample locations:

Waterbody	Site Designation	Description
Onondaga Creek	OC1	Tully Farms Road
	OC2	Webster Road
	OC3	Dorwin Avenue
	OC4	Spencer Street
Ley Creek	LC1	Townline Road
	LC2	7th North Street
	LC3	Park Street
Harbor Brook	HB1	Velasko Road
	HB2	Hiawatha Boulevard
	HB3	Rt. 690

At each location the following water quality parameters were recorded: water temperature (°C), conductivity (µS), pH, and dissolved oxygen (mg/L). Substrate type was determined by visually estimating the percentage of clay, silt, sand, gravel, cobble and boulder in the sample. Tributary width and estimated high water mark were measured. The percentage of overhead vegetative cover and the presence of any submerged aquatic vegetation were recorded.

Kick sampling was conducted at tributary sites where riffle areas were present. Kick sampling was conducted at all four Onondaga Creek sites (OC1, OC2, OC3 and OC4), two Harbor Brook sites (HB1 and HB2). Kick sampling was conducted in riffle areas with substrate predominately composed of cobble, gravel and/or sand, a water depth of less than 0.5m and a mean water column velocity of greater than 0.4m/sec. A standard 9 in x 18 in D-net with 0.8 mm mesh was used. At each station, sampling progressed diagonally 5 m across the stream for 5 minutes. The sample was taken by positioning the D-net on the bottom about 0.5 m downstream of the person sampling. The sampler used his/her feet to disturb the bottom so the streambed material, including macroinvertebrates, was carried into the net. The material from the net was removed and placed into a U.S. No. 30 mesh wash bucket and gently rinsed with water to remove fine materials. The remaining contents were placed into labeled wide-mouth glass sample jars, preserved with 10% formalin, and stored for transport to the processing laboratory. Four replicates were collected at each of these locations.

No sites in Ley Creek were kick sampled because of the sand and silt sediments in this stream. Jab samples, an alternate method of sampling developed by NYSDEC for sampling sandy streams, were used to collect samples at all three Ley Creek sites (LC1, LC2, and LC3) and one Harbor Brook site (HB3). Four replicates were also taken at each jab sample site. Jab samples were collected from the mid section of slow, soft-bottomed areas. A D-net with the same dimensions as used for kick sampling was used. The net was jabbed into the soft bottom sediments and raked across the bottom until the net was filled with sediment. The net was brought to the surface and rinsed while still in the net to remove most fine materials. The material from the net was then removed and placed into a U.S. No. 30 mesh wash bucket and gently rinsed with water to remove remaining fine materials. The remaining contents were placed into labeled wide-mouth glass sample jars, preserved with 10% formalin, and stored for transport to the processing laboratory.

A-2 Laboratory Methods

Prior to sorting, all samples that had initially been fixed with formalin were rinsed through a U.S. no. 60 sieve with water, transferred back to their original sample bottle and preserved with 75% ethyl alcohol.

A-2.1 Sorting

Samples were washed through a U.S. no. 60 sieve with tap water to remove any remaining fine sediments and excess alcohol, and then emptied into a shallow pan. A small amount of tap water was added. The material was distributed evenly in the pan and the contents examined under magnification. Invertebrates were removed from the debris as they were encountered. Organisms were sorted into major groups, placed in labeled vials containing 75% ethyl alcohol, and counted. Sorting continued until 100 organisms had been removed.

A-2.2 Identification

All organisms were sent to the Aquatic Resources Center (ARC) of College Grove, Tennessee, for identification. All organisms were identified to the lowest possible taxonomic level. Generally, chironomids and oligochaetes needed to be cleared, slide-mounted and viewed through a compound microscope for proper identification. Most other organisms could be identified using a dissecting stereomicroscope. The number of individuals of each species from each sample were recorded on laboratory data sheets and entered into an Excel spreadsheet. Identified organisms were returned to Onondaga County for an archived reference collection.

A-3 Analysis

Biological monitoring programs using benthic macroinvertebrates to assess water quality often rely on several different indices of community composition to evaluate the ecological status of the sampled community (Novak and Bode 1992). Each index should contribute different information to the assessment to avoid redundancy and conflicting results. The Onondaga County macroinvertebrate monitoring program uses NYSDEC's Biological Assessment Profiles as the primary measure of the macroinvertebrate community.

A-3.1 NYSDEC Biological Assessment Profile

Sites are compared using NYSDEC Biological Assessment Profiles. An overall assessment of water quality for each site is calculated by averaging results of four individual metrics obtained through a scaled ranking of the index values. The index values are converted to a common scale of water quality ranging from 0-10, with 0 being severely impacted and 10 being non-impacted. After all index values for a site are converted to a common scale value, they are averaged to obtain a score denoting overall assessment of water quality.

The score results in a designation of one of four categories: non-impacted, slightly impacted, moderately impacted, or severely impacted. Tributary assessments are calculated by using a combined index incorporating species richness, EPT richness, Hilsenhoff Biotic Index (HBI), Percent Model Affinity (PMA) (kick samples only), or non-chironomid and oligochaete richness (NCO) (jab samples only). The reader is directed to NYSDECs Quality Assurance Work Plan for Biological Stream Monitoring in New York State, November 1996, for more detailed information.

A-3.2 Hilsenhoff Biotic Index (HBI) Score

This index is used as part of NYSDECs water quality impact determination. The rationale and methodology for calculating HBI is that HBI is considered by many investigators to be the most reliable index of composition of the macroinvertebrate community and water quality status (Novak and Bode 1992). HBI indicates the effects of organic pollution and is based on species-specific tolerance levels. Taxa are assigned tolerance values ranging from zero to ten, where zero and ten represent the extremes for intolerance and tolerance respectively (Hilsenhoff 1987). HBI not only includes the numbers of species and the distribution of individuals among species, but weighs abundance of each species according to its known ability to tolerate adverse water quality conditions, particularly organic inputs. High HBI values are associated with adverse impacts of organic pollution. Low HBI values indicate that the macroinvertebrate community is not impacted by organic pollution.

Because this index directly tests for the impacts of organic enrichment, we have also chosen to look at this index independently. A raw HBI score is ranked on a scale from 0 to 10 with zero being best and ten being worst. NYSDEC converts these HBI values into their water quality scale of 0 to 10 with zero being worse and ten being best. In order to avoid confusion we present the separate HBI values as the NYSDEC score for HBI and not the raw HBI calculation.

A-3.3 Percent Oligochaetes

The percent contribution of oligochaetes will also be used as an index of change over time. Oligochaetes can often thrive in areas where other invertebrates may not because of factors such as competition, soft substrate, organic enrichment, or low oxygen conditions. Some oligochaetes are found at the extremes of environmental conditions. For example, *Tubifex tubifex* may be found in very unproductive cold pristine headwater streams and near extremely productive, warm sewage discharges (Dr. Deedee Kathman, personal communication). Since few organisms are suited for the extreme conditions found in these two very different settings, *T. tubifex* can thrive by taking advantage of the lack of competition. It is quite unlikely that any of the sites in this monitoring effort would ever approach what would be considered an unproductive state. As oligochaetes are often found in high relative proportions in areas impaired by organic enrichment, their percent contribution to the community can be a good measure of the relative amount of organic enrichment at different locations. More importantly, the change in the percent contribution of oligochaetes over time, as well as the species composition, will be a good measure of the change in organic enrichment at the study sites.

A-3.4 NYSDEC Impact Source Determination

The NYSDEC Impact Source Determination (ISD) ascertains the primary factor influencing the macroinvertebrate community in stream riffle habitats based on similarity to impacted community models (Bode et al. 1996). The methods used for constructing these models can be found in Bode, et al. 1996. The community types used for impact source determination are as follows: Natural, Nutrient Additions-Nonpoint Sources, Toxic, Sewage Effluent/Animal Waste, Municipal/Industrial, Siltation, and Impoundment. The model community that exhibits the highest similarity to the test data indicates the likely impact source type for that site. If data from a site do not match any of the modeled communities (based on a standard of 50% affinity) the determination is “inconclusive”.

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