EIGHTEENMILE CREEK
AND
OLCOTT HARBOR

SEDIMENT STUDY

Summary of May 25, September 12, and October 11-12, 1994 Results

New York State Department of Environmental Conservation

Metals, Pesticide and PAH Evaluation
Bruce Garabedian

PCB and Dioxin Evaluation
Frank Estabrooks

Toxicity Testing
Gary Neuderfer

Benthic Bioassessment
Robert Bode, Margaret Novak, Larry Abele

Microtox® Analysis
Edward Kuzia, Diana Heitzman

Project Coordinator
Bruce Garabedian

October 29, 1998

Abstract

Sediment cores and surficial sediment samples were collected at eight sites on Eighteenmile Creek and Olcott Harbor on September 12, and October 11-12, 1994. This study was conducted to evaluate trace metals and organic chemical concentrations. Sediment coring was performed from onboard the USEPA R/V Mudpuppy using an electric vibrocoring device. Funding for the project was provided by a grant from the EPA's Great Lakes National Program Office (GLNPO).

The study results will be made available for use in the development of the Remedial Action Plan (RAP) for the Olcott Harbor Area of Concern (AOC).

High concentrations of cadmium (26 ppm), chromium (1,910 ppm), copper (2,340 ppm), lead (7,850 ppm), nickel (523 ppm), and zinc (24,000 ppm) were found in sediment cores collected from depositional waters behind the Burt and Newfane Dams (Newfane, NY). High levels of mercury were measured in sediment samples taken from the Olcott Harbor turning basin (3.3 ppm) and immediately upstream of the Route 18 bridge (3.8 ppm).

A small number of samples were found to have pesticide concentrations greater than analytical detection limits. High PCB and dioxin and furan concentrations were encountered in the Burt and Newfane Dam Pools (PCBs up to 23 ppm and dioxin/furan toxic equivalences up to 1305.3 ppt).

High concentrations of polynuclear aromatic hydrocarbons (PAHs) were detected in a sediment core collected immediately downstream of the Eighteenmile Creek's confluence with the Erie Canal (119,130 ppb). Sediments contaminated from various sources along the Erie Canal are believed responsible for the high PAHs encountered. Mirex and Octachlorostyrene were not detected in any sediment samples evaluated. Photomirex was not evaluated as reliable laboratory standards could not be obtained.

Acute elutriate toxicity testing produced no statistically significant effects. Ten day solid phase toxicity tests demonstrated toxicity to *Chironomus tentans* in Eighteenmile Creek and Olcott Harbor (Station Nos. 1 through 6). Solid phase toxicity tests did not produce toxicity in *Hyalella azteca*. All surficial sediment samples elicited toxicity to *Photobacterium phosphoreum* (Microtox® sediment assay). Pore water from Station Nos. 2 and 3 also elicited toxicity, however, confidence intervals were unacceptably broad, suggesting a problem with the procedure.

Continued development and application of a benthic biological assessment technique for large, slow-moving rivers was also performed. Macroinvertebrate species richness and diversity, biotic index, dominance and percent model affinity were evaluated as part of the benthic biological assessment. Based on the application of the indices and criteria selected, and the interpretation of these index values, the invertebrate communities of the sediments of Olcott Harbor and Eighteenmile Creek indicate slight to moderate impact.

Additional, limited sediment sampling is recommended to further define the spatial and temporal distribution of those analytes encountered in high concentrations. An evaluation of bed-loads of these contaminants should also be performed. This information would be necessary for estimating the cost of any potential remediation measures, if proposed.

Acknowledgments

This project could not have been completed without the considerable input and dedication of those involved in this undertaking.

Special thanks to Steve Garbaciak, who trained us in the use of GLNPO's electric vibrocore sampler. As captain of the R/V Mudpuppy, Bill Bacon operated the boat in a very professional and safe manner.

Consistent support in the planning, field sampling and data reduction aspects of the study was provided by Jim Swart. Bernadette Anderson assisted with the field sampling as did John Donlon, who also operated the NYSDEC's old pneumatic vibrocorer during reconnaissance sampling. Mr. Mark Eschbacher (Roy F. Weston, Inc.) provided invaluable geotechnical insight regarding the sediment core samples.

This project was composed of several special studies and were it not for the efforts of the following investigators, this report would not exist. Gary Neuderfer conducted the toxicity testing with assistance from Bob Bauer at the Avon Field Station. Dr. Edward Kuzia and Diana Heitzman performed the Microtox® analyses. Bob Bode, Margaret Novak, and Larry Abele completed the benthic bioassessment portion of the Study.

This study was funded by a grant from the Environmental Protection Agency's Great Lakes National Program Office (Grant No. GL995405-01-0).

LIST OF AUTHORS (ALPHABETICAL)

Larry Abele
Environmental Program Specialist I
Stream Biomonitoring Unit
50 Wolf Road
Albany, NY 12233-3503

Robert W. Bode
Research Scientist III
Stream Biomonitoring Unit
50 Wolf Road
Albany, NY 12233-3503

Frank Estabrooks
Environmental Program Specialist II
50 Wolf Road
Albany, NY 12233-3503

Bruce Garabedian, P.E.
Environmental Engineer II
50 Wolf Road
Albany, NY 12233-3503

Diana Heitzman
Environmental Program Specialist I
50 Wolf Road
Albany, NY 12233-3503

Edward J. Kuzia, Ph.D.
Research Scientist III
50 Wolf Road
Albany, NY 12233-3503

Gary Neuderfer
Biologist 2 (Ecology)
6274 E. Avon Lima Road
Avon, NY 14414

Margaret Novak
Environmental Program Specialist II
Stream Biomonitoring Unit
50 Wolf Road
Albany, NY 12233-3503

CONTRIBUTING AUTHOR

Robert Bauer
Environmental Chemist II
6274 E. Avon-Lima Road
Avon, NY 14414

Contents

Chapter		Page
	Abstract	i
	Acknowledgments	ii
	Authors	iii
	Contents	iv
	List of Figures	vi
	List of Tables	vii
1	Introduction	1-1
Results/Discussion		
2	Metals	2-1
3	Pesticides	3-1
4	PCBs	4-1
5	Dioxins/Furans	5-1
6	PAHs	6-1
7	Mirex	7-1
8	Octachlorostyrene	8-1
9	Inorganics	9-1
10	Sediment Toxicity	10-1
11	Microtox®	11-1
12	Macroinvertebrate Sampling	12-1
13	Summary/Conclusions	13-1
14	QA/QC	14-1
	Data Quality Requirements and Assessments	14-1
	Sampling Procedures	14-3
	Documentation, Data Reduction and Reporting	14-4
	Data Validation	14-4
	Quality Control Evaluation	14-8
	Field Audit	14-17
15	References	15-1

Contents (cont.)

Appendix Page

A. Radionuclide Results A-1

B. E.C. Jordan Sediment Sampling Results B-1

C. Pesticide/PCB Aroclor Results C-1

D. PAH Results D-1

E. Growth and Survival Data E-1

F. Water Chemistry F-1

G. Invertebrates in Ponar Samples G-1

H. NYSDEC Field Audit H-1

Figures

Page

1-1 Study Area and Sampling Stations 1-3

1-2 Study Area and Sampling Stations 1-4

1-3 Study Area and Sampling Stations 1-5

1-4 Study Area and Sampling Stations 1-6

2-1 Trace Metals Data..... 2-6

2-2 Trace Metals Data..... 2-7

2-3 Trace Metals Data..... 2-8

5-1 Dioxin/Furan Homolog Abundance.....5-13

6-1 Total PAH Concentrations.....6-2

6-2 PAH Results.....6-5

6-3 PAH Results.....6-6

6-4 PAH Results.....6-7

6-5 PAH Results.....6-8

12-1 Biological Assessment Profiles of Index Values for Ponar Samples from Four Rivers in New York State.....12-6

12-2 Derivation of Profile Values for Ponar Sample Indices..... 12-8

12-3 Biological Assessment Profile of Index Values, Olcott Harbor and Eighteenmile Creek.....12-11

Tables

		Page
1-1	Sampling Locations	1-7
1-2	Field Sampling Summary	1-9
1-3	Sediment Analytical Methods	1-13
2-1	Trace Metals Data	2-2
2-2	Trace Metals Results at Station 4a	2-5
3-1	Pesticide Results	3-2
4-1	Surficial Sediment Results and Selected Guidance Values for Characterizing PCB Concentrations in Sediment	4-2
4-2	Sediment Core Results and Selected Guidance Values for Characterizing PCB Concentrations in Sediment	4-3
5-1	Dioxin/Furan Data	5-6
5-2	Dioxin/Furan Homolog Abundance	5-13
9-1	Inorganic Data	9-2
9-2	Sample Physical Descriptions	9-3
9-3	Particle Size Distribution	9-4
9-4	Particle Size Distribution	9-5
10-1	Characteristics of Avon Field Stations Culture Water	10-3
10-2	C. tentans Initial Head Capsule Width Data	10-4
10-3	Summary of Test Conditions	10-7
10-4	Statistical Summary of Survival and Weight Data for H. azteca and C. tentans	10-10
10-5	Summary of acute toxicity test conditions for D. magna and P. promelas elutriate toxicity tests on Eighteenmile Creek Sediment Samples	10-15
10-6	Summary of Eighteenmile Creek Sediment Elutriate Acute Toxicity Data for D. magna and P. promelas	10-16
11-1	Toxicity of Whole Sediment to Photobacterium phosphoreum	11-3
11-2	Five and Fifteen Minute Photobacterium phosphoreum EC50 Values of Pore Water from Eighteenmile Creek	11-3
12-1	Community Types Found in Benthic Invertebrate Ponar Samples	12-12

Chapter 1 -Introduction

This study provides information on the levels of organic chemicals and trace metals in the bottom sediments of Eighteenmile Creek and Olcott Harbor. Summaries of the levels of contamination in various depositional zones within the study area have been prepared. General conclusions regarding contaminant concentrations in the areas sampled have been drawn. A benthic bioassessment and an evaluation of the toxicity of the bottom sediments within the study area were conducted and are summarized.

Background

The International Joint Commission has identified Eighteenmile Creek and Olcott Harbor as an Area of Concern (AOC) due to high levels of conventional pollutants, heavy metals, and organic pollutants in the water column, sediments, and biota. Total dioxin levels as high as 35,000 pg/g have been found in bottom sediments behind Newfane Dam. Elevated levels of heavy metals have also been detected in the sediments of Eighteenmile Creek (i.e., lead as high as 4,700 μg/g, copper as high as 2,700 μg/g, and cadmium as high as 9.7 μg/g). A comprehensive evaluation of contaminant levels in Olcott Harbor was not available prior to this study.

Data Usage

Data generated from this study will be used to evaluate sediment contaminant levels for those parameters analyzed. Benthic community structure richness, biological impairment, and sediment toxicity within the study area will also be evaluated. This information will be made available for use in the development of the Remedial Action Plan (RAP) for the AOC. This study will also provide information useful for evaluating the toxicity of potential dredge material. This information is of great interest to many organizations, including the New York State Department of Environmental Conservation (NYSDEC), as open water disposal of dredged material is currently allowed in New York State.

Field Study

Included in this report are the results from three field sampling events conducted on Eighteenmile Creek and Olcott Harbor on May 25, September 12, and October 11-12, 1994. An overview map of the study area, including all sampling stations, is presented in Figures 1-1 through 1-4. Complete descriptions of all sampling locations have also been summarized, and are included in Table 1-1.

The May 25, 1994, field survey was conducted as a reconnaissance survey, to evaluate site conditions and to select sampling locations for the primary sampling event, which was subsequently performed on September 12, 1994. Very limited sampling was conducted during the reconnaissance survey. All of the large diameter sediment cores (four inch) evaluated for this study were collected on September 12, 1994. The remaining cores (two inch diameter) were collected using a push-corer on October 11-12, 1994. Surficial sediment samples used for chemical and biological analyses were collected during both the September 12, 1994, and October 11-12, 1994 sampling events.

The area sampled was larger than proposed in the approved Quality Assurance Project Plan (QAPP) prepared by the NYSDEC (1994a). Specifically, one additional sampling site was added upstream of the AOC. This new sampling site was the furthest upstream site sampled on Eighteenmile Creek. Information from this location was deemed a necessary component of this study as resulting data would be used to define the potential impact from the Erie Barge Canal on Eighteenmile Creek. A complete discussion of the sampling site locations will be presented later. Evaluation of sediments from the site located upstream of the AOC was deemed necessary to adequately assess potential remediation measures in the AOC since natural transport mechanisms can be expected, over time, to move contaminated sediments downstream into the AOC.

The Environmental Protection Agency's Research Vessel (R/V) Mudpuppy was used to collect the sediment cores at Station Nos. 2 through 5, as detailed in the approved project QAPP.

Figure 1-1. Study Area and Sampling Stations

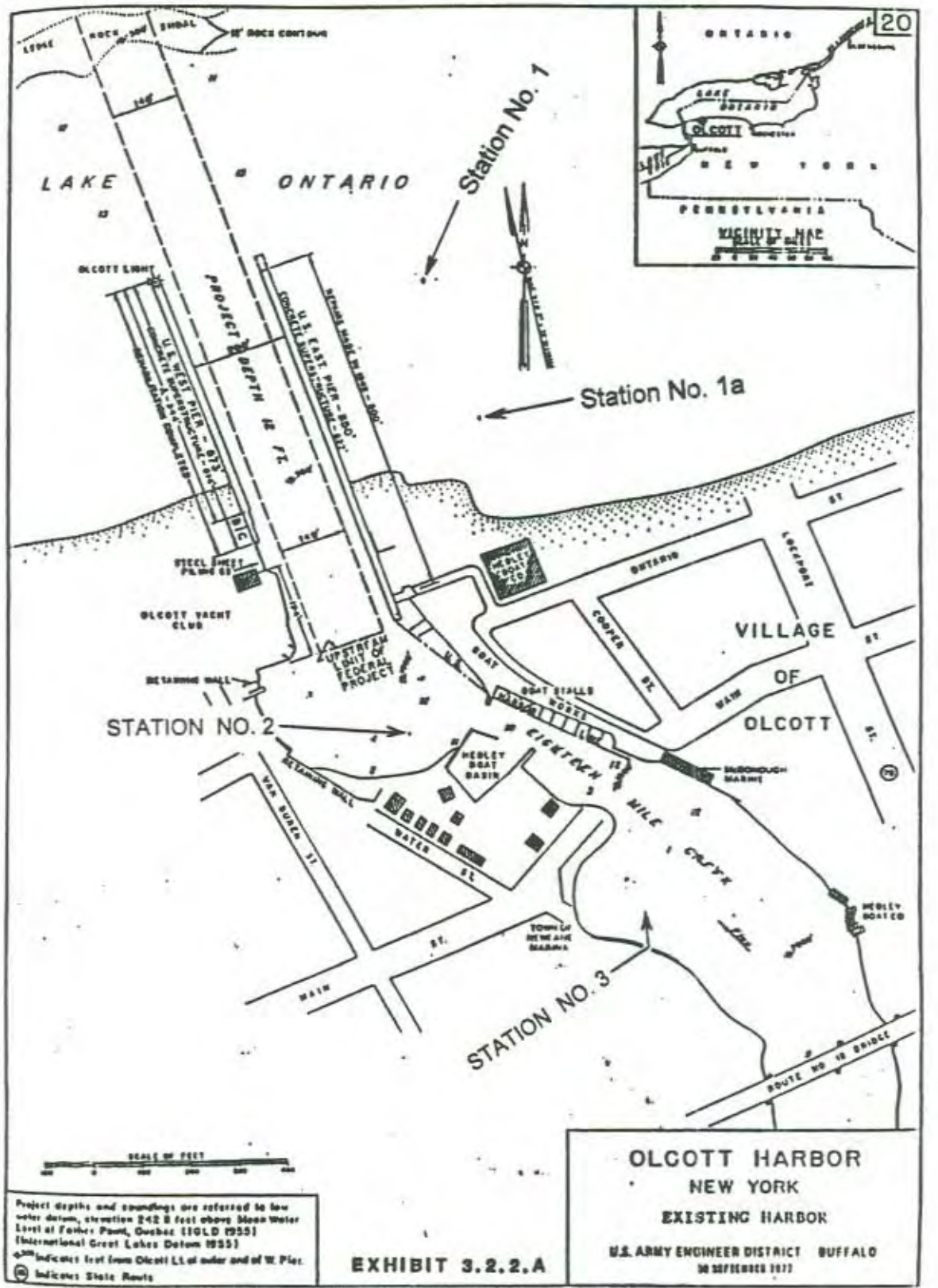


Figure 1-2. Study Area and Sampling Stations

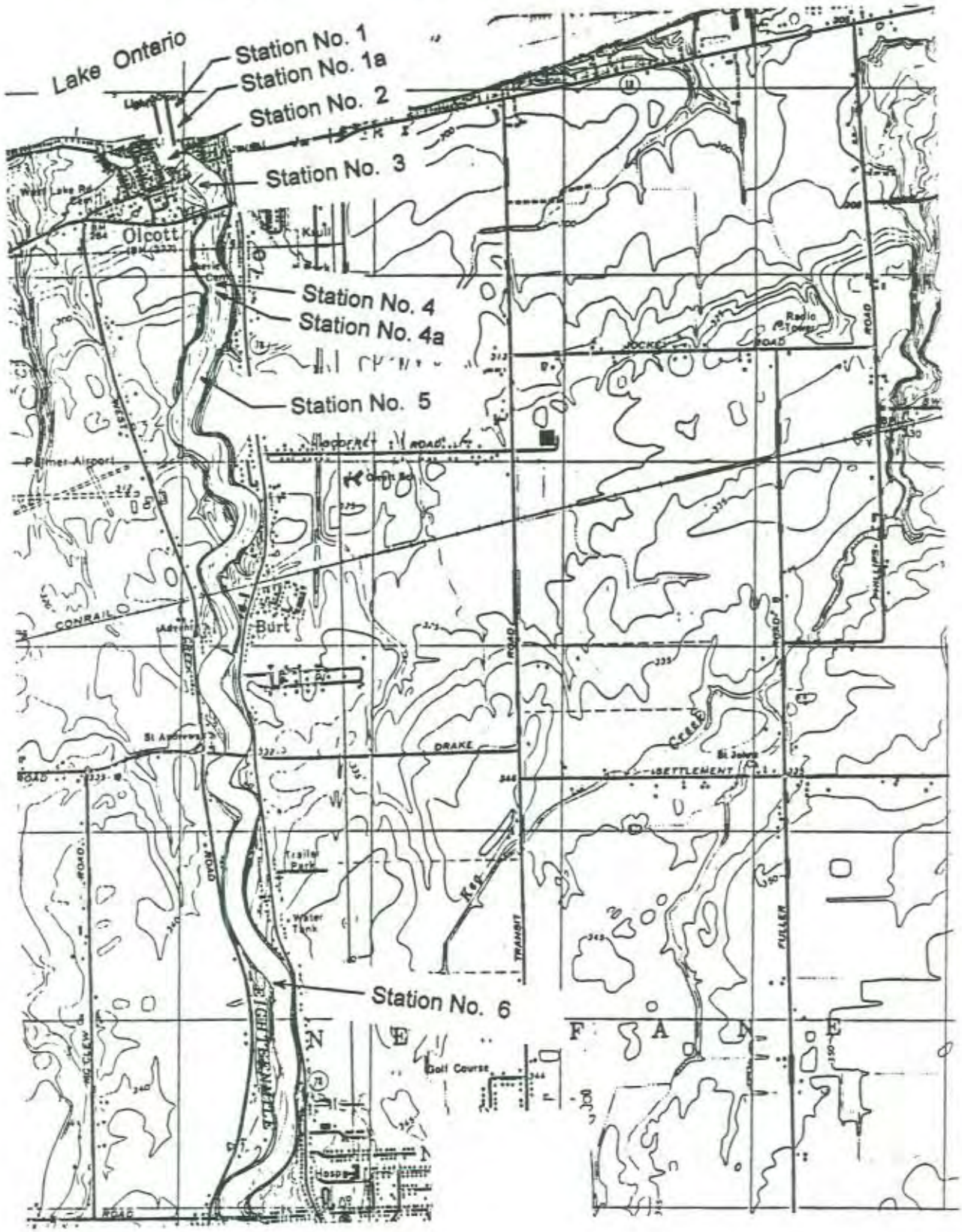


Figure 1-3. Study Area and Sampling Stations

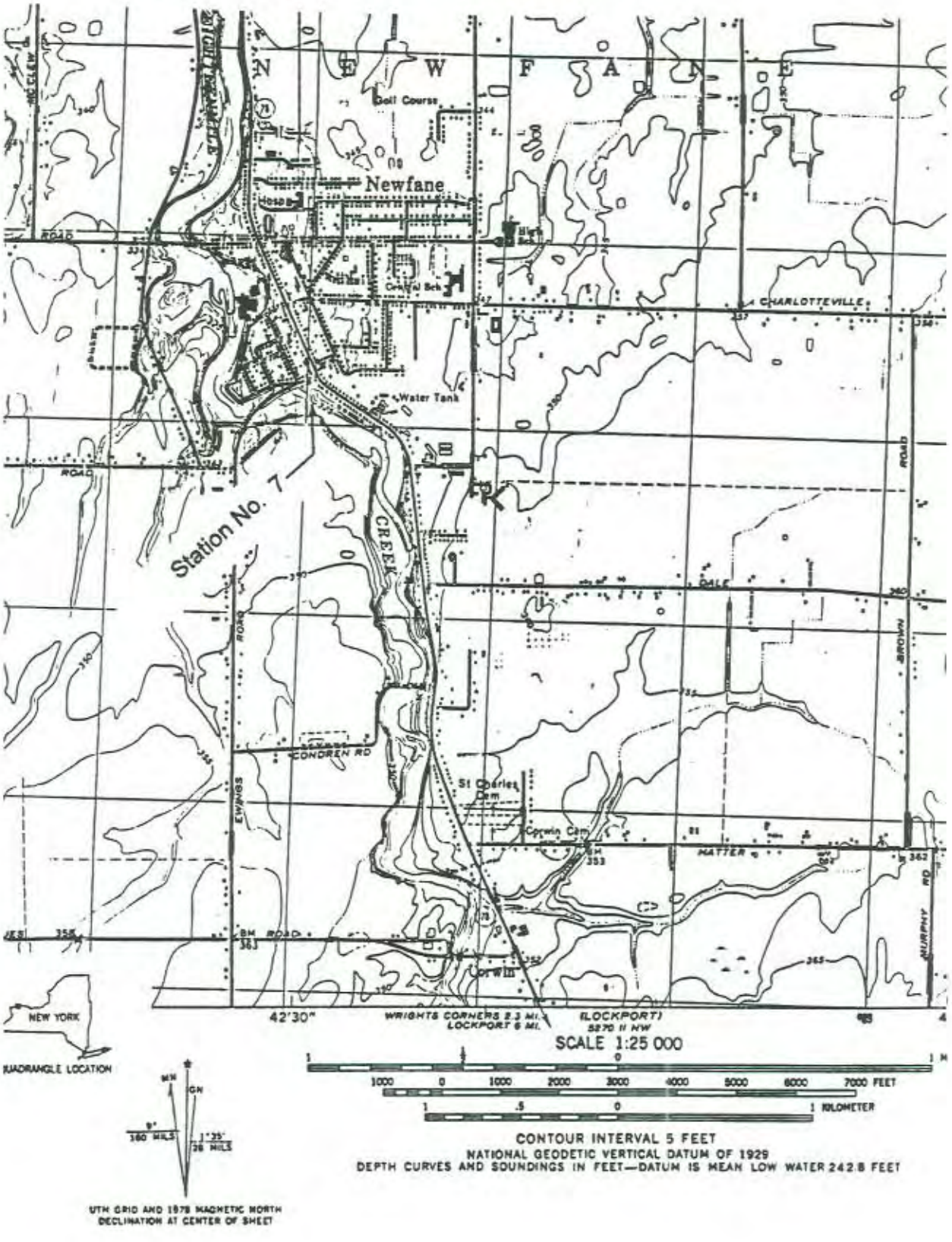


Figure 1-4. Study Area and Sampling Stations

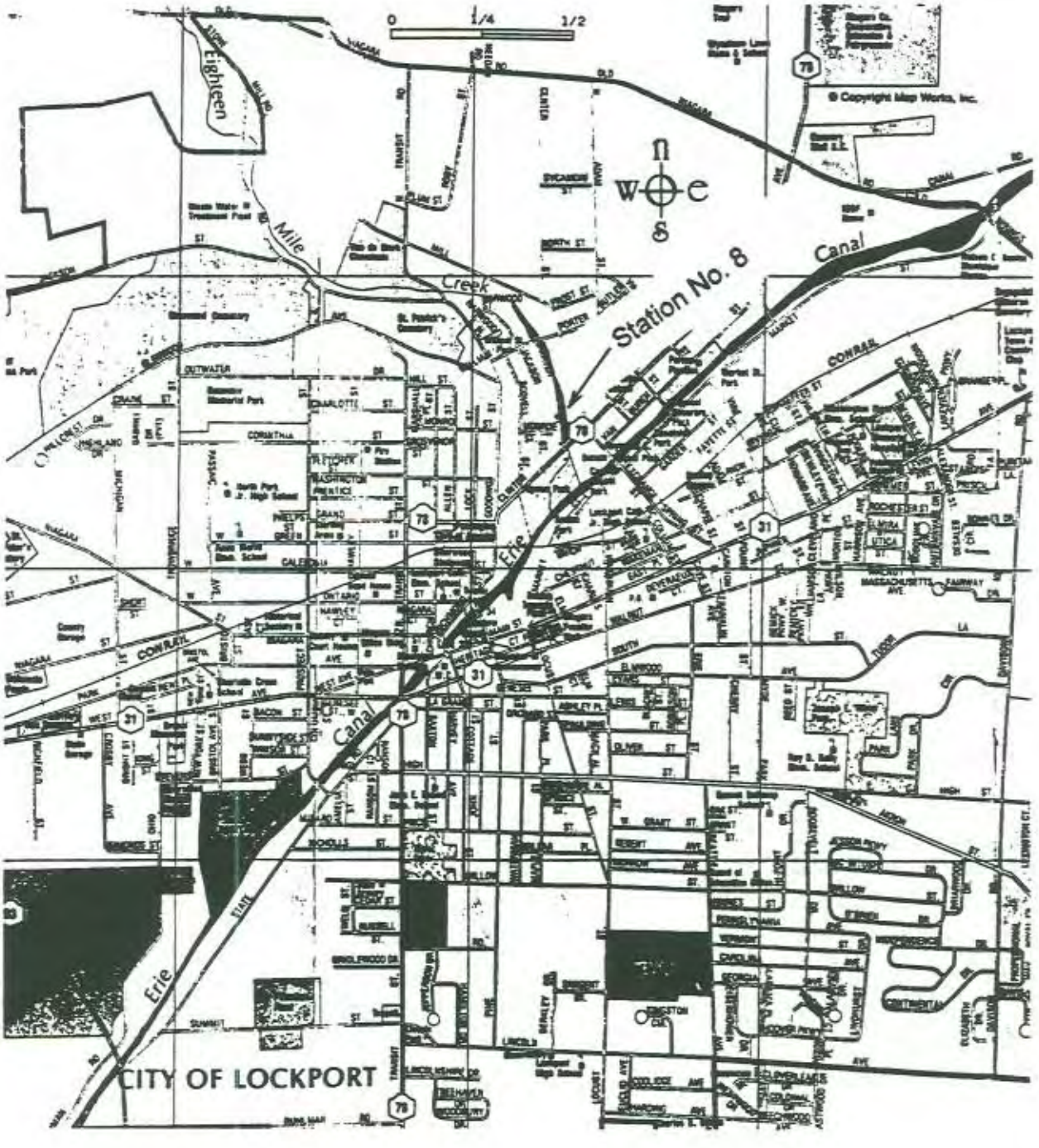


TABLE 1-1. SAMPLING LOCATIONS
EIGHTEENMILE CREEK/OLCOTT HARBOR SEDIMENT STUDY

STATION NO.	SAMPLE TYPE	WATERBODY	RIVER MILE	SAMPLING LOCATION	SAMPLE DATE	COLLECTION TIME	WATER COLUMN DEPTH(M)	COORDINATES (LAT./LONG.) (deg.-min.-sec.)	TEMPERATURE (°C) AIR	TEMPERATURE (°C) WATER
1	Surficial	Lake Ontario	NA	Approx. 45 m East of Eastern breakwater and 25 m South of Northern tip of breakwater.	12-Oct-94	09:00 AM	2.0	43-20-26 78-43-06	5.5	13.7
1a	Surficial	Lake Ontario	NA	Approx. 25 m East of Eastern breakwater and 25 m from shore.	25-May-94	10:00 AM	*NC*	43-20-22 78-43-06	*NC*	*NC*
2(replicate #1) 2(replicate #2)	Surficial Surficial Core	Olcott Harbor	0.10	In turning basin, approximately 30 M North of Headley Boat Basin and 30 m East of retaining wall on West bank.	11-Oct-94 11-Oct-94 12-Sep-94	05:30 PM 06:00 PM 05:00 PM	3.7 3.7 3.7	43-20-15 78-43-06	12 12 *NC*	13 13 *NC*
3(replicate #1) 3(replicate #2)	Surficial Surficial Core	Olcott Harbor	0.23	Collected in Town of Newfane Marina, at end of dock(Slip 42) 40 m from shore.	11-Oct-94 12-Oct-94 12-Sep-94	06:30 PM 12:10 PM 03:50 PM	3 3 1.8	43-20-09 78-42-56	11 12.4 *NC*	13 13.7 *NC*
4	Surficial Core	Eighteenmile Creek	0.58	400 m Upstream of Rt. 18 Bridge, approximately 50 m downstream of sandbar in center of channel.	12-Oct-94 12-Sep-94	10:15 AM 03:00 PM	3 3	43-19-55 78-42-58	8.9 *NC*	12.6 *NC*
4a	Core	Eighteenmile Creek	0.61	At dnstrm. end of sandbar, approximately 400 m upstream of Rt. 18 bridge.	25-May-94	11:00 AM	0.6	43-19-53 78-42-58	*NC*	*NC*
5	Surficial 2 Cores	Eighteenmile Creek	0.93	Sample collected approximately 10 m from Eastern shoreline and 1.75 km downstream of Burt dam.	12-Oct-94 12-Sep-94	11:15 AM 10:20 AM	2.7 1.3	43-19-39 78-43-02	10.5 19.2	12.7 17.1
6	Surficial & Core	Eighteenmile Creek	3.28	100 m South of overhead power lines, 10 m from W. shoreline,adjacent to yellow house on East shore.	11-Oct-94	06:15 PM	1.5	43-17-51 78-42-45	10	13
7	Core	Eighteenmile Creek	5.20	30 m upstrm. of Newfane Dam, immediately upstrm. of demolished power house.	12-Oct-94	10:00 AM	1.1	43-16-43 78-42-27	*NC*	*NC*
8	Surficial & Core	Eighteenmile Creek	14.13	Collected in center of impoundment, approximately 150 m dnstrm. of Clinton St. bridge.	12-Oct-94	09:00 AM	1.5	43-10-43 78-41-23	*NC*	*NC*

NC- NOT COLLECTED

This sampling was performed on September 12, 1994. All field sampling activities conducted during the three surveys associated with this project have been summarized in Table 1-2.

All sediment samples were collected from depositional areas located outside shipping channels that are normally dredged. Samples collected from non-dredged areas are useful for evaluating the historical loadings of contaminants.

The most upstream sampling station was located on Eighteenmile Creek (Station No. 8), at a location approximately 150 m downstream from where the Eighteenmile Creek passes under the Erie Canal in a series of culverts. It is at this crossing where flow from the Erie Canal is diverted into Eighteenmile Creek. This site was selected to evaluate the upstream boundary conditions of the Study Area. Sediments evaluated from this site are expected to represent the potential impact of contamination from the Erie Canal. A very small percentage of the total Eighteenmile Creek drainage basin is located upstream of this point.

Significant sediment deposition typically occurs upstream of a dam due to the backwater condition and resulting reduction in stream velocity. For this reason, sediment samples were collected behind the Burt and Newfane Dams (Station Nos. 6 and 7). These were the only major dams located within the Study Area and it is expected they acted as significant "sediment sinks" over the years. The Burt and Newfane Dams are located in the Hamlets of Burt and Newfane, respectively.

All of the remaining sampling sites were located in depositional zones downstream of the last dam (Burt Dam) on Eighteenmile Creek. These sites were all located less than one mile upstream of the Eighteenmile Creek mouth at Lake Ontario. This section of Eighteenmile Creek was much shallower than the section located immediately upstream of the Burt Dam.

Station No. 5 was the most upstream sampling location in this section. This site was located approximately 1.75 km downstream of the Burt Dam. Radiodating of one of the two

TABLE 1-2. FIELD SAMPLING SUMMARY
EIGHTEENMILE CREEK/ OLCOTT HARBOR SEDIMENT STUDY

-----STATION----- NO.	LOCATION	SEDIMENT CORES COLLECTED	SURFICIAL SEDIMENT SAMPLES COLLECTED
1	Lake Ontario	*NC*	1(Chemical Analysis, Toxicity Testing,Bioassment)[2]
1a	Lake Ontario	*NC*	1(Recon Sample, Limited Chemical Analysis,Microtox)
2(replicate #1)	Olcott Harbor	1(Chemical Analysis:2 sub-samples)[1]	1(Chemical Analysis, Toxicity Testing)[3]
2(replicate #2)		*NC*	1(Chemical Analysis, Toxicity Testing)
3(replicate #1)	Olcott Harbor	1(Chemical Analysis:4 sub-samples,1 ms/msd sub-sample)[1]	1(Chemical Analysis, Toxicity Testing)[3]
3(replicate #2)		*NC*	1(Chemical Analysis, Toxicity Testing)
4	Eighteenmile Creek	1(Chemical Analysis:3 sub-samples)[1]	1(Chemical Analysis, Toxicity Testing,Bioassment)[2]
4a	Eighteenmile Creek	1(Chemical Analysis:8 sub-samples)[3]	1(Recon Sample, Limited Chemical Analysis,Microtox)
5	Eighteenmile Creek	2(1-Chemical Analysis:3 sub-samples;1- Radiodating)[1]	1(Chemical Analysis, Toxicity Testing)[2]
6	Eighteenmile Creek	1(Chemical Analysis:2 sub-samples)[1]	1(Chemical Analysis, Toxicity Testing)[2]
7	Eighteenmile Creek	1(Chemical Analysis:2 sub-samples)[1]	*NC*
8	Eighteenmile Creek	1(Chemical Analysis:1 sub-sample)[1]	1(Chemical Analysis, Toxicity Testing)[2]

NOTES:
1-Includes analysis of all analytes presented in Table 1-3.
2-Includes analysis of all analytes presented in Table 1-3 except Dioxin/ Furan, PCB congeners, mirex, and octachlorostyrene.
3-Includes analysis of all analytes presented in Table 1-3 except Dioxins/ Furans.
NC- not collected

sediment cores collected at this site was also performed. This site was selected for radiodating due to its close proximity to the AOC, and as it was believed to be far enough upstream from the potential effects from Lake Ontario. Radiodating analyses are useful for determining depositional rates and historical distribution of contamination to a waterbody. The radiodating analysis performed at this site was not productive, as the sediment core evaluated was, apparently, not chronologically deposited. The sediments contained in the core evaluated were believed to be from a major depositional event. This issue is discussed further in the Metals Section of this report (Chapter 2).

The next downstream sampling sites were Station Nos. 4 and 4a. These sites were located approximately 2.25 km downstream of the Burt Dam. Again, only limited sampling was performed at Station No. 4a during the reconnaissance survey of May 25, 1994. Although Station Nos. 4 and 4a were located within several meters of each other, considerable variation in the contaminant concentrations at these sites was observed. A portion of the observed variability is attributed to using two different laboratories for the analysis of these samples. Also, considerable spatial variability in contaminant concentrations is normally expected in sediments .

Station Nos. 3 and 2 were both located within the Olcott Harbor AOC. The Station No. 3 sampling site was located at the end of the Newfane Town Marina Public Dock while the sample at Station No. 2 was collected from within the Olcott Harbor Turning Basin. The information resulting from these samples is expected to be useful for evaluating potential remediation measures in the AOC. Results of the sample collected at Station No. 2 are also expected to be useful for characterizing the quality of sediments discharged into Lake Ontario from Eighteenmile Creek.

Station No. 1 was located in Lake Ontario just East of the Eastern Pier at the mouth of Eighteenmile Creek. This site was selected as the downstream boundary site, to provide information on the impacts to the biota of Lake Ontario from the Eighteenmile Creek sediments. A sediment core was not collected at the Station No. 1 sampling site during the September 12, 1994 field survey as ledge rock was encountered.

All field sampling and analytical methods were performed in accordance with US

Environmental Protection Agency (EPA) approved methods. This information is presented in detail in the EPA approved Quality Assurance Project Plan for the project dated September 2, 1994. A summary of the parameters and media analyzed during the September 12, and October 11-12, 1994 study is presented below.

Cores

A total of nine sediment cores were collected from locations within the study area where dredging activities were not believed to have occurred. Of this total, two replicate cores were taken at Station No. 5. The first replicate from this site was used for radiodating analyses while subsamples for chemical analyses were taken from the second replicate. Five of these nine cores were collected from onboard the USEPA's Research Vessel (R/V) Mudpuppy during the September 12, 1994 field study. The R/V Mudpuppy is outfitted with a four-inch diameter electric vibrocorer. Although this boat provides an excellent working platform for coring in open water it could not, due to its size, be launched upstream of the Burt and Newfane Dams. Due to this limitation an inflatable boat was utilized for sample collection behind the Burt Dam. Two inch diameter hand push cores were collected from behind the Burt and Newfane Dams, and also at the Station No. 8 sampling site. The cores collected behind the Newfane Dam and Station No. 8 were collected from shore. A pneumatic vibrocorer was used to collect a 4 inch core at Station No. 4a on May 25, 1994.

All cores collected were subsectioned based upon visual determination of sediment stratification. The four inch cores were typically subsectioned into two to three subsamples while the two inch cores were typically subsectioned into one or two subsections. A very short core (33 cm) with homogeneous sediments was encountered at Station No. 8. Only one subsample was taken from this core. All samples were composited over the entire length of each respective subsection. Complete subsample physical descriptions and lengths are presented in the Inorganics Section of this report (see Table 9-2).

Samples collected during the main sampling surveys of September 12, and October 11-12, 1994 were analyzed for dioxins and furans (tetra-through-octa homolog totals and 2,3,7,8-substituted dioxin and furan congeners), organochlorine pesticides, polychlorinated biphenyls (PCBs), mirex, octachlorostyrene, heavy metals, polynuclear aromatic hydrocarbons (PAHs), total organic carbon, and total volatile solids. It had been planned that photomirex be evaluated during this study. However, the laboratory contractor was unable to obtain a reliable source of photomirex laboratory standards, and this parameter was not analyzed. A complete summary of the sediment analytical methods employed during this study is presented in Table 1-3.

Surficial Samples

Nine surficial sediment samples were collected from the Study Area during the September 12 and October 11-12, 1994 field surveys. These samples were collected adjacent to sediment core sampling sites previously discussed. Samples collected at these locations were intended to provide an accurate representation of current ambient conditions at the time of sampling. Replicate sampling, to evaluate spatial variability in contaminant concentrations, accounted for two of the nine surficial samples. The replicate sampling was performed at Station Nos. 2 and 3.

A ponar dredge that was modified to allow the removal of its screens, was used for the collection of all surficial samples. Surficial samples were analyzed for many of the same parameters as the core subsamples. Dioxin and furan analyses were not performed on the surficial sediment samples due to the expense of this procedure. The dioxin and furan analyses performed on the upper subsections of the cores were used to characterize the current concentrations at the respective sampling site. Analysis of PCB congeners was performed only on the surficial samples collected at Station Nos. 2 and 3. This evaluation was conducted as a part of the quality assurance quality control (QA/QC) component of the study.

TABLE 1-3. SEDIMENT ANALYTICAL METHODS

EIGHTEENMILE CREEK/ OLCOTT HARBOR SEDIMENT STUDY

ARAMETER	STANDARD METHOD	SAMPLE CLEANUP	PRECISION	ACCURACY	--------CALIBRATION-------- INITIAL	ONGOING	BLANKS	DETECTION LIMIT (mg/kg)	REPORTING LIMIT (mg/kg)
DIOXIN/FURAN 2,3,7,8-SUBSTITUTED CONGENERS AND TETRA THRU OCTA HOMOLOG TOTALS	EPA-1613A		+/- 40%* *(BASED ON EPA-8290; STUDY NOT DONE FOR EPA-1613)	+/- 40%*	when necessary	DAILY	PER METHOD	1-10pg/gm	
ORGANOCHLORINE PESTICIDES	EPA- 8080		+/- 50%RPD	/- 50-120%	3 pt. crv	EVERY 12 SAMP.	EVERY 7 SAMP.	SEE APPENDIX C [1]	SEE APPENDIX C [1]
PCB CONGENERS,MIREX, PHOTO-MIREX, OCTACHLOROSTYRENE	ASP 91-11	FLORISIL, OTHERS AS NEEDED	---	---	PER METHOD		1 EXTRACTION BATCH	SEE APPENDIX C [1]	5-10 ug/kg(see app. c) [1]
--METALS--									
Pb	EPA-239.2 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.4	0.6
As	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1	2
Ni	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	2.4	8
Zn	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	2	4
Cu	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1.4	5
Cd	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1	1
Se	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1	1
Cr	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1.2	2
Fe	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1.4	20
Ag	EPA-200.7 CLP-M		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1	2
Hg	EPA 7471		+/- 20%RPD	+/- 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.1	0.1
PAHs	EPA-8310	PER SW-846	STUDY NOT DONE		5 POINT	EVERY 10 SAMP.	EVERY 10 SAMP. BATCH	SEE APPENDIX C [1]	SEE APPENDIX C [1]
TOC	9060 W/LLOYD KAHN (SEE APPENDIX F) [2]	NA	+/- 20%RPD	+/- 20%	ICV/CCV 15%			20	20
TVS	ASTM D2974	NA		PER METHOD		NA		0.1%	0.01 %

TABLE 1-3. SEDIMENT ANALYTICAL METHODS, cont.
EIGHTEENMILE CREEK/ OLCOTT HARBOR SEDIMENT STUDY

ARAMETER	STANDARD METHOD
TOXICITY TESTING	
ELUTRIATE TEST	EPA(PELTIER & WEBER,1985) AND ASTM (1993b & c)[3]
SOLID PHASE TEST	EPA(1994) & ASTM(1993d & e)[3]
MICROTOX® ANALYSIS	MICROBICS CORPORATION;METHOD DETALED IN MICROTOX® MANUAL ,VOL. 2,DETAILED PROTOCALS,1992;SEE APP. B FOR DETAILS[4]
BENTHIC BIOLOGICAL ASSESSMENT	STUDY INTENDED TO DEVELOP METHOD[5]

Note: ALL REFERENCES TO APPENDICES AND LITERATURE REFERENCES REFER TO SEPTEMBER 2, 1994 APPROVED STUDY QAPP

[1] SEE APPENDIX C FOR COMPLETE DETAILS

[2] SEE APPENDIX F FOR COMPLETE DETAILS

[3] SEE APPENDIX A FOR COMPLETE DETAILS

[4] SEE APPENDIX B FOR COMPLETE DETAILS

[5] SEE APPENDIX B FOR COMPLETE DETAILS

Elutriate and solid phase toxicity tests were performed using the surficial sediments collected from seven sampling sites. Elutriate tests mix sediment and dilution water in a 1:4 ratio, and tests are run on the supernatant. The elutriate procedure results are used to estimate the toxicity test of sediments when they are resuspended during high flow scouring conditions or during dredging operations. The elutriate procedure used for this study was the acute toxicity test using *Daphnia Magna* and fathead minnow larvae.

Solid phase toxicity tests were performed using epibenthic test species that live in the sediment-pore water interface. Sediment was placed in beakers and dilution water was exchanged above the sediment. Solid phase toxicity tests estimate the effects of in-place sediments on indigenous aquatic organisms. Data resulting from this test can be used to evaluate the potential toxicity from undisturbed sediment deposits or from dredge spoil material. Decisions regarding open water disposal of dredge spoils can be made based upon these results.

Additional toxicity testing was performed on surficial sediment samples using the Microtox® sediment assay. Toxicity tests were performed on both pore water and sediment according to the Microtox® methods. These toxicity tests were used to identify relative toxicity among sites and establish possible correlation with toxicant concentrations in sediments.

Chapter 2 -Metals

Sediment trace metal concentrations were determined in accordance with the EPA standard analytical methods previously summarized in Table 1-3. Results presented herein are based upon sampling conducted on May 25, September 12, and October 11-12, 1994. Analytical results from the September 12 and October 11-12, 1994 surveys are summarized in Table 2-1, as are selected results from the May 25 survey. Complete results from the May 25 survey are presented in Table 2-2. All trace metal concentrations are reported in milligrams per kilogram (mg/kg) dry weight basis.

Selected analytical results from these field surveys are shown in Figure Nos. 2-1 through 2-3, as are sediment guidance values (Persaud et al., 1993; Long and Morgan, 1990) where developed. The Persaud sediment guidance values define the "lowest effect level" (LEL) and "severe effect level" (SEL) while the Long and Morgan guidance define the "effect range-low" (ERL) and "effect range-moderate" (ERM) levels. These guidance values are useful for evaluating the potential toxicity of sediments to benthic organisms. NYSDEC sediment guidance are not presented here but, generally, reflect the lower of the Persaud or Long and Morgan guidance values when both exist.

Upon review of the data presented in Figures 2-1 through 2-3 it can be seen that at most sampling stations, individual trace metal LEL guidance values were exceeded at least at one or more sample depth . An exception to this observation was at Station No. 1, where cadmium was the only trace metal to exceed its LEL guidance value, and only by a slight amount. It should be noted that Station No. 1 was the only sampling site located directly in Lake Ontario. The sample collected at this site was described as "clean beach sand" (Table 9-2) and, not surprisingly, it had the lowest Total Organic Carbon (TOC) concentration of all samples analyzed. Based upon visual observations at the time of sampling, this sample is believed representative of the typical Lake Ontario nearshore substrate.

Table 2-1. Trace Metals Data

Eighteenmile Creek/ Olcott Harbor Sediment Study

All Concentrations in mg/kg Dry Weight Basis

		Arsenic, Total			Cadmium, Total			Chromium, Total			Copper, Total		
Station No.	Depth(cm.)	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit
1	Surficial		1.0	0.32	U	0.68	0.68		9.6	1.3		5.6	0.48
2	Surficial(rep. 1)		2.5	0.3		1.2	0.66		21.7	1.2		35.9	0.47
2	Surficial(rep. 2)		5.7	0.52		3.3	1.1		45.1	2.1		78.6	0.77
2	0-61		11.3	0.79	U	1.1	1.1		61.2	1.2		106	0.48
2	61-117		11.6	0.90	U	1.2	1.2		101	1.4		155	0.56
3	Surficial(rep. 1)		4.0	0.5		2.1	1.1		94.7	2.1		131	0.78
3	Surficial(rep. 2)		3.4	0.61		2.5	1.3		71.8	2.4		124	0.92
3	0-61		1.8	0.44	U	1.1	1.1		17.7	1.2		10.9	0.49
3	61-178		1.6	0.45	U	1.4	1.4		17.2	1.5		11.2	0.61
3	178-203		1.9	0.60	U	1.7	1.7		17.9	1.8		13.1	0.77
3	203-279		1.5	0.42	U	1.3	1.3		16.3	1.4		11.0	0.58
4	Surficial		4.5	0.64		3.2	1.3		112	2.4		142	0.9
4	0-61		1.1	0.47	U	1.2	1.2		18.0	1.3		11.1	0.55
4	61-178		1.0	0.42	U	1.3	1.3		17.7	1.4		10.2	0.58
4	178-287		1.4	0.33	U	0.91	0.91		18.7	0.99		10.2	0.41
4a (1)	0-4		7		U		6		128			228	
4a (1)	4-8		13		U		5		102			177	
4a (1)	8-13		13		U		5		88			131	
4a (1)	13-23		10		U		5		75			92	
4a (1)	23-33		5		U		4		21			22	
4a (1)	33-43		5		U		4		21			19	
4a (1)	43-53		6		U		5		19			20	
4a (1)	53-64		6		U		5		19			16	
5	Surficial		4.3	0.54		1.6	1.2		80.0	2.2		127	0.83
5	0-61		1.4	0.43	U	1.2	1.2		18.5	2.2		10.3	0.84
5	61-244		1.6	0.48	U	1.0	1.0		17.7	1.9		11.2	0.72
5	244-306		1.4	0.47	U	1.0	1.0		19.0	2.0		10.8	0.73
6	Surficial		5.6	0.92		5.7	1.9		189	3.6		353	1.3
6	0-51		5.1	0.78		5.6	1.6		250	3.1		462	1.2
6	51-62		14.5	0.87		26.0	1.9		1910	3.6		2340	1.3
7	0-30		11.3	0.79		22.3	1.7		1470	3.2		2130	1.2
7	30-50		12.7	0.68		11.2	1.5		927	2.8		1620	1
8	Surficial		3.6	0.67		2.0	1.5		44.8	2.8		238	1
8	0-33		4.8	0.46		8.9	1		66.5	1.9		447	0.72

Notes: Data Qualifier:U -conc. not detected at or above reported conc.; -conc. equals reported conc;NC- Not Collected
(1)NYSDOH Data, (2)Brooks Rand,Ltd. Data

Table 2-1. Trace Metals Data, cont

Eighteenmile Creek/ Olcott Harbor Sediment Study

All Concentrations in mg/kg Dry Weight Basis

		Iron, Total			Lead, Total			Mercury, Total			Nickel, Total		
Station No.	Depth(cm.)	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc	Detection Limit
1	Surficial		10,700	0.46		3.8	0.28	U	0.11	0.11		5.6	0.64
2	Surficial(rep. 1)		9,190	0.45		66.5	0.45		0.53	0.082		11.6	0.62
2	Surficial(rep. 2)		14,000	0.74		291,000	216		1.9	0.17		21.3	1
2	0-61		23,500	1		231	6.9		2.8	0.17		23.6	3.8
2	61-117		24,500	1.2		419	8.1		3.3	0.18		21.4	4.4
3	Surficial(rep. 1)		19,400	0.75		226	8.8		0.48	0.19		102	1
3	Surficial(rep. 2)		22,000	0.88		141	10.2		0.38	0.19		105	1.2
3	0-61		20600	1		6.7	0.26	U	0.17	0.17		22.9	3.8
3	61-178		20,100	1.3		7.2	0.26	U	0.20	0.2		20.6	4.8
3	178-203		20,900	1.6		7.5	0.35	U	0.22	0.22		20.7	6
3	203-279		20,300	1.2		7.6	0.25	U	0.16	0.16		21.6	4.5
4	Surficial		21,700	0.86		196	10.1		0.55	0.16		90.9	1.2
4	0-61		23,000	1.2		8.6	0.27	U	0.15	0.15		20.1	4.3
4	61-178		22,000	1.2		7.6	0.24	U	0.18	0.18		22.2	4.6
4	178-287		22,700	0.88		6.4	0.19	U	0.12	0.12		22.6	3.2
4a (1)	0-4		29,100			296			2.251	2)		151	
4a (1)	4-8		25,000			249			1.892	2)		107	
4a (1)	8-13		28,400			277			3.759	2)		37	
4a (1)	13-23		27,600			222			3.609	2)		32	
4a (1)	23-33		25,800			19			0.102	2)		27	
4a (1)	33-43		27,200			14			0.0422	2)		24	
4a (1)	43-53		35,400			4			0.038	2)		29	
4a (1)	53-64		25,100			4			0.033	2)		28	
5	Surficial		21,500	0.8		178	9.3		0.72	0.15		49.2	1.1
5	0-61		20,400	0.8		7.1	0.3	U	0.16	0.16		23.7	1.1
5	61-244		20,200	0.69		7.6	0.29	U	0.15	0.15		22.8	0.97
5	244-306		21,200	0.7		6.7	0.34	U	0.13	0.13		24.0	0.98
6	Surficial		28,200	1.3		486	14.9		0.69	0.26		79.8	1.8
6	0-51		28,000	1.1		644	12.9		0.79	0.22		150	1.5
6	51-62		32,900	1.3		4500	15		1.1	0.34		523	1.8
7	0-30		26,400	1.1		7850	13.3		2.2	0.22		350	1.6
7	30-50		30,600	0.99		3670	11.6		1.7	0.2		383	1.4
8	Surficial		14,400	0.99		475	11.5		0.66	0.21		31.8	1.4
8	0-33		18,300	0.69		1260	8		2.1	0.13		46.7	0.96

Notes: Data Qualifier:U -conc. not detected at or above reported conc., -conc. equals reported conc;NC- Not Collected
(1)NYSDOH Data, (2)Brooks Rand,Ltd. Data

Table 2-1. Trace Metals Data, cont

Eighteenmile Creek/ Olcott Harbor Sediment Study

All Concentrations in mg/kg Dry Weight Basis

		Selenium, Total			Silver, Total			Zinc, Total		
Station No.	Depth(cm.)	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit	Data Qualifier	Conc.	Detection Limit
1	Surficial	U	0.38	0.38	U	0.48	0.48		53.7	0.42
2	Surficial(rep. 1)		0.45	0.36	U	0.47	0.47		128	0.41
2	Surficial(rep. 2)	U	0.62	0.62		4.1	0.77		252	0.68
2	0-61	U	0.53	0.53		2.0	0.67		299	0.77
2	61-117	U	0.60	0.6		1.0	0.79		401	0.9
3	Surficial(rep. 1)		0.75	0.59	U	0.78	0.78		746	0.69
3	Surficial(rep. 2)	U	0.73	0.73	U	0.92	0.92		611	0.8
3	0-61	U	0.59	0.59	U	0.68	0.68		67.3	0.78
3	61-178	U	0.60	0.6	U	0.86	0.86		66.0	0.98
3	178-203	U	0.80	0.8		1.8	1.1		68.2	1.2
3	203-279	U	0.56	0.56	U	0.81	0.81		67.4	0.92
4	Surficial		1.1	0.75	U	0.90	0.9		918	0.79
4	0-61	U	0.62	0.62	U	0.77	0.77		86.4	0.88
4	61-178	U	0.56	0.56	U	0.82	0.82		74.0	0.93
4	178-287	U	0.43	0.43		0.66	0.58		68.6	0.66
4a (1)	0-4	U	2		U	20			1080	
4a (1)	4-8	U	3		U	20			957	
4a (1)	8-13	U	4		U	20			483	
4a (1)	13-23	U	5		U	20			289	
4a (1)	23-33	U	6		U	10			91	
4a (1)	33-43	U	7		U	10			81	
4a (1)	43-53	U	8		U	20			79	
4a (1)	53-64	U	9		U	20			71	
5	Surficial		0.80	0.65	U	0.83	0.83		470	0.73
5	0-61	U	0.51	0.51	U	0.84	0.84		63.0	0.73
5	61-244	U	0.56	0.56	U	0.72	0.72		61.7	0.63
5	244-306	U	0.56	0.56	U	0.73	0.73		63.6	0.64
6	Surficial		1.7	1.1		2.0	1.3		1540	1.2
6	0-51		1.6	0.93		1.7	1.2		2360	1
6	51-62		2.3	1		5.7	1.3		16500	1.2
7	0-30		1.7	0.94		4.4	1.2		24000	1
7	30-50		1.3	0.81		4.2	1		10500	0.91
8	Surficial		1.4	0.79		2.1	1		423	0.9
8	0-33	U	0.55	0.55		4.2	0.72		874	0.63

Notes: Data Qualifier: U -conc. not detected at or above reported conc.; -conc. equals reported conc; NC- Not Collected
(1)NYSDOH Data, (2)Brooks Rand, Ltd. Data

TABLE 2-2. TRACE METALS RESULTS AT STATION 4a

EIGHTEENMILE CREEK/ OLCOTT HARBOR SEDIMENT STUDY

ALL CONCENTRATIONS REPORTED AS TOTALS IN MG/KG, DRY WEIGHT BASIS

SAMPLING DATE:MAY 25, 1994

Sample Depth(cm)	Mean Sample Depth(cm)	Aluminum	Antimony		Arsenic	Barium	Beryllium		Cadmium		Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
0-4	2	19,700	2	LT	7	228	2	LT	6	LT	9,710	128	15	228	29,100	296	6,390
4-8	6	17,300	2	LT	13	234	2	LT	5	LT	7,700	102	13	177	25,000	249	5,610
8-13	10	20,700	2	LT	13	315	2	LT	5	LT	4,500	88	13	131	28,400	277	6,460
13-23	18	17,200	2	LT	10	317	2	LT	5	LT	5,060	75	15	92	27,600	222	6,270
23-33	28	14,500	2	LT	5	128	1	LT	4	LT	14,600	21	12	22	25,800	19	6,530
33-43	38	15,200	2	LT	5	128	1	LT	4	LT	10,900	21	11	19	27,200	14	6,410
43-53	48	14,200	2	LT	6	117	2	LT	5	LT	21,700	19	13	20	35,400	4	6,360
53-64	58	13,000	2	LT	6	97	2	LT	6	LT	4,410	19	13	16	25,100	4	6,080

Sample Depth(cm)	Mean Sample Depth(cm)	Manganese	Mercury(1)	Molybdenum		Nickel	Potassium	Selenium		Silver		Sodium		Strontium	
0-4	2	409	2.251	40	LT	151	2630	2	LT	20	LT	1000	LT	100	LT
4-8	6	296	1.892	30	LT	107	2400	2	LT	20	LT	900	LT	90	LT
8-13	10	268	3.759	30	LT	37	3360	2	LT	20	LT	800	LT	80	LT
13-23	18	282	3.609	30	LT	32	2470	2	LT	20	LT	800	LT	80	LT
23-33	28	360	0.102	30	LT	27	2230	2	LT	10	LT	700	LT	70	LT
33-43	38	366	0.0422	30	LT	24	2200	2	LT	10	LT	700	LT	70	LT
43-53	48	392	0.038	40	LT	29	3120	2	LT	20	LT	900	LT	90	LT
53-64	58	307	0.033	30	LT	28	2510	2	LT	20	LT	800	LT	80	LT

Sample Depth(cm)	Mean Sample Depth(cm)	Total Organic Carbon (%) UV Oxidation	Thermal Cond.	Solids Dry(%)	Solids Volatile(%)	Thallium		Tin		Titanium	Vanadium	Zinc
0-4	2	1.3	5.3	41	11	5	LT	100	LT	160	31	1080
4-8	6	0.9	5.3	46	11	4	LT	90	LT	138	27	957
8-13	10	0.7	5.3	48	9	4	LT	80	LT	165	34	483
13-23	18	0.6	4.2	51	9	4	LT	80	LT	124	28	289
23-33	28	0.4	2.2	60	5	4	LT	70	LT	118	25	91
33-43	38	0.5	2.5	58	7	3	LT	70	LT	131	26	81
43-53	48	0.7	5.2	44	11	5	LT	90	LT	135	27	79
53-64	58	0.4	3.5	49	10	4	LT	80	LT	139	25	71

(1)-Analysis performed by Brooks Rand, Ltd.

LT-Less Than

Figure 2-1. Trace Metals Data

Olcott Harbor Sediment Study

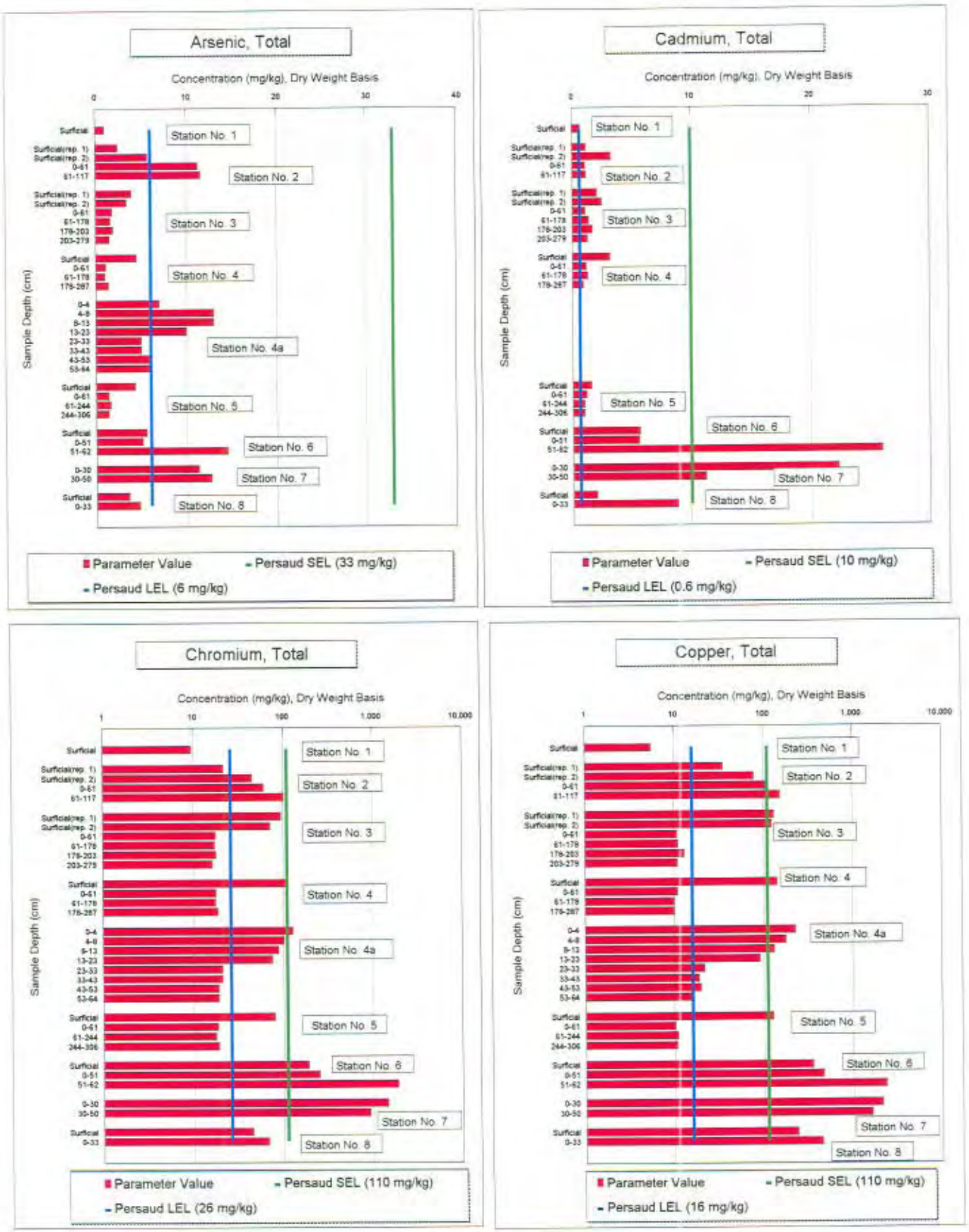


Figure 2-2. Trace Metals Data

Olcott Harbor Sediment Study

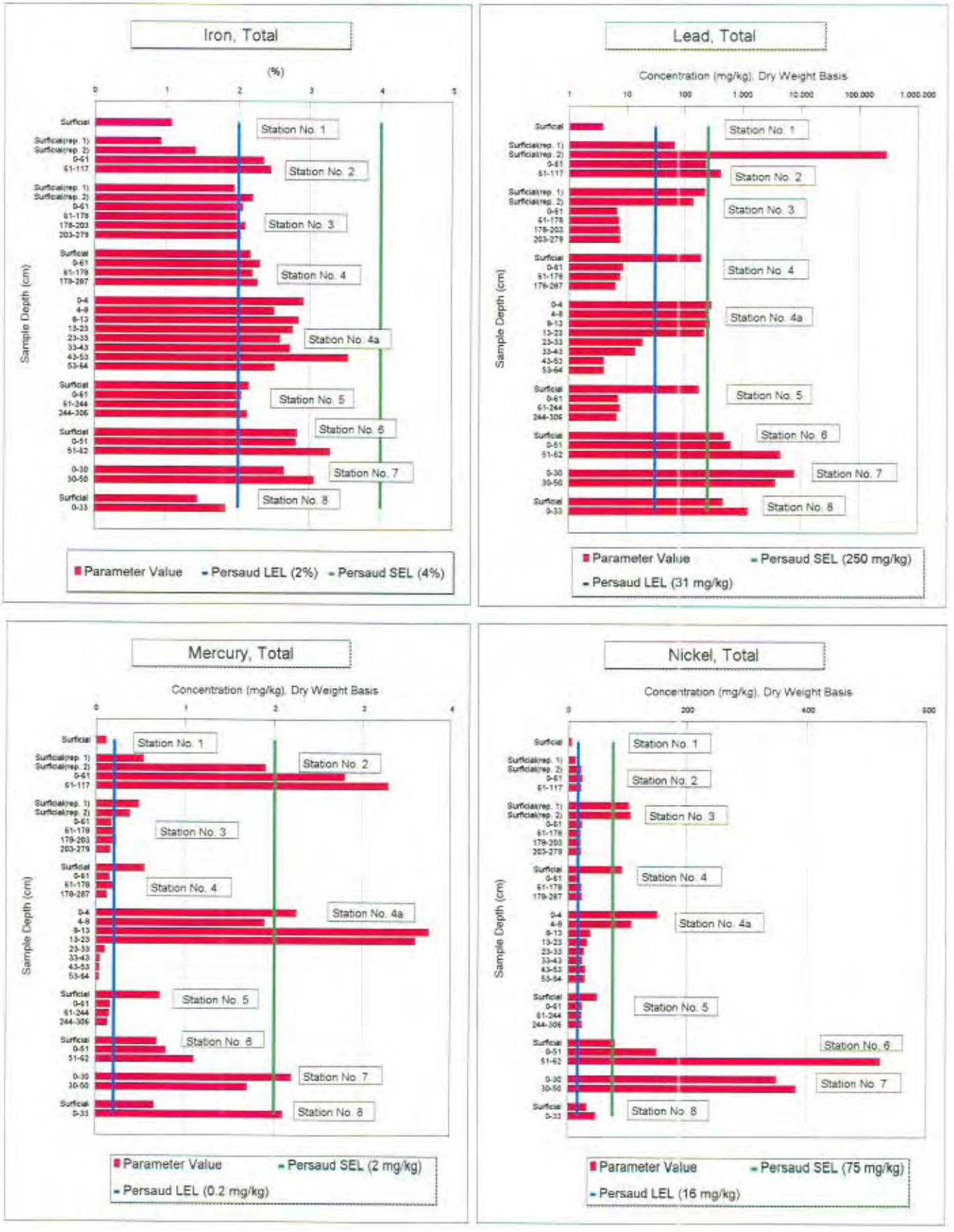
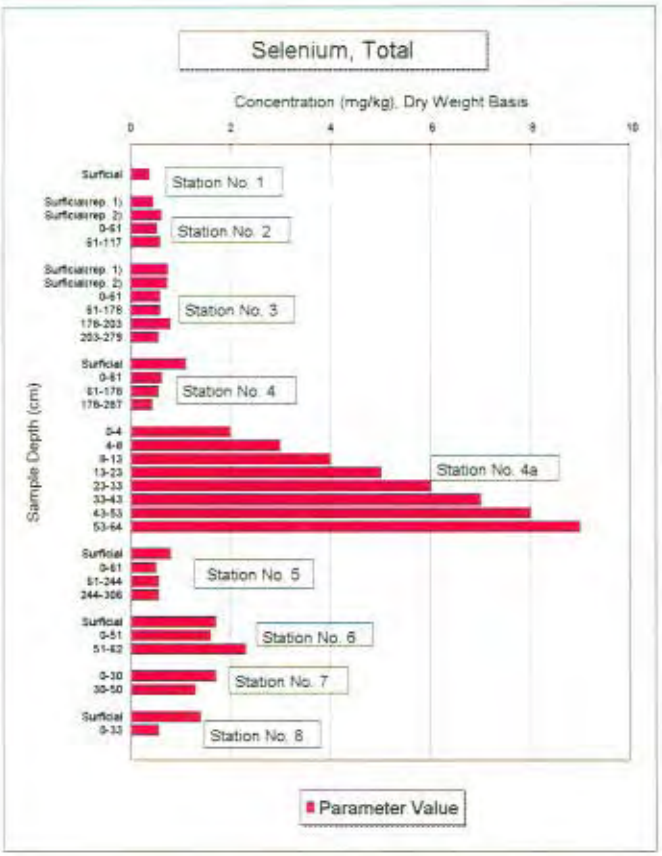
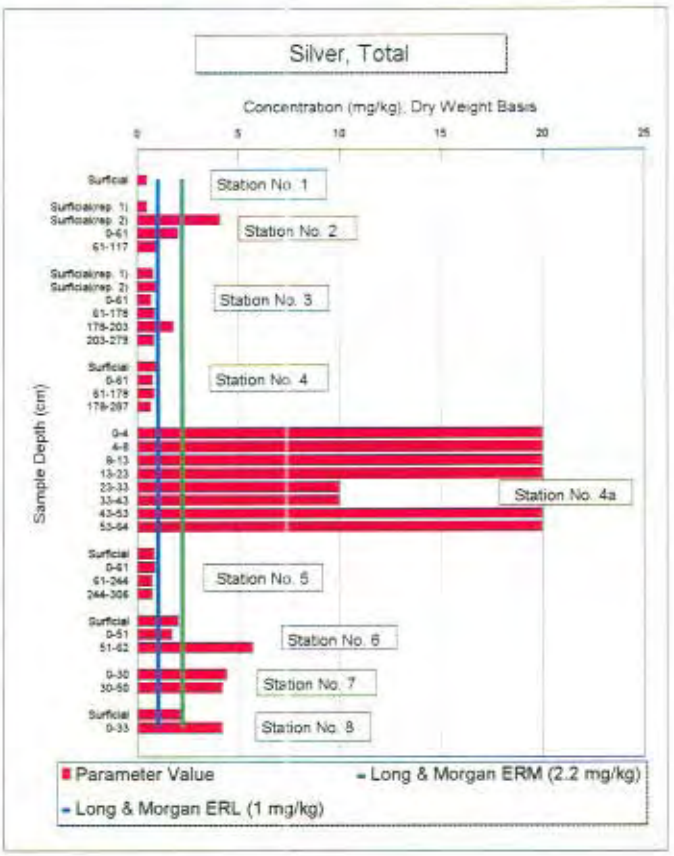
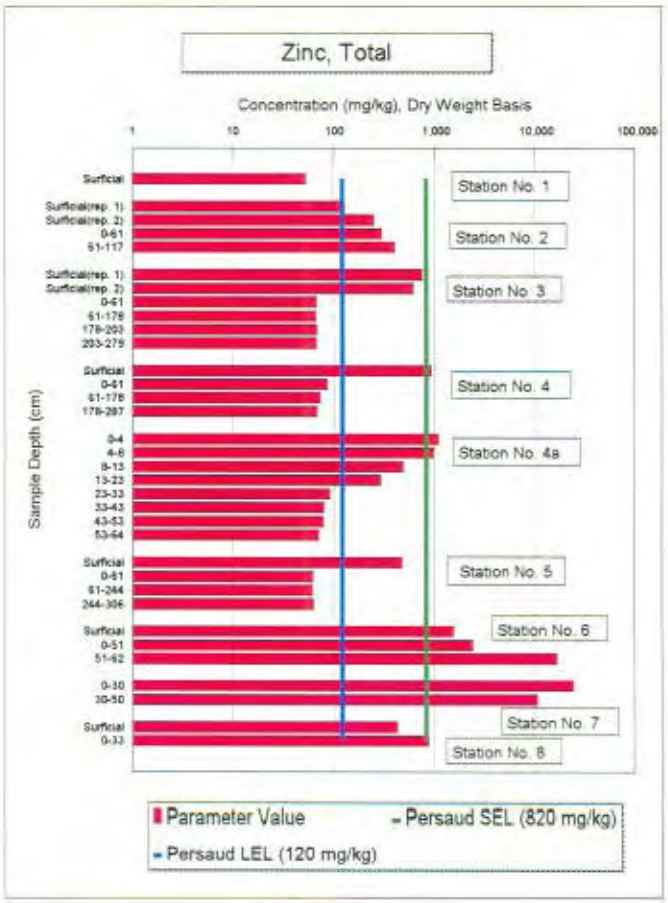


Figure 2-3. Trace Metals Data

Olcott Harbor Sediment Study







Persaud's SEL guidance values for cadmium (10 mg/kg), chromium (110 mg/kg), copper (110 mg/kg), lead (250 mg/kg), nickel (75 mg/kg), and zinc (820 mg/kg) were exceeded by greatest magnitude and frequency at Station Nos. 6 and 7. The SEL guidance value for mercury (110 mg/kg) and the ERM guidance value for silver (10 mg/kg) were exceeded by the greatest magnitude and frequency at Station Nos. 2 and 4, and Station No. 4a, respectively.

The highest concentrations of cadmium (26 mg/kg), chromium (1,910 mg/kg), copper (2,340 mg/kg), nickel (523 mg/kg), and zinc (24,000 mg/kg) were encountered at Station Nos. 6 and 7. Concentrations of these metals were high at these sites, which were located in depositional areas upstream of the Burt and Newfane Dams, respectively.

Total metals concentrations generally increased with depth at Station 6, indicating a history of prior contamination. It is unknown if the highest metals concentrations at this site were those observed in the deepest subsection sampled (51-62 cm) or if higher concentrations would be encountered in sediments buried deeper than 62 cm. This question can only be answered by collecting an additional sediment core from this site, whose length is greater in length than 62 cm.

The Station No. 7 results are also quite interesting. The core collected at this site was also relatively short (50 cm) as hand push cores were collected at both Station Nos. 6 and 7. These relatively short cores were all that could be collected at the time, as a boat launch, suitable for launching the EPA R/V Mudpuppy couldn't be found behind the Burt or Newfane Dams. It was uncertain, at the time of collection, if the push core sample collected from the stream bank at Station No. 7 would be representative of depositional sediments or the bank material from this site. Based upon the high metals concentrations reported at Station No. 7, it appears the core collected did provide good depositional sediments for analysis. In fact, the TOC concentrations in the two core subsection samples from this site were the highest observed during the study.

The highest concentration of lead measured during this study was found in a surficial sample collected at Station No. 2 (291,000 mg/kg, Replicate No. 2). The exceptionally high lead concentration observed in this sample is suspected to be an anomaly as a correspondingly high concentration was not encountered in the second field replicate sample collected at this site (66.5

mg/kg, Replicate No. 1). Additional sampling at this site would be necessary to confirm these results. Very high lead concentrations were also encountered in the sediment core samples collected at Station Nos. 6 and 7. The peak concentration observed at Station No. 6 (4,500 mg/kg) was found in the deepest subsection of the core collected at that site (51-62 cm). The highest concentration measured at Station No. 7 was 7,850 mg/kg. This concentration was observed in the uppermost subsample (0-30 cm) from that site.

Trace metals exceeding Persauds SEL guidance values include cadmium, chromium, copper, lead, mercury, nickel, silver and zinc. With the exceptions of lead, mercury, and silver, exceedance of SEL sediment guidance for these analytes was greatest at Stations 6 and 7. If the high lead concentration observed at Station 2 (Replicate No. 2) is discounted as an anomaly, then Persauds SEL guidance value for lead is also exceeded at Station Nos. 6 and 7.

The highest mercury concentrations measured during the study were found in the sediment core collected at Station No. 4a. This core was collected during the reconnaissance survey of May 25, 1994. Mercury concentrations were highest in the near-surface subsamples from this core. The highest concentration observed (3.8 mg/kg) was found in the 8-13 cm subsample depth. The source of mercury encountered at this site is unknown. However, the Burt Dam hydroelectric generating facility and several industrial facilities as well as Lockport STP are located upstream from this site.

Similarly high mercury concentrations were not observed in the samples collected at Station Nos. 4 and 5. It can be seen, however, that the mercury data presented in Figure 2-2 show the highest concentrations were measured in the near-surface core subsections. It is unknown whether resuspension and transport downstream of more highly contaminated sediments from behind the Burt and Newfane Dams could be responsible for the surficial contamination observed at Station No. 5 and other downstream sites. These sediments could have passed through the Burt Dam when it was refurbished in the late 1980's.

Although Station Nos. 4 and 4a were located approximately 50 meters apart, there was little correlation between the mercury concentrations measured at these sites. Sediment samples

from these sites were collected on different dates and analyzed by different laboratories. Also, considerable variability between the total organic carbon (TOC) concentrations at these sites was observed. Further sampling at this location would need to be performed to refine these results. This information would be necessary for developing an estimate of the volume of contaminanted sediment.

Mercury concentrations were also quite high further downstream at Station No. 2. The concentration of this trace metal increases with depth at Station No. 2. It is unknown if the highest mercury concentration at this site is the 3.3 mg/kg found in the core subsample collected at the 61-117 cm depth or if higher concentrations would be encountered at deeper depths. Again, this question can only be answered by analyzing a longer (deeper) core at Station No. 2.

To better understand, in a quantitative sense, the period in which peak trace metals concentrations occurred, radionuclide dating techniques were employed for this study. A second (field replicate) sediment core was collected at Station No. 5 and radiodated using Cesium-137 and Beryllium-7 as tracers. Cesium-137 and Beryllium-7 levels were enumerated in eight sediment core subsections. Unfortunately, the radiodating results were inconclusive, as the Beryllium-7 and Cesium-137 concentrations were determined to be at background levels in each subsection analyzed. It is unclear why these radionuclide levels were so low. Complete radionuculide dating results from this study are presented in Appendix A.

Included with the Application for Exemption for the Burt Dam Hydroelectric Project (FERC, 1983) are results of sediment sampling performed by the applicants environmental consultant, E. C. Jordan. Nine two-foot sediment cores were collected immediately upstream of the existing Dam while three were collected in the tailrace. Cores collected upstream of the dam were taken at 100-foot intervals. The cores were then composited into four samples and analyzed. With the exception of mercury, metals concentrations reported by E. C. Jordan are similar in concentration to the findings of this study. All mercury concentrations evaluated during that study were reported to be less than 1 mg/kg (dry weight basis). A complete summary of the E. C. Jordan sediment sampling results, and a sampling location map is presented in Appendix B.

Chapter 3 -Pesticides

All surficial and sediment core subsamples were analyzed for pesticides and PCB Aroclors using EPA Method 8080. Dual column, electron capture gas chromatography was employed. PCB Aroclor results are summarized with the PCB congener data in Chapter 4. Complete pesticide and PCB Aroclor analytical results are presented in Appendix C.

Very few samples collected during the study were found to have pesticide concentrations greater than analytical detection limits. As such, only those samples with concentrations reported to be greater than detection limits have been summarized in Table No. 3-1.

Of the few pesticide compounds detected, 4,4'-DDT (DDT) and its metabolites 4,4'-DDD (DDD) and 4,4'-DDE (DDE) were the most prevalent. Aldrin and endosulfan II were also detected, but only at one station each and at trace concentrations.

DDT, an insecticide, was banned in lake trout producing waters in New York State in 1965. It is a persistent chlorinated compound that slowly metabolizes to DDD and DDE. Due to its propensity to metabolize, one would expect to find higher concentrations of metabolites than parent material if no additional DDT had been applied in the recent past.

The DDT results presented in Table 3-1, especially those data observed at Station Nos. 2, 3, 4, and 5 show only metabolized DDE compounds were found at these sites. This suggests the DDT metabolites encountered at these sites are the result of historic applications.

In addition, DDT, DDD, and DDE compounds were reported in surficial and sediment core samples collected at Station Nos. 6, 7, and 8. Upon review of the data presented in Table 3-1, it can be seen that DDT concentrations at these sites increase with depth. Based upon these data, it is suspected that higher concentrations might be found in the deeper sediments at these sites.

Table 3-1. Pesticide Results

Olcott Harbor Sediment Study

All concentrations ug/kg, dry weight unless otherwise noted

DDT and Metabolites

Station No.	Depth(cm)	DDT	DDD	DDE	---DDT + DDD + DDE---- Sample Concentration	Sediment Guideline(1)	TOC(%)
2	surficial	U	U	3.6 (J)	1.8 (2)	0.315	3.15
2(replicate no 1)	surficial	U	U	8.7	8.7	0.286	2.86
3	surficial	U	U	11	11	0.308	3.08
3(replicate no 1)	surficial	U	U	7 (J)	3.5 (2)	0.253	2.53
4	surficial	U	U	16	16	0.217	2.17
5	surficial	U	U	7.9	7.9	0.357	3.57
6	surficial	12	U	18	30	0.282	2.82
6	51-62	21	U	280	301	0.297	2.97
7	0-30	U	31	U	31	1.07	10.7
7	30-50	16	U	36	52	1.32	13.2
8	surficial	7.5 (J)	9	U	12.75 (2)	0.538	5.38
8	0-33	62	59	U	121	0.524	5.24

Aldrin

Station No.	Depth(cm)	Sample Concentration	Sediment Guideline(3)	TOC(%)
2(replicate no 1)	surficial	2.7 (J)	3.15	3.15

Endosulfan II

Station No.	Depth(cm)	Sample Concentration	Sediment Guideline(4)	TOC(%)
3	surficial	5.8 (J)	0.924	3.08

Notes: (1) NYSDEC site specific concentration based on human health bioaccumulation guidance of 0.01 ug of contaminant per gram of organic carbon.

(2) Includes 50% of reported trace concentrations.

(3) NYSDEC site specific concentration based on human health bioaccumulation guidance of 0.1 ug of contaminant per gram of organic carbon.

(4) NYSDEC site specific concentration based on benthic aquatic life cronic toxicity guidance of 0.03 ug of contaminant per gram of organic carbon.

U-Indicates compound analyzed,but not detected.
J-Trace concentration, compound present but below detection limit.

The highest concentrations of DDT (62 ppb) and DDD (59 ppb) measured during the study were in the 0-33 cm depth subsample collected at Station No. 8

Station No. 8, the most upstream site sampled, was located just downstream of the Clinton Street Bridge in Lockport, New York. The source(s) of the pesticides observed in this sample is unknown; however, flow from the New York State Erie Canal feeds Eighteenmile Creek at a location immediately upstream of the Clinton Street crossing.

Upon further review of the Station Nos. 2, 3, 4, and 5 results, it can be seen that the DDD and DDE encountered was found only in the surface samples from these sites. Surficial sediment samples typically represent the most recent deposition, and it is not expected sediments contaminated with "old" metabolized DDT (from the 1960's) would still be found on the surface. It is possible that overlying sediments at these sites were scoured away, exposing these "older" contaminated sediments. It is also possible these surficial sediments were contaminated elsewhere and recently deposited at Station Nos. 2, 3, 4, and 5. Potential sources of pesticide contamination include surface runoff of new pesticide application(s), non-point source runoff of previously contaminated soils, instream resuspension of previously contaminated sediments, and atmospheric deposition of contaminated particles.

Evaluation of several of these potential sources, including: atmospheric deposition, surface water runoff monitoring, and an evaluation of water column dissolved and particulate pesticide concentrations was not conducted as part of this study. However, upon further review of the data presented in Table 3-1, it can be seen that much higher concentrations of DDE are present in sediments buried upstream at Station No. 6. It is suspected that sediments from this location might have been resuspended during a high flow event and may be the source of the DDE contamination observed downstream at Station Nos. 2, 3, 4, and 5.

Pesticide results were also evaluated to determine whether reported concentrations exceeded NYSDEC Divisions of Water and Fish and Wildlife sediment screening guidelines

(NYSDEC, 1993). These guidelines are included in Table 3-1. The pesticides and associated metabolites measured do exceed the NYSDEC human health (bioaccumulation) guidelines by one to three orders of magnitude. It should be noted that basically any detectable level of pesticide compound reported would exceed the sediment guidance for human bioaccumulation since the analytical reporting levels are generally greater than the corresponding human bioaccumulation values. The highest concentrations of these compounds were, as previously reported, found in the deeper sediments at Station Nos. 6 (Burt Dam) and 8 (impoundment immediately downstream of Clinton Street).

It is suspected that the sediments buried in the 51-62 cm depth at Station No. 6 will remain immobile, unless a high flow event were to resuspend them. Furthermore, it is unknown if peak pesticide concentrations at Station Nos. 6 and 8 are represented in the results from the deepest subsamples collected at these sites (51-62 cm and 0-33 cm, respectively) or if they occur in the deeper sediments not sampled at these sites. Only the collection of additional deeper cores from these sites will answer this question. Also, the sediment core collected at Station No. 7 was collected from shore, and it is recommended that additional core sampling be performed at this site to further evaluate the depositional sediments located behind the Newfane Dam. This site is only accessible by boat which must be portaged a few hundred meters. Such sampling would be necessary to adequately characterize the potentially large volume of sediments trapped by the Newfane Dam.

Chapter 4 -Polychlorinated Biphenyls

For this study, PCBs were analyzed in sediments using two analytical methods, EPA SW-846-8080 and NYSDEC ASP 91-11. Since organochlorine pesticides were also being analyzed as part of the study, using EPA SW-846-8080 produced both pesticide and Aroclor PCB results.

Method 91-11 was performed because many times it produces more detailed information. Besides giving analytical results for many individual congeners (which is useful in source trackdown, transport, and fate studies), it usually provides data with lower analytical reporting levels.

The analytical results from this study are listed in Tables 4-1 (surficial samples) and 4-2 (core samples).

These results are evaluated using two independent sediment assessment protocols. One set of values were developed within the New York State Department of Environmental Conservation (Division of Fish and Wildlife) and are documented in a 1993 publication. This assessment uses two guidance values; one for human health bioaccumulation and a second for wildlife bioaccumulation. These guidance values were derived using equilibrium partitioning methodology and are calculated as a function of the organic carbon content of the sediment being evaluated.

The second set of guidance values used were documented by Persaud, et al. (1993). This guidance contributed three assessment values; one for a no-effect level (NEL), another for a lowest-effect level (LEL) and a third for severe-effects (SEL). These guidance values were formulated from field data (contaminant concentrations and in-situ benthic invertebrate abundance counts) and defined as 10th (lowest-effect) and 90th (severe-effect) percentiles of the database. The severe-effect guidance is a function of organic carbon concentration.

Table 4-1. Surficial Sediment Results and Selected Guidance Values for Characterizing PCB Concentrations in Sediments
Eighteenmile Creek Sediment Study

All Concentrations in µg/g Dry Weight Basis Unless Otherwise Noted

		Analytical Results			NYSDEC Technical Bioaccumulation Guidance		Persaud's Provisional Sediment Guidlines		
Station No.	Location	Sum of Congeners	Aroclors	TOC(%)	Human	Wildlife	NEL	LEL	SEL
1	Lake Ontario East of Breakwater	NA	ND(<0.039)	0.4	0.000003	0.006	0.01	0.07	2.12
2	In Olcott Harbor Turning Basin	0.045	ND(<0.040)	3.2	0.000026	0.045	0.01	0.07	16.96
2	(Replicate)	0.061	ND(<0.067)	NA					
3	In Town of Newfane Marina	0.361	1248- 0.46 1254- 0.16	3.1	0.000025	0.043	0.01	0.07	16.43
3	(Replicate)	0.148	1248- 0.39 1254- 0.14	NA					
4	400 m upstream of Rt. 18 Bridge	NA	1248- 0.63 1254- 0.23	2.2	0.000018	0.031	0.01	0.07	11.66
5	Downstream of Burt Dam	NA	1248- 0.42 1254- 0.21	3.6	0.000029	0.05	0.01	0.07	19.08
6	In Burt Dam Pool	NA	1248- 1.90 1254- 0.59	2.8	0.000022	0.039	0.01	0.07	14.84
8	Downstream of Clinton St. Bridge	1.672	1248- 1.2 1260- 0.19	5.8	0.000046	0.081	0.01	0.07	30.74

NA- Not Analyzed ND- Not Detected - Referenced Guidance Value Exceeded

Table 4-2. Sediment Core Results and Selected Guidance Values For Characterizing PCB Concentrations in Sediments Eighteenmile Creek Sediment Study

All Concentrations in µg/g Dry Weight Basis Unless Otherwise Noted

			Analytical Results			NYSDEC Technical Bioaccumulation Guidance		Persaud's Provisional Sediment Guidlines		
Station No.	Location	Sample Depth (cm)	Sum of Congeners	Aroclors	TOC(%)	Human	Wildlife	NEL	LEL	SEL
2	In Olcott Harbor Turning Basin	0-61	ND	ND(<0.061)	1.9	0.000015	0.027	0.01	0.07	10.07
		61-117	0.00036	ND(<0.063)	1.5	0.000012	0.021	0.01	0.07	7.95
3	In Town of Newfane Marina	0-61	ND	ND(<0.066)	4.1	0.000033	0.057	0.01	0.07	21.73
		61-178	ND	ND(<0.070)	4.4	0.000035	0.062	0.01	0.07	23.32
		178-203	ND	ND(<0.086)	2.8	0.000022	0.039	0.01	0.07	14.84
		203-279	ND	ND(<0.064)	3.9	0.000031	0.055	0.01	0.07	20.67
4	400 m upstream of Rt. 18 Bridge	0-61	ND	ND(<0.068)	1.7	0.000014	0.024	0.01	0.07	9.01
		61-203	ND	ND(<0.065)	1.6	0.000013	0.022	0.01	0.07	8.48
		203-287	ND	ND(<0.052)	2.5	0.00002	0.035	0.01	0.07	13.25
5	Downstream of Burt Dam	0-61	ND	ND(<0.060)	4.9	0.000039	0.069	0.01	0.07	25.97
		61-244	ND	ND(<0.062)	2.8	0.000022	0.039	0.01	0.07	14.84
		244-306	ND	ND(<0.061)	4	0.000032	0.056	0.01	0.07	21.2
6	In Burt Dam Pool	0-51	1.812	1248-1.8 1254-0.62	4.4	0.000035	0.062	0.01	0.07	23.32
		51-62	11.244	1248-27 1260-0.72	3	0.000024	0.042	0.01	0.07	15.9
7	In Newfane Dam Pool	0-30	10.075	1248-23 1260-0.93	10.7	0.000086	0.15	0.01	0.07	56.71
		30-50	14.79	1248-22 1260-0.56	13.2	0.000106	0.185	0.01	0.07	69.96
8	Downstream of Clinton St. Bridge	0-33	3.379	1248-8.6 1260-0.27	5.2	0.000042	0.073	0.01	0.07	27.56

ND- Not Detected

- Referenced Guidance Value Exceeded

Surficial Sample Results

The replicate samples at stations 2 and 3 indicate little spatial variability for PCBs.

Most sampling stations have PCB concentrations that exceed DEC's human and wildlife bioaccumulation guidance values and Persaud's no- and low-effects levels (see note 1).

No surficial results approached Persaud's severe-effects level.

Core Results

Between stations 2 and 5 there was only one detectable level of PCB's in any core sub-section.

Between stations 6 and 8 the sub-surface concentrations of PCBs are quite high (Aroclor 1248 at 22, 23 and 27 ppm). The severe-effects level of Persaud was exceeded in the Burt Dam pool core between 51 and 62 cm.

NOTE 1 - Even though there are numerous exceedences of DEC's wildlife and human bioaccumulation guidelines and Persaud's no- and low-effects levels, these guidance values are low enough that any quantity of PCB detected by the Aroclor method is likely to exceed these values. It is also likely that many of the congener results with all "less than" values may actually contain enough total PCB to exceed the human bioaccumulation level.

Observations

For the surficial samples, the Aroclors detected at stations 3 thru 6 were 1248 and 1254. The Aroclors identified at station 8 were 1242 and 1260.

For the core sub-sections at stations 6, 7 and 8, the uppermost section at station 6 contained detectable levels of Aroclors 1248 and 1254. All other subsections at these three sites had detectable levels of Aroclors 1248 and 1260. This pattern is consistent. Its cause is unknown. The dominant Aroclor for all these results was

1248.

The concentrations of PCB's in the Burt and Newfane Dam pools warrant additional monitoring to further characterize spatial/temporal extent, impacts and likely sources.

Chapter 5 - Dioxins/Furans

The dioxin and furan analytes were measured using EPA method 1613A. This analytical procedure produces fifteen 2,3,7,8-substituted congener and ten tetra- through octa- homolog results. The results are shown in Table 5-1.

The dioxin/furan results will be elevated from three different perspectives; analytical concentrations, toxic equivalencies and percent abundance patterns.

1. Analytical Concentrations

For this report, the following qualitative designations have been used to evaluate the dioxin and furan homolog concentrations. They are based on analytical results of sediments sampled by NYSDEC from around New York State.

tetra- through octa- dioxin homolog totals:

≤1,000 ppt	low, background type
>1,000 ppt and <25,000 ppt	moderate
≥25,000 ppt	high

tetra- through octa- furan homolog totals:

≤100 ppt	low, background type
>100 ppt and <2,500 ppt	moderate
≥2,500 ppt	high

The exceptions to the low, background concentrations are a moderate furan level in the lower subsample collected in the Olcott Harbor Turning Basin (Site 2) and high concentrations of dioxins and furans in all core subsections collected from the Burt Dam pool (Site 6), the Newfane Dam pool (Site 7) and in Eighteenmile Creek downstream of Clinton Street bridge (Site 8).

2. Toxic Equivalencies

Toxic equivalency is a methodology that quantifies the toxicity of 2,3,7,8-substituted dioxin and furan congeners by proportionalizing their toxicities to 2,3,7,8-TCDD. These values can then be summed and the total represents the aggregate toxicity of the various 2,3,7,8-substituted congeners.

The toxic equivalency values used in this report are the International Toxicity Equivalency Factors (NATO, 1988) used by both the US EPA and the New York State Department of Health.

To offer some evaluation of the equivalency values, they will be compared to human health and wildlife bioaccumulation sediment guidance values that are presented in a DEC publication, Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1993). These values are based on equilibrium partitioning methodology and are a function of the organic carbon content of the sediment being evaluated.

The respective toxic equivalency, organic carbon, and calculated guidance values are listed in Table 5-1. These results show that all core subsections collected from the Burt Dam pool (Site 6), the Newfane Dam pool (Site 7) and in Eighteenmile Creek downstream of the Clinton Street bridge (Site 8), as well as the lower subsection sample collected in the Olcott Harbor Turning Basin, exceeded the NYSDEC wildlife bioaccumulation guidance value. The lower subsection sample from the Burt Dam pool was contaminated enough to exceed the NYSDEC human bioaccumulation guidance level.

All other core subsamples contained dioxin and furan concentrations that should be considered as at low or background levels.

The relative toxicity of the dioxin and furan 2,3,7,8-substituted congeners from Sites 6, 7 and 8 are also of interest. The toxic equivalence of the upper Burt Dam pool subsection and the Clinton Street bridge sample are generally split between the dioxin and furan compounds. The major portion of the toxic equivalence of the lower Burt Dam pool subsection is provided by the furan congeners, while the Newfane Dam pool samples toxic equivalence is dominated (>85%) by the 2,3,7,8-substituted dioxin congeners.

3. Percent Abundance Patterns

Percent abundance patterns are useful in characterizing the composition of complex compounds such as dioxins, furans, and PCBs. Percent abundances are calculated by dividing each individual congener and/or homolog concentration by a respective total. These percent abundance values can then be arranged in a fixed sequence which establishes a pattern. This pattern can be used to compare the similarity or divergence of the analytical results of multiple samples.

For the evaluation of the Eighteenmile Creek/Olcott Harbor data two separate patterns were established. The first used the fifteen 2,3,7,8-substituted congener results by dividing each congener's analytical value by its respective homolog total. The second pattern used the ten homolog results for the dioxins/furans, and divided each individual value by the relative total of the tetra- through octa- homologs of the respective compound. Five additional values were added to this second data string. These numbers represent the ratio of each dioxin homolog to the total concentration of the respective dioxin plus furan homologs (e.g. TCDD/(TCDD + TCDF)).

It was eventually determined that there was little assessment utility of the congener strings because of the numerous "less than" results for the 2,3,7,8-substituted congeners. The homolog data set also contained many "less than" results and because of this, only five core subsections had enough positive results to calculate authentic percent abundance patterns. These included: the Burt Dam pool(2), the Newfane Dam pool (2), and Eighteenmile Creek

below Clinton Street bridge (1). The numerical results of these patterns are listed in Table 5-2. The graphical representation of this data is shown in Figure 5-1.

The homolog patterns of the five samples are practically identical for the dioxin and furan homolog totals. These percent abundance patterns show the characteristics that are typically found in sediments and are thought to be produced by contamination from multiple combustion sources. The dioxins are dominated by the octa-homolog and the furans by the hepta- and octa-homolog. One interesting characteristic of the furan concentrations with these samples, is relative dominance of the hepta-homolog as compared to the other furan homologs, even the octa-homologs.

The only divergence within the percent abundance patterns occurs in the homolog ratio section. The homolog ratios show that the furans are more abundant in the lower chlorinated homologs (tetra-, penta-), while the dioxins dominate the higher chlorinated (hepta, octa-). The samples from the Newfane Dam pool and the lower subsection from the Burt Dam pool are graphically different from all the others.

Observations

The relative concentrations, toxic equivalency ratios, and the percent abundance patterns of the dioxins and furans from the Newfane Dam pool core subsamples are dissimilar to those associated with the sediment cores collected in the Burt Dam pool (downstream) and near the Clinton Street bridge (upstream).

However, a surficial sediment sample collected from the Newfane Dam pool (Estabrooks, et al., 1991) corresponds closely with the Burt and Clinton Street samples. Without radio-dated cores, better spatial data or a more detailed industrial/discharge/dumping history in this area, it is virtually impossible to reasonably speculate as to a cause for these data patterns.

There are, however, enough elevated concentrations of dioxins and furans within the

Burt and Newfane Dam pools to warrant further study to better define the spatial and temporal distribution of these contaminants, given the proximity of the Olcott Harbor AOC.

Table 5-1. Dioxin/Furan Data
Olcott Harbor Sediment Study
Station No. 2; Olcott Harbor

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-61	61-117
2,3,7,8-TCDD		< 0.67	< 0.5
1,2,3,7,8-PeCDD		< 0.78	< 0.7
1,2,3,4,7,8-HxCDD		< 0.78	< 0.5
1,2,3,6,7,8-HxCDD		< 1	< 1.3
1,2,3,7,8,9-HxCDD		< 1.4	< 1.6
1,2,3,4,6,7,8-HpCDD		< 9	< 10
2,3,7,8-TCDF		21	41
1,2,3,7,8-PeCDF		< 7.2	12
2,3,4,7,8-PeCDF		< 4.5	< 8.7
1,2,3,4,7,8-HxCDF		< 7.7	13
1,2,3,6,7,8-HxCDF		< 2.3	< 4
1,2,3,7,8,9-HxCDF		< 1.6	< 1.7
2,3,4,6,7,8-HxCDF		< 2.8	< 4.4
1,2,3,4,6,7,8-HpCDF		< 5.6	11
1,2,3,4,7,8,9-HpCDF		< 1.2	< 1.2
TCDDs (total)		< 1.5	< 2.1
PeCDDs (total)		< 0.92	< 2.2
HxCDDs (total)		< 2.1	< 3.3
HpCDDs (total)		12	13
OCDD		480	490
TCDFs (total)		66	180
PeCDFs (total)		< 7.2	26
HxCDFs (total)		< 7.7	13
HpCDFs (total)		< 5.6	11
OCDF		< 5.8	< 11

Data Summary(1)

Tetra thru Octa Homolog Totals		
Dioxin Homologs	492	503
Furan Homologs	66	230
Sum	558	733
2,3,7,8-TCDD Toxic Equivalence(2)	2.58	6.6
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)		
Human Bioaccumulation(sc=10,000 pg/gOC)	191	151
Wildlife Bioaccumulation(sc=200 pg/gOC)	3.82	3
Total Organic Carbon(%)	1.91	1.5

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.
Olcott Harbor Sediment Study
Station No. 3; Olcott Harbor

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-61	61-178	178-203	203-279
2,3,7,8-TCDD		< 0.25	< 0.23	< 0.18	< 0.35
1,2,3,7,8-PeCDD		< 0.26	< 0.25	< 0.34	< 0.33
1,2,3,4,7,8-HxCDD		< 0.44	< 0.48	< 0.46	< 0.44
1,2,3,6,7,8-HxCDD		< 0.58	< 0.59	< 0.56	< 0.54
1,2,3,7,8,9-HxCDD		< 0.38	< 0.48	< 0.46	< 0.44
1,2,3,4,6,7,8-HpCDD		14	< 9.8	< 8.5	< 7.2
2,3,7,8-TCDF		< 0.22	< 0.17	< 0.23	< 0.25
1,2,3,7,8-PeCDF		< 0.14	< 0.17	< 0.23	< 0.16
2,3,4,7,8-PeCDF		< 0.15	< 0.15	< 0.23	< 0.15
1,2,3,4,7,8-HxCDF		< 0.18	< 0.26	< 0.41	< 0.14
1,2,3,6,7,8-HxCDF		< 0.14	< 0.39	< 0.36	< 0.12
1,2,3,7,8,9-HxCDF		< 0.21	< 0.34	< 0.51	< 0.19
2,3,4,6,7,8-HxCDF		< 1	< 0.98	< 1.1	< 1
1,2,3,4,6,7,8-HpCDF		< 0.48	< 0.59	< 0.36	< 0.69
1,2,3,4,7,8,9-HpCDF		< 0.55	< 0.43	< 0.66	< 0.18
TCDDs (total)		< 1.1	< 0.94	< 1.3	< 0.83
PeCDDs (total)		< 0.4	< 0.34	< 0.34	< 0.33
HxCDDs (total)		< 1.4	< 1.1	< 1	< 1.2
HpCDDs (total)		14	< 9.8	< 8.5	< 7.2
OCDD		370	280	290	330
TCDFs (total)		< 0.22	< 0.23	< 0.29	< 0.25
PeCDFs (total)		< 0.15	< 0.18	< 0.82	< 0.16
HxCDFs (total)		< 1	< 0.98	< 1.1	< 1
HpCDFs (total)		< 0.55	< 0.59	< 0.66	< 0.69
OCDF		< 0.36	< 0.44	< 1.1	< 0.87

Data Summary(1)

Tetra thru Octa Homolog Totals				
Dioxin Homologs		384	280	290	330
Furan Homologs		0	0	0	0
		384	280	290	330
2,3,7,8-TCDD Toxic Equivalence(2)		0.51	0.28	0.29	0.33
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)					
Human Bioaccumulation(sc=10,000 pg/gOC)		412	440	279	393
Wildlife Bioaccumulation(sc=200 pg/gOC)		8.24	8.8	5.58	7.86
Total Organic Carbon(%)		4.12	4.4	2.79	3.93

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.

Olcott Harbor Sediment Study

Station No. 4; Eighteenmile Creek

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-61	61-178	178-287
2,3,7,8-TCDD		< 0.2	< 0.36	< 0.43
1,2,3,7,8-PeCDD		< 0.41	< 0.18	< 0.15
1,2,3,4,7,8-HxCDD		< 0.57	< 0.5	< 0.52
1,2,3,6,7,8-HxCDD		< 0.7	< 0.6	< 0.65
1,2,3,7,8,9-HxCDD		< 0.57	< 0.5	< 0.52
1,2,3,4,6,7,8-HpCDD		11	9.9	< 3
2,3,7,8-TCDF		< 0.25	< 0.36	< 0.18
1,2,3,7,8-PeCDF		< 0.25	< 0.22	< 0.17
2,3,4,7,8-PeCDF		< 0.23	< 0.22	< 0.15
1,2,3,4,7,8-HxCDF		< 0.37	< 0.31	< 0.15
1,2,3,6,7,8-HxCDF		< 0.17	< 0.16	< 0.081
1,2,3,7,8,9-HxCDF		< 0.17	< 0.13	< 0.074
2,3,4,6,7,8-HxCDF		< 0.98	< 0.92	< 0.75
1,2,3,4,6,7,8-HpCDF		< 2.9	< 2	< 0.6
1,2,3,4,7,8,9-HpCDF		< 3.1	< 0.16	< 0.74
TCDDs (total)		< 0.88	< 0.82	< 0.77
PeCDDs (total)		< 0.41	< 0.55	< 0.34
HxCDDs (total)		< 1.6	< 1.6	< 1.3
HpCDDs (total)		21	9.9	< 5.1
OCDD		290	270	110
TCDFs (total)		< 0.29	< 0.36	< 0.18
PeCDFs (total)		< 0.25	< 0.22	< 0.17
HxCDFs (total)		< 1	< 0.92	< 0.75
HpCDFs (total)		< 4.2	< 5.2	< 0.74
OCDF		< 4.3	< 2.8	< 0.45

Data Summary(1)

Tetra thru Octa Homolog Totals			
Dioxin Homologs	311	280	110
Furan Homologs	0	0	0
	311	280	110
2,3,7,8-TCDD Toxic Equivalence(2)	0.4	0.369	0.11
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)			
Human Bioaccumulation(sc=10,000 pg/gOC)	169	160	250
Wildlife Bioaccuumulation(sc=200 pg/gOC)	3.38	3.2	5
Total Organic Carbon(%)	1.69	1.6	2.5

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.
Olcott Harbor Sediment Study
Station No. 5; Eighteenmile Creek

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-61	61-244	244-306
2,3,7,8-TCDD		< 0.63	< 0.27	< 0.39
1,2,3,7,8-PeCDD		< 0.83	< 0.16	< 0.24
1,2,3,4,7,8-HxCDD		< 0.79	< 0.39	< 0.52
1,2,3,6,7,8-HxCDD		< 1.1	< 0.46	< 0.63
1,2,3,7,8,9-HxCDD		< 0.53	< 1	< 0.5
1,2,3,4,6,7,8-HpCDD		19	10	11
2,3,7,8-TCDF		< 0.62	< 0.18	< 0.27
1,2,3,7,8-PeCDF		< 0.53	< 0.12	< 0.21
2,3,4,7,8-PeCDF		< 0.37	< 0.15	< 0.19
1,2,3,4,7,8-HxCDF		< 0.83	< 0.25	< 0.38
1,2,3,6,7,8-HxCDF		< 0.3	< 0.21	< 0.14
1,2,3,7,8,9-HxCDF		< 0.32	< 0.27	< 0.13
2,3,4,6,7,8-HxCDF		< 1.8	< 0.94	< 0.9
1,2,3,4,6,7,8-HpCDF		12	< 2	< 2.3
1,2,3,4,7,8,9-HpCDF		< 0.49	< 0.2	< 0.29
TCDDs (total)		< 0.83	< 0.96	< 1.1
PeCDDs (total)		< 0.9	< 0.57	< 0.48
HxCDDs (total)		< 3.3	< 1.6	< 1.5
HpCDDs (total)		39	10	11
OCDD		290	210	250
TCDFs (total)		< 0.76	< 0.23	< 0.38
PeCDFs (total)		< 0.62	< 0.2	< 0.21
HxCDFs (total)		< 2.8	< 1.2	< 0.9
HpCDFs (total)		28	< 2.6	< 2.6
OCDF		< 17	< 2.7	< 2.8

Data Summary(1)

Tetra thru Octa Homolog Totals			
Dioxin Homologs	329	220	261
Furan Homologs	28	0	0
	357	220	261
2,3,7,8-TCDD Toxic Equivalence(2)	0.6	0.31	0.36
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)			
Human Bioaccumulation(sc=10,000 pg/gOC)	491	275	401
Wildlife Bioaccumulation(sc=200 pg/gOC)	9.82	5.5	8.02
Total Organic Carbon(%)	4.91	2.75	4.01

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.

Olcott Harbor Sediment Study
Station No. 6; Eighteenmile Creek

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-51	51-62
2,3,7,8-TCDD		4.3	27
1,2,3,7,8-PeCDD		< 5.9	39
1,2,3,4,7,8-HxCDD		< 9.6	85
1,2,3,6,7,8-HxCDD		100	630
1,2,3,7,8,9-HxCDD		28	170
1,2,3,4,6,7,8-HpCDD		2,300	12,000
2,3,7,8-TCDF		23	350
1,2,3,7,8-PeCDF		< 16	< 200
2,3,4,7,8-PeCDF		17	230
1,2,3,4,7,8-HxCDF		240	4,200
1,2,3,6,7,8-HxCDF		56	800
1,2,3,7,8,9-HxCDF		< 9.5	< 98
2,3,4,6,7,8-HxCDF		< 37	260
1,2,3,4,6,7,8-HpCDF		1,800	21,000 E
1,2,3,4,7,8,9-HpCDF		53	430
TCDDs (total)		84	600
PeCDDs (total)		< 54	580
HxCDDs (total)		690	3,100
HpCDDs (total)		4800	23,000
OCDD		31,000 E	140,000 D
TCDFs (total)		410	2,200
PeCDFs (total)		160	2,500
HxCDFs (total)		710	11,000
HpCDFs (total)		3,700	28,000
OCDF		2,900	20,000 D

Data Summary(1)

Tetra thru Octa Homolog Totals		
Dioxin Homologs	36,574	167,265
Furan Homologs	7,880	63,715
	44,454	230,980
2,3,7,8-TCDD Toxic Equivalence(2)	132.9	1305.3
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)		
Human Bioaccumulation(sc=10,000 pg/gOC)	444	297
Wildlife Bioaccumulation(sc=200 pg/gOC)	8.88	5.94
Total Organic Carbon(%)	4.44	2.97

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.
Olcott Harbor Sediment Study
Station No. 7; Eighteenmile Creek

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-30	30-50
2,3,7,8-TCDD		26	24
1,2,3,7,8-PeCDD		28	40
1,2,3,4,7,8-HxCDD		83	90
1,2,3,6,7,8-HxCDD		860	1000
1,2,3,7,8,9-HxCDD		220	240
1,2,3,4,6,7,8-HpCDD		15,000 E	17,000 E
2,3,7,8-TCDF		67	46
1,2,3,7,8-PeCDF		< 24	< 14
2,3,4,7,8-PeCDF		30	18
1,2,3,4,7,8-HxCDF		130	140
1,2,3,6,7,8-HxCDF		60	52
1,2,3,7,8,9-HxCDF		< 3.8	14
2,3,4,6,7,8-HxCDF		84	43
1,2,3,4,6,7,8-HpCDF		3,100	4,100
1,2,3,4,7,8,9-HpCDF		190	280
TCDDs (total)		150	190
PeCDDs (total)		330	520
HxCDDs (total)		5,100	6,800
HpCDDs (total)		34,000	41,000
OCDD		250,000 D	270,000 D
TCDFs (total)		670	430
PeCDFs (total)		400	390
HxCDFs (total)		3,200	3,800
HpCDFs (total)		14,000	17,000
OCDF		9,300 D	14,000 D

Data Summary(1)

Tetra thru Octa Homolog Totals		
Dioxin Homologs	289,580	318,510
Furan Homologs	27,570	35,620
	317,150	354,130
2,3,7,8-TCDD Toxic Equivalence(2)	647.6	713.3
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)		
Human Bioaccumulation(sc=10,000 pg/gOC)	1070	1320
Wildlife Bioaccumulation(sc=200 pg/gOC)	21.4	26.4
Total Organic Carbon(%)	10.7	13.2

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-1. Dioxin/Furan Data,cont.
Olcott Harbor Sediment Study
Station No. 8; Eighteenmile Creek

All concentrations in pg/g

Analyte	Sample Depth(cm)	0-33
2,3,7,8-TCDD		4.5
1,2,3,7,8-PeCDD		< 5.1
1,2,3,4,7,8-HxCDD		< 8.3
1,2,3,6,7,8-HxCDD		49
1,2,3,7,8,9-HxCDD		20
1,2,3,4,6,7,8-HpCDD		1,000
2,3,7,8-TCDF		9.4
1,2,3,7,8-PeCDF		< 12
2,3,4,7,8-PeCDF		< 16
1,2,3,4,7,8-HxCDF		130
1,2,3,6,7,8-HxCDF		33
1,2,3,7,8,9-HxCDF		< 6.1
2,3,4,6,7,8-HxCDF		21
1,2,3,4,6,7,8-HpCDF		740
1,2,3,4,7,8,9-HpCDF		19
TCDDs (total)		74
PeCDDs (total)		48
HxCDDs (total)		330
HpCDDs (total)		2,000
OCDD		11,000 E
TCDFs (total)		200
PeCDFs (total)		180
HxCDFs (total)		560
HpCDFs (total)		1,600
OCDF		1,200

Data Summary(1)

Tetra thru Octa Homolog Totals	
Dioxin Homologs	13,452
Furan Homologs	3,740
	17,192
2,3,7,8-TCDD Toxic Equivalence(2)	60.53
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)	
Human Bioaccumulation(sc=10,000 pg/gOC)	524
Wildlife Bioaccumulation(sc=200 pg/gOC)	10.48
Total Organic Carbon(%)	5.24

(1)Only results greater than laboratory reporting limits used in data summary.
(2)International Toxicity Equivalency Factors
(3)NYSDEC Division of Fish and Wildlife

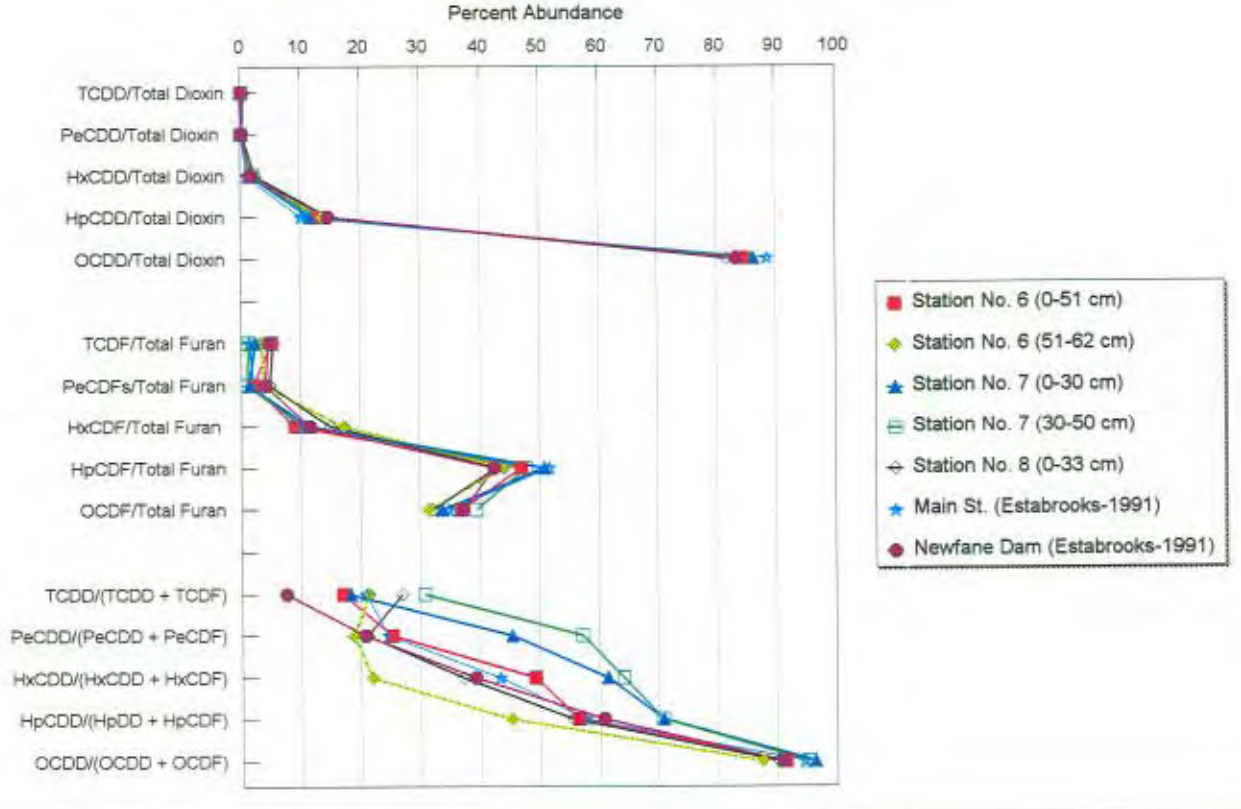
-- Moderate Concentration
-- High Concentration

-- Exceeds Human Bioaccumulation Criteria
-- Exceeds Wildlife Bioaccumulation Criteria

Table 5-2. Dioxin/Furan Homolog Abundance (%)
Olcott Harbor Sediment Study

Analyte	Station Depth(cm)	6 0-51	6 51-62	7 0-30	7 30-50	8 0-33	Main Street Surficial	Newfane Dam Surficial
TCDD/Total Dioxin		0.23	0.36	0.05	0.06	0.55	0.06	0.08
PeCDD/Total Dioxin		0.15	0.35	0.11	0.16	0.36	0.10	0.24
HxCDD/Total Dioxin		1.88	1.85	1.76	2.13	2.45	1.09	1.67
HpCDD/Total Dioxin		13.10	13.75	11.74	12.87	14.87	10.22	14.66
OCDD/Total Dioxin		84.63	83.69	86.33	84.77	81.77	88.54	83.35
TCDF/Total Furan		5.20	3.45	2.43	1.21	5.35	1.46	4.63
PeCDFs/Total Furan		2.03	3.92	1.45	1.09	4.81	2.16	4.11
HxCDF/Total Furan		9.01	17.27	11.61	10.67	14.97	9.87	11.57
HpCDF/Total Furan		46.95	43.96	50.78	47.73	42.78	51.72	42.42
OCDF/Total Furan		36.80	31.40	33.73	39.30	32.09	34.79	37.28
TCDD/(TCDD + TCDF)		17.00	21.43	18.29	30.65	27.01	20.92	7.46
PeCDD/(PeCDD + PeCDF)		25.23	18.83	45.21	57.14	21.05	24.59	20.79
HxCDD/(HxCDD + HxCDF)		49.29	21.99	61.45	64.15	37.08	43.24	39.19
HpCDD/(HpDD + HpCDF)		56.47	45.10	70.83	70.69	55.56	57.69	60.71
OCDD/(OCDD + OCDF)		91.45	87.50	96.41	95.07	90.16	94.61	90.91

Figure 5-1. Dioxin/Furan Homolog Abundance (%)



Chapter 6 -PAHs

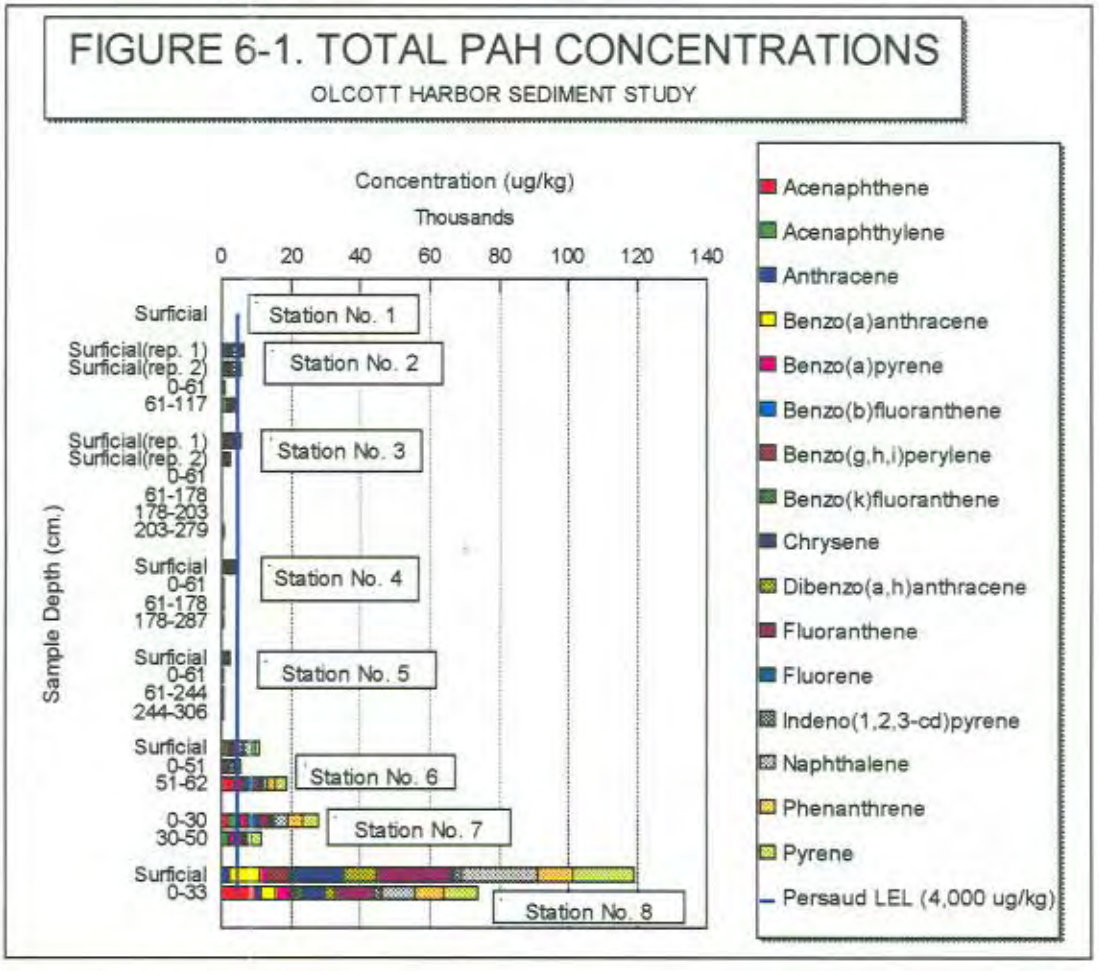
In an effort to characterize the impact, if any, of fuel oil contamination to the sediments of Eighteenmile Creek and Olcott Harbor, polynuclear aromatic hydrocarbons (PAHs), including anthracene, benzo(a)anthracene and chrysene were evaluated. These compounds are characterized as some of the more potent PAH compounds in the NYSDEC Dredge Guidance (NYSDEC, 1994b).

PAHs comprise a large class of compounds, some of which result from the incomplete combustion of fossil fuels. High concentrations of PAHs in the sediments are a good indication of diesel or heavy petroleum contamination.

Evaluation of benzene, toluene, ethylbenzene, and xylenes, which are collectively referred to as BTEX, was not performed. Sediments with high concentrations of these compounds would suggest fresh, or unweathered, gasoline contamination. BTEX compounds were not evaluated due to fiscal constraints and as they were not identified as major contaminants of concern. Complete laboratory results of PAH analyses performed for this study are provided in tabular form in Appendix D.

Total PAH concentrations exceeding analytical detection limits have been summarized on a station by station basis and are presented graphically in Figure 6-1. The Ministry of Ontario Guideline for the Protection and Management of Aquatic Sediment Quality in Ontario (Persaud et al., 1993) is also presented. This guideline is useful for evaluating sediment contaminant levels and their expected long term, or chronic, impact on sediment-dwelling organisms. Although Persaud has established guidelines for the No Effect Level (NEL), Lowest Effect Level (LEL), and the Severe Effect Level (SEL), only the LEL guidance value was included in Figure 6-1. This was done as the SEL guidance values for total PAHs were not exceeded at any of the stations sampled. Sediments exceeding the SEL guidance are considered heavily polluted and likely to adversely affect the health of the majority of sediment-dwelling organisms. The LEL

guidance value is intended to reflect sediments which are clean to marginally polluted and could be tolerated by the majority of benthic organisms.



Upon review of the data presented in Figure 6-1, it can be seen that the highest concentrations of total PAHs encountered during the study were observed at Station No. 8. Total PAH concentrations were highest in the surficial sediments and not in the deeper core samples from this site. Surficial samples typically represent the most recently deposited sediments. Station No. 8, located on Eighteenmile Creek, was the most upstream site sampled. It was located just downstream of the point where Eighteenmile Creek passes under the Erie Barge Canal in a series of culverts. Flow from the Erie Canal augments the Eighteenmile Creek flow at this location.

It is unknown if the PAHs at Station No. 8 are the result of atmospheric deposition, a limited oil spill, or due to chronic leakage from an oil storage tank. Due to the magnitude of the PAHs quantified, atmospheric deposition is not suspected to be the main source of the contamination encountered at this site.

The NYSDEC Division of Spills Management (DSM) maintains a database of Major Oil Storage Facilities (MOSF). Upon review of this database, only one MOSF was identified at a location upstream of Station No. 8. The primary products stored at this facility were numbers 1, 2, or 4 fuel oil. The listed site is operated by J. Ward Reid and Son and is located adjacent to the Erie Canal at Genesee Street in Lockport, NY. The NYSDEC DSM records indicate oil spills to the Erie Canal have occurred at this site.

Another potential source might be the New York State Electric and Gas (NYSEG) site on High Street in Lockport, NY. This site was once listed as an inactive hazardous waste site. The main contaminant was coal tar, which is not considered a hazardous waste. Niagara County Health Department officials suspected gasoline, from a leaking underground tank located at a gas station next to the NYSEG site, may have helped to liquefy buried coal tar thereby allowing it to flow more readily. This site is upgradient to the Erie Barge Canal. Additional PAH sampling in the Erie Barge Canal would help to confirm or eliminate these sites as potential sources and delineate any contamination in the Canal.

Upon further review of the data presented in Figure 6-1 it can be seen that total PAH levels at Station Nos. 7 and 6 are also relatively high and do exceed the Persaud LEL guidance value of 4000 ppb. Station Nos. 7 and 6 are located immediately upstream of the Newfane and Burt Dams, respectively. It is expected that significant sediment deposition has occurred over the years in the slow moving backwaters created by these dams. Total PAH concentrations are highest at the top of the core collected at Station No. 7. Sediments at the top of a core are typically the result of recent deposition. Surficial sediments may, however, represent older, buried sediments recently resuspended upstream as the result of a storm or other high energy event.

Total PAH concentrations at Station No. 6 increase with depth, with the highest concentration reported in the deepest core subsection sampled. Due to the short length of the core collected at this site (50 cm) it was subdivided into only two subsections. The trend observed at this site suggests higher PAH concentrations might be found in the sediments below those sampled during this study. Additional deeper sediment coring at this site is recommended to confirm the maximum PAH concentrations behind the Burt Dam.

It is unknown if the PAH contamination observed at Stations Nos. 7 and 6 is due to the downstream migration of the more highly contaminated sediments observed at Station No. 8 or is the result of an additional PAH source. Migration downstream of some sediments from Station No. 8 would be expected during high flow, high energy events. Such flows typically occur during spring thaws and major rainfall events.

In general, the PAH data presented in Figure 6-1 exhibit higher concentrations at or near the surface at all sampling sites except Station No. 6. The downstream migration of more highly contaminated sediments from Station No. 8 is a likely cause. A moderate increase at the surface is also seen at Station No. 6, where, in addition, the buried sediments are also contaminated with PAH compounds.

Laboratory results of individual PAH compounds have been summarized in graphic form and are presented in Figures 6-2 through 6-5. Persauds LEL guidance values for these compounds have also been presented. In addition, the NYSDEC Division of Fish and Wildlife (DFW) sediment guidance values for acenaphthene and benzo(b)fluoranthene are shown (NYSDEC, 1993). The DFW sediment guidance presented are intended to protect benthic aquatic life from chronic toxicity and human health from bioaccumulation.

As total PAH concentrations were highest at Station No. 8 it's not surprising that most of the individual PAH compounds were also highest at Station No. 8. Persauds LEL guidance values for individual PAH compounds were also exceeded with the greatest magnitude and frequency at Station No. 8 and to a lesser degree at Station Nos. 7 and 6. Field notes taken

Figure 6-2. PAH Results
Olcott Harbor Sediment Study

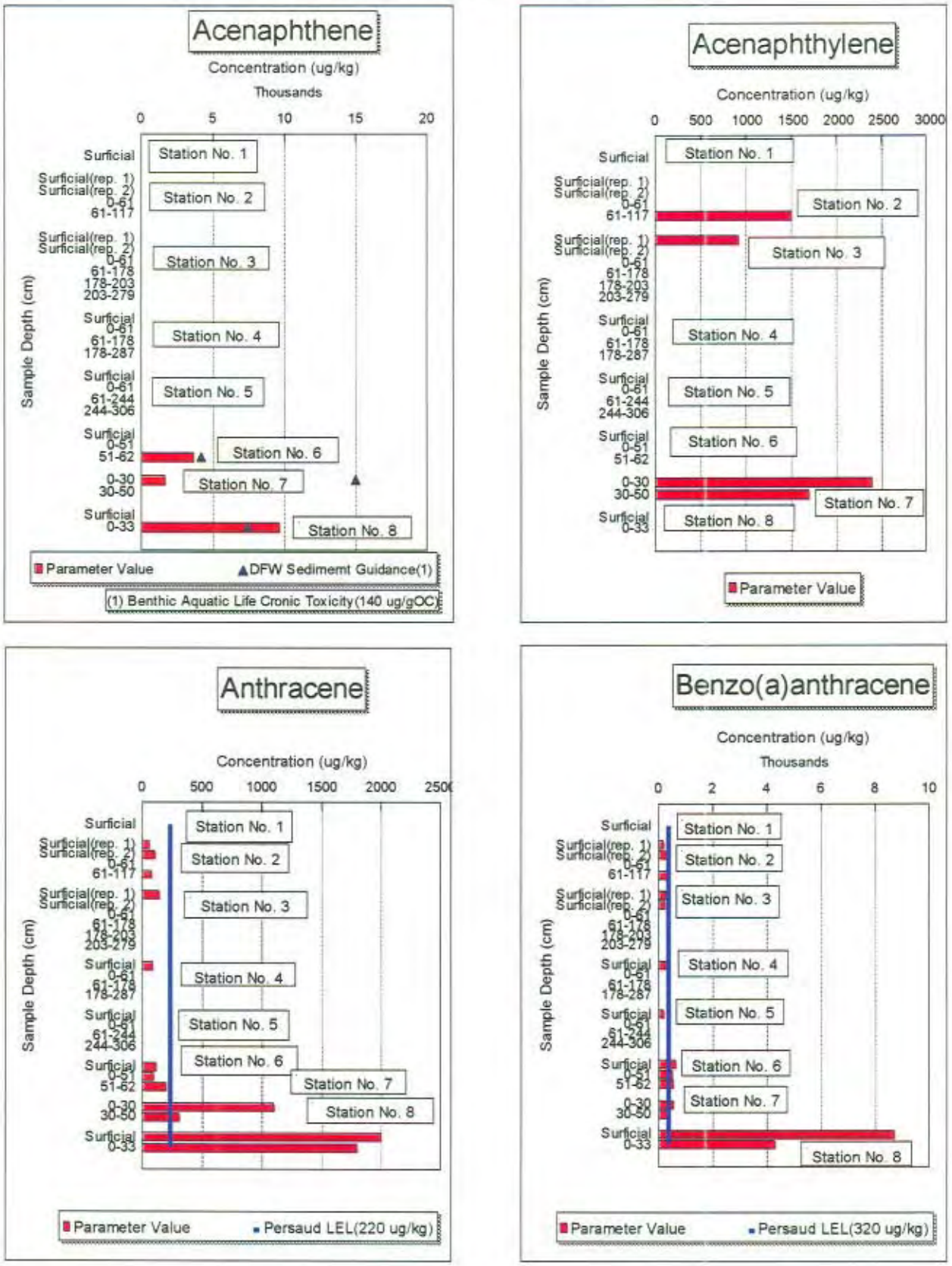


Figure 6-3. PAH Results
Olcott Harbor Sediment Study

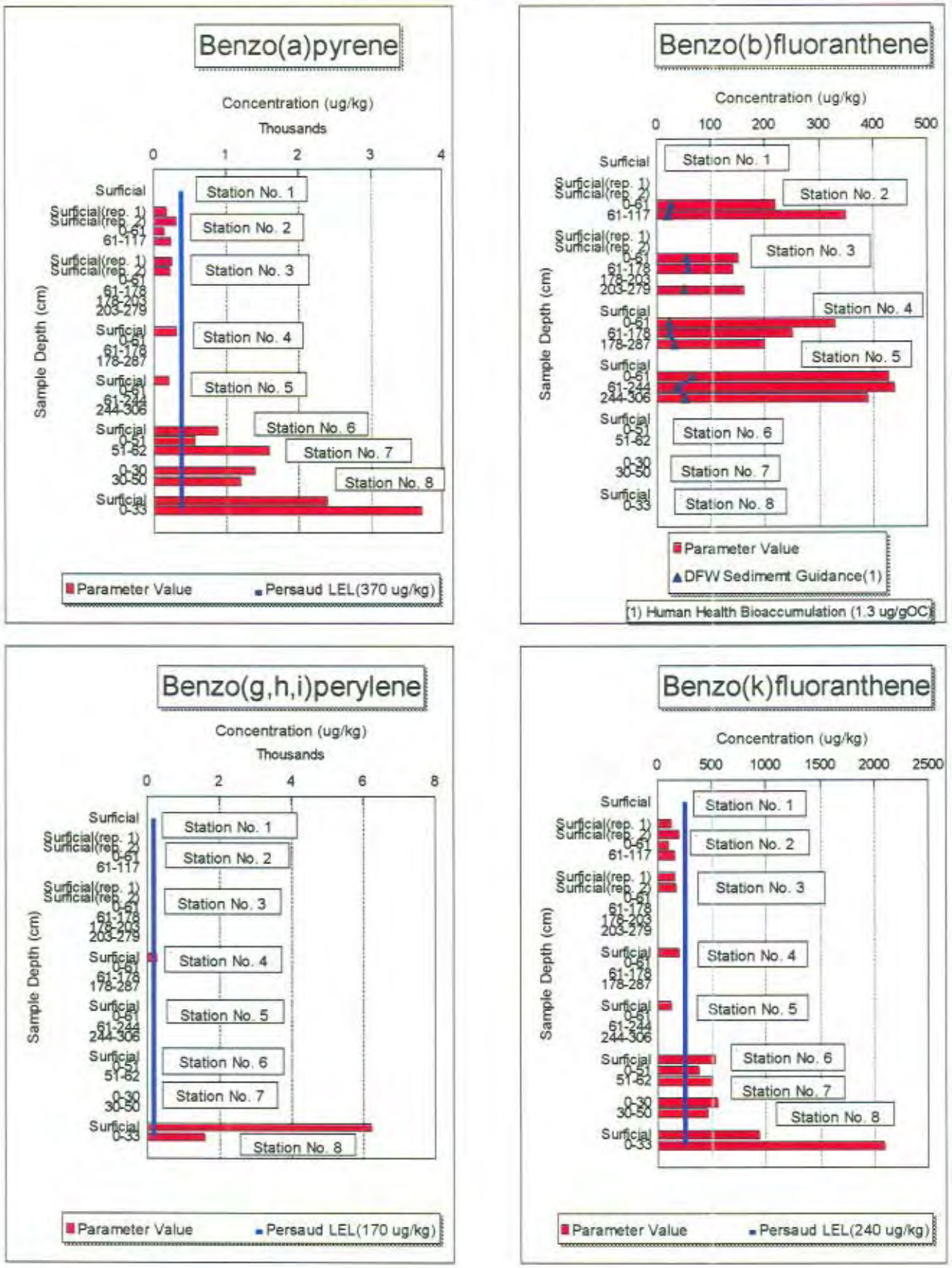


Figure 6-4. PAH Results
Olcott Harbor Sediment Study

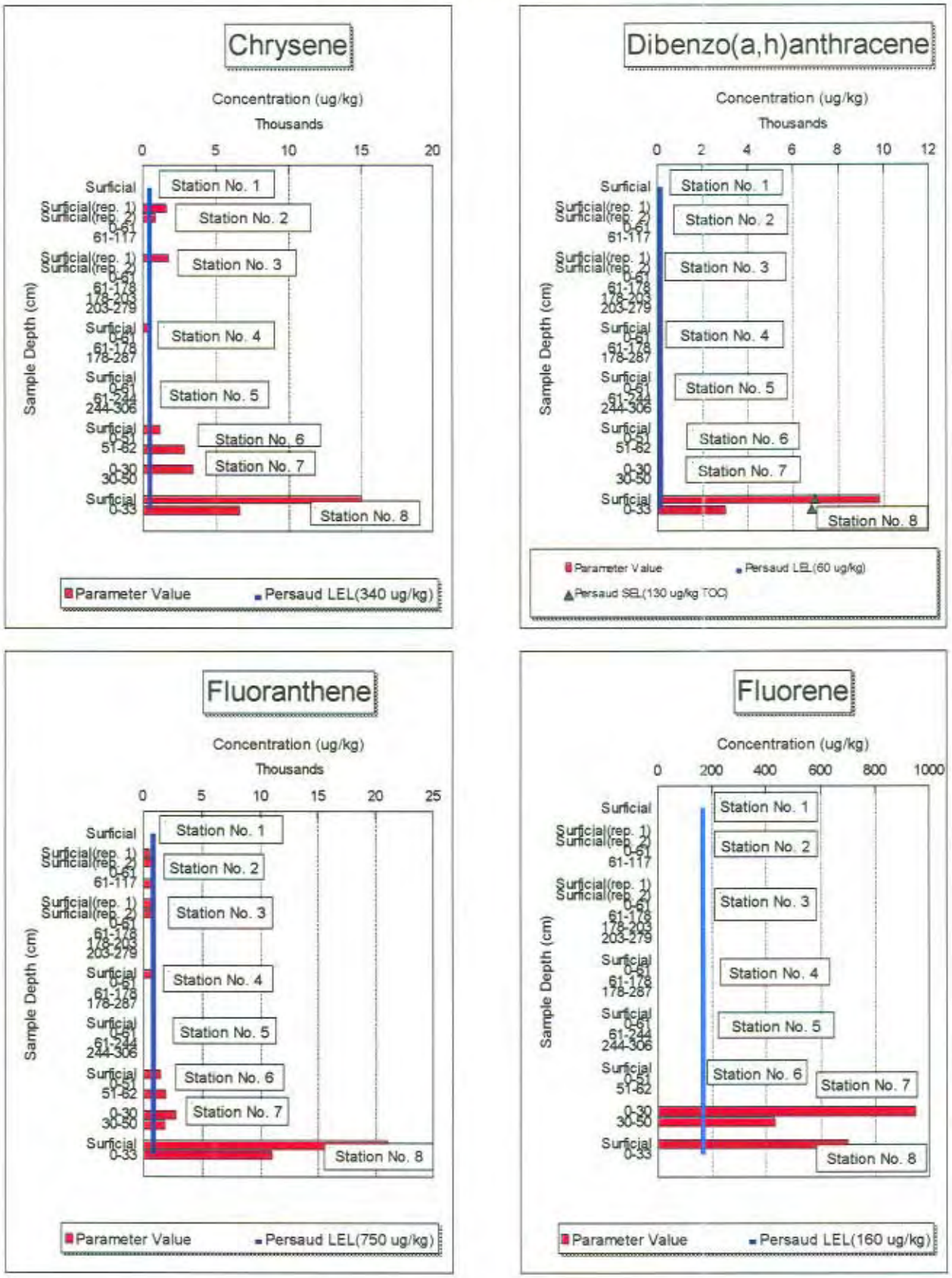
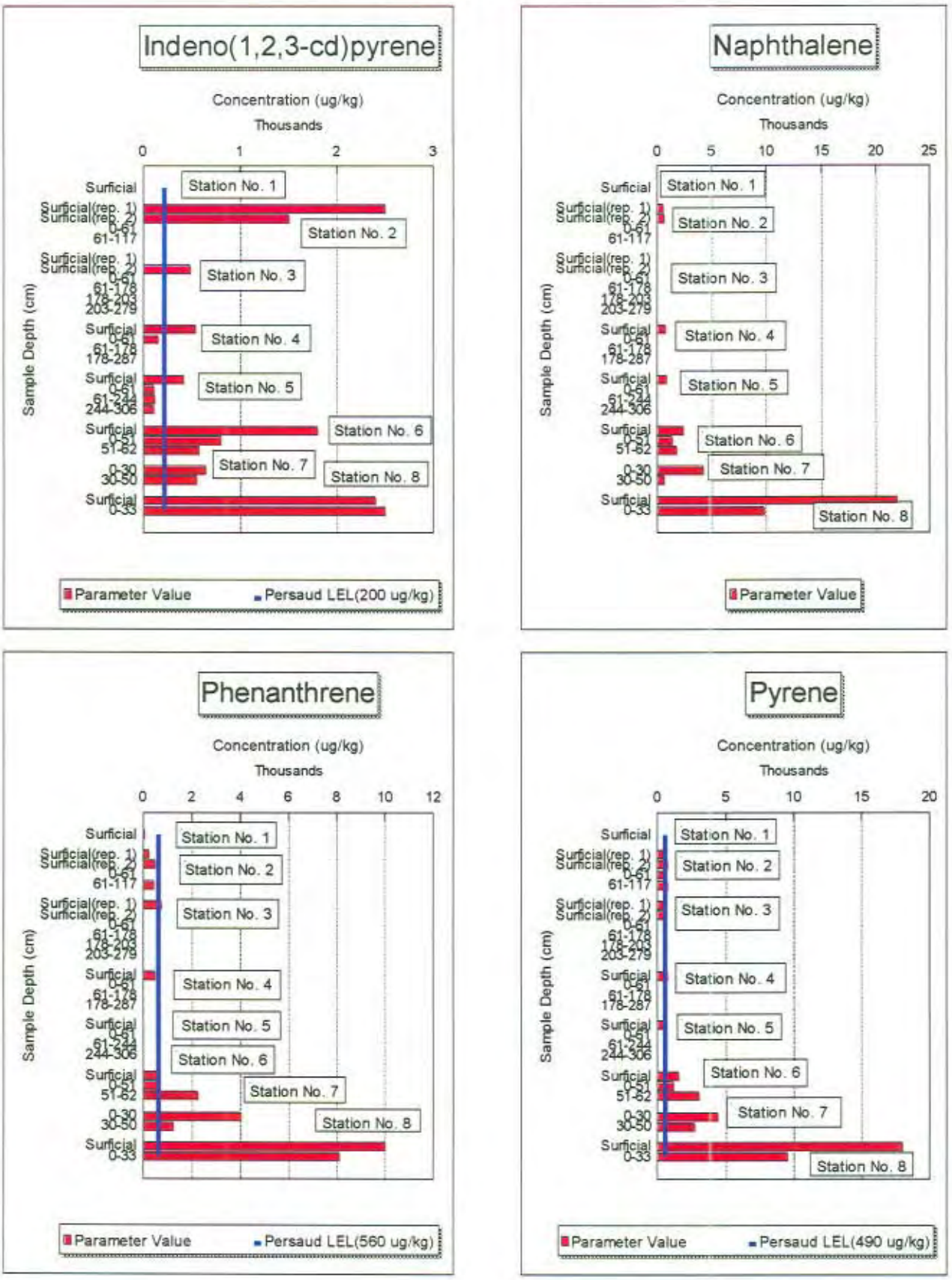


Figure 6-5. PAH Results
Olcott Harbor Sediment Study



during sample collection do indicate a slight oil smell was encountered when the cores were collected at Station Nos. 6 and 8.

Several PAH compounds exceeded Persauds LEL guidelines, these include anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno (1,2,3-cd) pyrene, phenanthrene, and pyrene. Persauds SEL guideline for dibenzo(a,h,)anthrecene was exceeded in the surficial sample collected at Station No. 8. This was the only site where any of Persauds SEL guidelines for individual PAH compounds were exceeded.

The NYSDEC DFW sediment guidance value (benthic toxicity) for acenaphthene was exceeded at Station No. 8 while the benzo(b)fluoranthene guidance value (human health bioaccumulation) was exceeded at Station Nos. 2 through 5. It should be noted that the DFW sediment criterion were developed in units of micrograms of contaminant per gram of organic carbon. Resulting sediment criterion are site specific, as they are dependent upon the samples concentration of organic carbon.

Chapter 7 -Mirex

Mirex was analyzed for but not detected in any of the samples submitted to Roy F. Weston, Inc. for analysis. Minimum detection limits ranged from 0.17 to 0.48 ppb. Analysis of mirex was not performed on the reconnaissance samples collected at Station Nos. 1a and 4a on May 25, 1994. Photomirex was not evaluated as reliable standards could not be obtained.

Chapter 8 -Octachlorostyrene

Octachlorostyrene was analyzed but not detected in any of the samples submitted to Roy F. Weston, Inc. for analysis. Minimum detection limits ranged from 0.17 to 0.48 ppb. Analysis of octachlorostyrene was not performed on the reconnaissance samples from Station Nos. 1a and 4a, collected on May 25, 1994.

Chapter 9 -Inorganics

Results of inorganic analyses performed on sediment samples collected for the Olcott Harbor Sediment Study are presented in Table 9-1. Total organic carbon (TOC), percent volatile solids, and percent solids were evaluated in all samples collected. Physical descriptions of all surficial and sediment core samples collected are presented in Table 9-2.

Many trace elements and non-polar organic compounds tend to sorb more readily to the fine-grained organic sediments. As such, determination of a sample's organic content is useful for evaluating its capacity to concentrate such contaminants. There is, typically, considerable variability in the TOC concentrations of samples collected from within a given study area. Sample results can be evaluated, or normalized, in terms of contaminant concentration per gram of organic carbon concentration which may account for some of this variability. Calculating a sample's TOC normalized contaminant concentration in this way is useful for evaluating relative contaminant concentrations within a study area.

In addition, the NYSDEC Division of Fish and Wildlife sediment guidance used to evaluate trace elements and nonpolar organic compounds in this report is based upon equilibrium partitioning methodology using water quality standards and TOC concentrations. Sediment TOC concentrations ranged from 1.51 to 13.2 percent (Table 9-1).

Included with the bioassessment results from the Oswego River Sediment Study (NYSDEC, 1996) was a recommendation that sediment grain size be evaluated when conducting future bioassessments. It was reported that this information, correlated with certain species or species assemblages, may be useful in understanding the distribution of benthic invertebrates. As such, sediment particle size distributions were evaluated in surficial sediment samples collected on October 11-12, 1994. These results are presented in Tables 9-3 and 9-4.

Table 9-1. Inorganic Data

Eighteenmile Creek/ Olcott Harbor Sediment Study

Sampling Summary: May 25, September 12 and October 11-12, 1994

Station No.	Sample Depth(cm)	Total Organic Carbon(%) Result	DL	Volatile Solids(%) Result	DL	Solids(%) Result	DL
1	Surficial	0.443	0.0571	0.33	0.10	80.4	0.10
1a	Surficial	*NE*		*NE*		*NE*	
2	Surficial(replicate no. 1)	3.15	0.182	2.0	0.10	52.9	0.10
	Surficial(replicate no. 2)	2.86	0.167	11.0	0.10	43.5	0.10
	0-61	1.91	0.0909	10.7	0.10	52.2	0.10
	61-117	1.51	0.154	16.7	0.10	45.5	0.10
3	Surficial(replicate no. 1)	3.08	0.182	8.6	0.10	43.4	0.10
	Surficial(replicate no. 2)	2.53	0.154	9.3	0.10	39.3	0.10
	0-61	4.12	0.105	9.9	0.10	49.7	0.10
	61-178	4.4	0.167	14.2	0.10	44.6	0.10
	178-203	2.79	0.333	11.1	0.10	38.7	0.10
	203-279	3.93	0.2	9.6	0.10	51.1	0.10
4	Surficial	2.17	0.133	8.7	0.10	42.3	0.10
	0-61	1.69	0.125	9.3	0.10	47.9	0.10
	61-178	1.6	0.1	8.2	0.10	50.9	0.10
	178-287	2.5	0.111	4.2	0.10	63.6	0.10
4a	0-4	5.3	—	11	—	41	—
	4-8	5.3	—	11	—	46	—
	8-13	5.3	—	9	—	48	—
	13-23	4.2	—	9	—	51	—
	23-33	2.2	—	5	—	60	—
	33-43	2.5	—	7	—	58	—
	43-53	5.2	—	11	—	44	—
	53-64	3.5	—	10	—	49	—
5	Surficial	3.57	0.2	7.9	0.10	46.6	0.10
	0-61	4.91	0.222	10.7	0.10	53.3	0.10
	61-244	2.75	0.222	8.4	0.10	52.2	0.10
	244-306	4.01	0.2	8.8	0.10	53.2	0.10
6	Surficial	2.82	0.167	13.4	0.10	28.5	0.10
	0-51	4.44	0.167	11.9	0.10	33.9	0.10
	51-62	2.97	0.182	25.8	0.10	28.0	0.10
7	0-30	10.7	0.333	19.8	0.10	33.0	0.10
	30-50	13.2	0.333	19.6	0.10	38.0	0.10
8	Surficial	5.38	0.25	12.4	0.10	33.2	0.10
	0-33	5.24	0.2	16.7	0.10	40.4	0.10

NE- Not Evaluated

Table 9-2. Sample Physical Descriptions

Eighteenmile Creek/ Olcott Harbor Sediment Study

Sampling Summary: May 25, September 12 and October 11-12, 1994

Station No.	Depth(cm.)	Physical Description
1	Surficial	looks like clean beach sand, no muck, 95% of sample passed #30 sieve
1a	Surficial	fine grained sand with clay, black and dark brown
2	Surficial(replicate no. 1)	dark brown silty or clayey sand,21% gravel, 22% silt
	Surficial(replicate no. 2)	dark brown silty or clayey sand,18% gravel, 29% silt
	0-61	silty clay, very fine grain, black- dark brown, mostly organic;
	61-117	2.5 cm organic layers(composed of leaves, cat tails) at 10, 43, 64, and 76 cm depths
3	Surficial(replicate no. 1)	(0-10 cm)silt, dark brown, bark and organic material
	Surficial(replicate no. 2)	same as above
	0-61	fine sand with silt, brown with bands of dark brown/black organic matl.
	61-178	same as above
	178-203	uniform fine grain silt with organic material, dark brown almost black
	203-279	(203- 257 cm) fine grain silt with some organics, lighter brown
		(257-287cm) uniform silt and clay, no organic, lighter brown
4	Surficial	(0- 13 cm)thick mud, silt/clay w/organics, dk. brown, normal organic smell
	0-61	similar to above, but less organic material
	61-178	silt, dark brown, no organics
	178-287	homogeneous silt, brown
4a	0-4	fine grained silt with organics, dark gray
	4-8	fine grained silt with organics, dark gray
	8-13	fine grained silt with organics, dark to light gray
	13-23	fine grained silt with organics, light gray
	23-33	fine grained silt with organics, light gray
	33-43	fine grained silt with organics, light gray
	43-53	fine grained silt with organics, light gray
	53-64	fine grained silt with organics, light gray
5-1	Surficial	dark brown silty or clayey sand,48% silt or clay
	0-61	sand, fine grained, homogeneous consistancy, light brown in color
	61-244	same as above
	244-306	same as above
5-2	300 cm total length	same as core 5-1 above
6	Surficial	(0-33 cm)brown loose silt, no sand
	0-51	(33-51 cm)very fine grained loose silt, darker brown color
	51-62	(51-60 cm)dark gray silt
		(60-62 cm)fine grained sand and silt, brown, oily smell
7	0-30	(0-13 cm) fine brown silt with clay
	30-50	(13-30 cm) black silty clay
		(30-38 cm) wood chips
		(38-43 cm) black silt
		(43-50 cm) fine gravel with wood chips
8	Surficial	(0-33 cm) dark gray silty sand, some organics,
	0-33	slight oil smell

Table 9-3. Particle Size Distribution

Eighteenmile Creek/Olcott Harbor Sediment Study

Sampling Summary: October 11-12, 1994

Surficial Station No.		1		2		2-Duplicate		3		3-Duplicate
U. S. Standard Diameter Sieve Size	mm	% Finer		% Finer		% Finer		% Finer		% Finer
3"	75	100	75	100	75	100	75	100	75	100
1 1/2"	37.5	100	37.5	100	37.5	100	37.5	100	37.5	100
3/4"	19	100	19	95.6	19	96	19	100	19	100
3/8"	9.5	100	9.5	86.2	9.5	89.5	9.5	100	9.5	100
#4	4.75	100	4.75	79.2	4.75	82.3	4.75	99.9	4.75	99.4
#10	2	99.9	2	74.1	2	76.2	2	99.4	2	98.2
#20	0.85	99.3	0.85	69.7	0.85	69.6	0.85	96.6	0.85	92.5
#50	0.3	96.5	0.3	61.9	0.3	61.9	0.3	88.5	0.3	76.4
#100	0.15	41.5	0.15	41.2	0.15	42.1	0.15	75.4	0.15	65.2
#200	0.075	3.2	0.075	22.1	0.075	29	0.075	62.1	0.075	54.3
Hydrometer	0.0523	2.3	0.0469	20.8	0.0472	20.5	0.0452	32.2	0.0435	37.3
	0.037	2.3	0.0349	13	0.0349	13.4	0.0322	30.9	0.0331	25.3
	0.0263	1.6	0.0254	8.1	0.0253	9.3	0.0234	26	0.0244	18.2
	0.0186	1.6	0.0181	7.1	0.018	8.3	0.0176	15	0.0174	15.8
	0.0136	1.6	0.0133	6.1	0.0132	7.3	0.013	12.5	0.013	12.2
	0.0096	1.6	0.0094	5.1	0.0094	6.3	0.0093	10.1	0.0093	8.6
	0.0068	1.6	0.0067	4.1	0.0067	4.3	0.0066	7.6	0.0067	6.2
	0.0048	0.9	0.0048	3.1	0.0047	4.3	0.0047	5.2	0.0047	5
	0.0034	0.9	0.0034	2.2	0.0034	3.2	0.0034	5.2	0.0034	3.8
	0.0024	0.9	0.0024	2.2	0.0024	2.2	0.0024	3.9	0.0024	2.6
	0.0014	0.9	0.0014	2.2	0.0014	2.2	0.0014	3.9	0.0014	2.6
	0.001	0.9	0.001	1.2	0.001	1.2	0.001	2.7	0.001	1.4
Sample Description		light gray brown poorly graded SAND with 3% silt or clay		dark brown silty or clayey SAND with 21% gravel and 22% silt or clay		dark brown silty or clayey SAND with 18% gravel and 29% silt or clay		gray SILT or CLAY with 38% sand		brown SILT or CLAY with 45% sand
Unified Soil Classification System (USCS) Group Symbol		SP		SM or SC		SM or SC		ML, CL, MH, or CH		ML, CL, MH, or CH

Table 9-4. Particle Size Distribution

Eighteenmile Creek/Olcott Harbor Sediment Study

Sampling Summary: October 11-12, 1994

Surficial Station No.		4		5		6	7		8
U. S. Standard Diameter Sieve Size	mm	% Finer		% Finer		% Finer	% Finer		% Finer
3"	75	100	75	100	75	100	Sample Not Collected	75	100
1 1/2"	37.5	100	37.5	100	37.5	100		37.5	100
3/4"	19	100	19	100	19	100		19	100
3/8"	9.5	100	9.5	100	9.5	100		9.5	100
#4	4.75	100	4.75	99.3	4.75	98.9		4.75	98.9
#10	2	97.7	2	97.7	2	71.4		2	93.8
#20	0.85	92	0.85	94.8	0.85	55.1		0.85	85.2
#50	0.3	79.5	0.3	85.3	0.3	50.1		0.3	70.8
#100	0.15	53.6	0.15	63.8	0.15	49		0.15	49.3
#200	0.075	33	0.075	48	0.075	47.7		0.075	12.8
Hydrometer	0.0484	19.1	0.0472	24.1	0.0472	28.1		0.0478	32.6
	0.0351	14.4	0.0342	19.4	0.034	23.9		0.0342	29
	0.0251	12	0.0247	15.8	0.0247	18.4		0.0247	23.7
	0.018	9.7	0.0178	12.2	0.0177	15.6		0.0176	21.9
	0.0132	8.5	0.0131	9.8	0.013	14.2		0.013	18.3
	0.0094	7.3	0.0093	8.6	0.0093	11.4		0.0093	14.7
	0.0067	6.1	0.0066	7.4	0.0066	8.6		0.0066	14.7
	0.0047	4.9	0.0047	6.2	0.0047	7.2		0.0047	11.1
	0.0034	3.8	0.0034	5	0.0034	5.8		0.0033	9.3
	0.0024	2.6	0.0024	3.8	0.0024	4.5		0.0024	9.3
	0.0014	2.6	0.0014	3.8	0.0014	4.5		0.0014	7.5
	0.001	2.6	0.001	2.6	0.001	3.1		0.001	5.7
Sample Description		dark brown silty or clayey SAND with 33% silt or clay		dark brown silty or clayey SAND with 48% silt or clay		brown silty or clayey SAND with 1% gravel and 48% silt or clay			gray silty or clayey SAND with 1% gravel and 13% silt or clay
Unified Soil Classification System (USCS) Group Symbol		SM or SC		SM or SC		SM or SC			SM or SC

Chapter 10 -Sediment Toxicity

Solid Phase Toxicity Test

Scope of Report

This report presents only the results from tests using USEPA Test Methods 100.1 and 100.2 (USEPA, 1994).

Test Method

The test methods outlined in this report conform to USEPA Test Methods 100.1 and 100.2 for 10-day survival and growth of *Hyalella azteca* and *Chironomus tentans*, respectively (USEPA, 1994).

Test Sediment Information

Control Sediment Source: Control sediment is from the south end of Hemlock Lake, Livingston County, New York. Hemlock Lake supplies drinking water for the City of Rochester, New York. The entire shoreline is undeveloped and owned by the City of Rochester. Watershed activities are closely monitored and controlled. This is a high-quality, fine-grained sediment. Sediment is collected using a petite Ponar Dredge and stored in 2-liter glass containers at 4° C until needed.

Test Sediment Source And Date Collected: Refer to Figures 1-1 through 1-4 for locations of sediment sampling stations. Test sediment was collected October 11-12, 1994.

Method Of Sediment Collection: Samples are collected with a modified Ponar Dredge sampler. The standard stationary screens have been replaced with sliding stainless steel screens. After the Ponar sample is brought to the surface, the sliding screens are opened and excess water is gently poured off the sediment's surface. The upper 3 to 5 cm of sediment is then scooped into a clean

stainless steel bucket. Additional Ponar samples are collected and sediment composited into the stainless steel bucket until the predetermined volume of sediment has been collected. This composite sample is then thoroughly mixed using a paddle, and subsampled into the proper containers for chemical, physical, and toxicological testing.

Sediment Handling And Shipping: Sediment samples for chemical, physical and toxicological analysis are placed in coolers with ice immediately after collection. Sediment samples for toxicity testing are packed in ice and either hand-delivered to the Avon Field Station or shipped via overnight courier service.

Upon arrival at the Avon Field Station, each sample is logged-in and assigned a laboratory accession number.

Storage: Sediment samples are stored in the dark at 4°C. All toxicity testing is initiated within two weeks of sample collection.

Disposal: All equipment contacting sediment is rinsed with culture water to remove sediment before washing or disposal. All rinse water (containing sediment) is held in a covered, 115-liter polyethylene tank. After a test is completed, the contents of this tank are allowed to settle for at least seven days. The supernatant is then slowly pumped through a granular activated carbon filter before disposal in the laboratory wastewater system. The sediment remaining in this tank and that remaining in sample containers is then placed in 19-liter polyethylene pails with twist-lock tops. These pails are labeled as to sediment source and stored in the Hazardous Materials Storage Building. The sediment is then properly disposed of, depending on its contaminant type and concentration.

Culture Water

Source: Water for the Avon Field Station's Aquatic Toxicology Laboratory is chlorinated and fluoridated municipal water supplied by the Town of Avon from Conesus Lake. It enters the lab through a polyethylene pipeline from the cast iron supply main.

Pretreatment: Following a 5 μm particulate filter, the water is dechlorinated using a granulated activated carbon filter, ultraviolet radiation, and chemical reduction with sodium metabisulfite. The water is then heated and dissolved gasses are stabilized in a 1900-liter open stainless steel tank that is vigorously mixed with a stirrer. Water is continuously circulated from this stainless steel tank through a granular activated carbon filter to remove excess sodium metabisulfite. From this carbon filter, water goes to a constant-head tank located above the Aquatic Toxicology Lab, which supplies water via gravity to the culture and test systems. Excess water overflows and is returned to the stainless steel tank for recirculation to the constant-head tank.

Characteristics: Water quality characteristics are listed in Table 10-1.

Table 10-1.Characteristics of Avon Field Station's culture water (N=50, from 01/09/80 - 01/07/81).

Parameter	Mean	Range
pH	8.15	7.97-8.31
Alkalinity (mg/l as $CaCO_3$)	111	103-118
Hardness (mg/l as $CaCO_3$)	147	138-158
Conductivity (µmhos)	367	332-382

Demonstration Of Adequacy To Support Aquatic Test Organisms: This water is high quality and is representative of surface waters in Central and Western New York State. It is monitored daily for total residual chlorine, which is maintained at ≤ 3 µg/l. This water has been used for culturing and testing aquatic organisms for 17 years, and cultures of *Hyalella azteca* and *Chironomus tentans* have done very well for four years.

Test Organisms

Test Organism Source: *H. azteca* and *C. tentans* are obtained from in-house laboratory cultures maintained under continuous conditions at Avon Field Station.

Original Genetic Source:

H. azteca: Genetic stock was obtained August 8, 1994 from the National Biological Survey Laboratory, Columbia, Missouri. From March, 1991 until August 8, 1994, a smaller Conesus Lake strain of *H. azteca* was used for toxicity testing at the Avon Field Station.

C. tentans: Genetic stock was obtained April 9, 1991 from the USEPA, Region 1, Lexington, Massachusetts.

Age Of Test Animals:

H. azteca: Seven-day old neonates were used to start these sediment toxicity tests.

C. tentans: Twelve-day old, third-instar larvae were used to start these sediment toxicity tests. Initial head capsule statistics are presented in Table 10-2.

Table 10-2: *C. tentans* initial head capsule width data (N=10).

Mean (mm)	Range (mm)	Std. Dev. (mm)
0.40	0.36- 0.42	0.02

Culture Procedure:

H. azteca

Culture procedures are consistent with Method 100.1. Mass cultures of mixed-age amphipods are maintained under flow-through conditions in 76-liter glass aquaria with overflows which maintain a water volume of 53-liters. Four to five volumes of water are added daily to maintain healthy culture conditions. Gentle aeration maintains dissolved oxygen concentration at ≥ 40% saturation. Water temperature is maintained at 23° C (± 2° C).

Amphipods are raised on artificial substrates made of polyester aquaculture filter material (Aquatic Eco-Systems, Apopka, FL). Six 20-cm diameter by 3.5 cm thick substrates are placed in each culture chamber along with 8 to 10 maple leaves. The maple leaves are pre-soaked for 30-days in flowing culture water before use. The organisms use these leaves as substrate and food. Fresh leaves are added about twice a week as the old ones are consumed.

Cultures are fed 3 g of Tetramin® fish food flakes and brine shrimp nauplii (≤ 24-h old) daily. Fecal material and excess *H. azteca* are siphoned from the culture chambers about twice a week. Through this siphoning, a healthy, reproducing standing crop of *H. azteca* is maintained at a level which just consumes the daily food ration.

Known-age amphipods are obtained by gently agitating several pieces of artificial substrate in a plastic pail containing several liters of culture water. The water and mixed-age amphipods are then gently poured though a # 25 mesh U.S. Standard Stainless Steel Sieve placed in a tray containing dilution water, so that the organisms do not contact air. The sieve is gently agitated in the tray, so that the mature amphipods are retained on the # 25 mesh sieve and immature ones pass through. The sieve and mature amphipods are then quickly transferred to another shallow pan containing culture water and left there overnight. After 24-hours, the sieve is gently agitated to rinse the newborn amphipods (≤ 24-h old) into the pan water. The sieve is removed, and the mature amphipods are quickly returned to the mass culture.

The newborn H. azteca are gently poured into a 6-liter glass aquarium. This aquarium is placed in a water bath at 23°C (± 2°C). This chamber is maintained in a flow-through condition, with two to three volumes of culture water added per day. Three or four pre-soaked maple leaves are added for substrate, and these known age test amphipods are fed a small amount of ≤ 60 mesh Tetramin® daily. These amphipods are held under these conditions for 6 to 13 days to provide 7- to 14-d old test organisms.

C. tentans

Culture procedures are consistent with Method 100.1. Mass cultures of mixed-age midges are maintained under flow-through conditions in 76-liter glass aquaria with about 32 liters of culture water. One to two volumes of water are added daily. The cultures are covered with 1 mm mesh netting to retain midge adults, and aerated to maintain dissolved oxygen at ≥ 40% saturation. Water temperature is maintained at 23° C (± 2° C).

Midges are raised on 1- to 2-cm of brown paper towel fiber substrate, and substrate is added whenever bare spots begin to form on the aquarium bottom. Paper towels are pre-soaked for a minimum of 7-days in flowing culture water. Three towels and 500 ml of culture water are then blended on high speed for 45 seconds. The blended paper towel mixture is then swirled for 15-20 seconds with an additional two liters of culture water in a plastic bucket, and strained through a # 120 mesh stainless steel sieve. This washed paper fiber is then placed in 250-ml plastic bottles, and distilled water is added to fill the bottle. Substrate is stored at 4°C for up to two-months.

Cultures are fed 20 ml (1.0 g dry solids) per day of a Tetrafin® fish flake suspension. The Tetrafin® suspension is prepared by blending 10 g Tetrafin® flakes with 200 ml of culture water on high for 45 seconds. It is stored in plastic bottles at 4°C for up to two-weeks, or until it smells rancid, whichever occurs first.

Every two to three weeks, excess fecal material must be removed from the cultures. The substrate and *C. tentans* are siphoned from the culture into a plastic bucket. The bucket's contents are gently stirred for about 10 seconds and then gently poured through a # 25 mesh stainless steel

sieve. The sieve contents are then mixed with about 3 liters of culture water, stirred, and sieved again. This stirring and sieving is repeated three times, and the remaining substrate and midges are returned to the culture. Fresh substrate is then added to a 1 to 2 cm depth.

Twelve days before a test is scheduled to start, egg masses laid the previous night are removed from the mass cultures. These freshly laid egg masses are easy to identify under a binocular microscope, because there is no tissue differentiation or polarization visible within the egg. Two or three fresh egg masses are then incubated in each of three 6-liter glass aquaria under flow-through conditions at 23° C (±1° C). Fine silica sand (25 ml) is placed on the bottom of the aquaria for substrate. These egg masses hatch in about 48 hours. Cultures are fed 2 ml/day of Tetrafin® suspension (100 mg dry weight) on days two and three, and 4 ml/day (200 mg dry weight) thereafter. On day 12, the majority of midge larvae are third instar and ready for testing. The larger and smaller individuals are not used in tests. The third instar is confirmed by measuring head capsule width on 10 specimens using an ocular micrometer in a compound microscope. Third instar larvae have head capsule widths of 0.33 - 0.45 mm (USEPA, 1994).

Summary Of Test Conditions

The test conditions are summarized in Table 10-3.

Table 10-3. Summary of test conditions.

TEMPERATURE:	23° ±1°C
LIGHT QUALITY:	Wide-spectrum fluorescent
ILLUMINANCE:	500 - 1,000 lux
PHOTOPERIOD:	16-h light:8-hour dark
TEST CHAMBER:	300 ml high-form lipless beaker
SEDIMENT VOLUME:	100 ml
OVERLYING WATER:	Avon Field Station culture water
OVERLYING WATER VOLUME:	175 ml

RENEWAL OF OVERLYING WATER:	Two volumes additions/day using automatic water delivery system (Zumwalt et al., 1994)
OVERLYING WATER QUALITY:	Hardness, alkalinity, conductivity, pH, and ammonia conducted at beginning and end of test. Temperature and dissolved oxygen daily
NUMBER OF ORGANISMS/CHAMBER:	10
NUMBER OF REPLICATE CHAMBERS/TREATMENT:	4
FEEDING:	
***H. azteca*:**	1.5 ml/day YCT (USEPA, 1994) to each test chamber
***C. tentans*:**	1.5 ml/day Tetrafin® suspension to each test chamber (4 mg dry solids)
AERATION:	None, unless dissolved oxygen in overlying water drops below 40% saturation
TEST CHAMBER CLEANING:	Gently brush outside of overflow screens
TEST ENDPOINTS:	Survival and growth as measured by weighing surviving organisms from each replicate test chamber to nearest 0.01 mg dry weight
TEST ACCEPTABILITY:	
H. azteca:	Minimum mean control survival of 80% and performance-based criteria specified in Table 11-3 (USEPA, 1994)
C. tentans:	Minimum mean control survival of 70% and mean weight per surviving control organism of 0.6 mg. Performance-based criteria specified in Table 12-3 (USEPA, 1994)

Statistical Methods

Statistical analyses were performed using TOXSTAT® 3.4 software (West, 1994). All data sets were visually checked for outliers (extreme values) before statistical analysis. If more than 10 organisms were recovered from a test container, it was assumed that the "extra" organisms were indigenous. For statistical calculations, test containers with more than 10 recovered organisms were assumed to have 100% survival (i.e., 10 organisms/container). Survival and growth data analysis followed the decision tree in the USEPA sediment test methods manual (USEPA, 1994),

using an $\propto$ of 0.05 (level of significance).

Parametric vs. Nonparametric Analysis: Parametric analysis of variance (ANOVA) statistical methods were used only if the data sets passed normality and homogeneity of variance tests. Data transformations were used to overcome normality and homogeneity of variance problems whenever possible.

Normality and Homogeneity of Variance Analysis: The Shapiro-Wilk's and Chi-square tests was used to test for normality. Bartlett's and Hartley's tests were used to test for homogeneity of variance.

Parametric Analysis: Data sets that passed the normality and homogeneity tests were analyzed using Dunnett's ANOVA test to determine differences between each group and control means.

Nonparametric Analysis: Data sets that pass the homogeneity test, but did not pass the normality test, were analyzed using Steel's Many-One Rank and Wilcoxon's Rank Sum tests to compare treatment and control means.

Heterogeneity of Variance: Data sets that did not pass the homogeneity of variance test were analyzed by a modified t-test for unequal variances.

Results And Discussion

All the test acceptability requirements for USEPA Test Methods 100.1 and 100.2 were met (USEPA, 1994).

Table 10-4 is a statistical summary of the survival and growth (weight/organism) data for *H. azteca* and *C. tentans*. The complete growth and survival data are presented in Appendix E. The water chemistry data is presented in Appendix F.

Table 10-4. Statistical Summary of Survival and Weight Data for *H. azteca (HA)* and *C. tentans (CT)*.

Station Number	Test Species	Number of Survivors			Weight/Organism (mg)		
		Mean	Range	Std. Dev.	Mean	Range	Std. Dev.
Control A	HA	8.25	5-10	2.36	0.089	0.079-0.094	0.007
2D	HA	8.25	7-10	1.26	0.101	0.086-0.114	0.012
3	HA	9.5	9-10	0.58	0.083	0.073-0.113	0.020
5	HA	8.00	5-10	2.16	0.084	0.076-0.090	0.006
8	HA	9.00	7-10	1.41	0.130*	0.107-0.154	0.020
Control B	HA	9.75	9-10	0.50	0.083	0.076-0.090	0.006
1	HA	10.00	10	0	0.096*	0.091-0.102	0.005
2	HA	8.75	8-10	0.96	0.079	0.071-0.090	0.009
4	HA	8.25	6-10	1.71	0.090	0.078-0.099	0.009
6	HA	8.50	6-10	1.73	0.078	0.064-0.094	0.012
Control A	CT	9.75	9-10	0.50	1.705	1.474-1.860	0.178
2D	CT	9.00	6-10	2.00	0.970**	0.693-1.193	0.206
3	CT	9.50	9-10	0.58	0.863**	0.769-1.017	0.118
5	CT	9.50	9-10	0.58	0.877**	0.762-1.0012	0.129
8	CT	9.50	9-10	0.58	2.157*	1.727-2.444	0.305
Control B	CT	9.75	9-10	0.50	1.729	1.553-1.921	0.185
1	CT	7.75	4-9	2.50	1.103**	0.879-1.558	0.312
2	CT	2.50**	0-10	5.00	1.144**	0	0
4	CT	9.00	8-10	1.15	1.104**	0.985-1.380	0.108
6	CT	8.50	8-9	00.58	1.181**	1.085-1.380	0.136

* Means are significantly (α =0.05) greater than their respective control means (no toxicity)

** Means are significantly (α=0.05) less than their respective control means (toxic response).

Survival of *C. tentans* was significantly reduced in sample 2 from site 2, indicating a toxic response. However, survivorship was not significantly reduced in the duplicate sample (2D) from site 2. Leeches were found in two test replicates of sample 2. These leeches may have eaten the *C. tentans larvae*. No other significant differences were found in *H. azteca* and *C. tentans* survivorship between Eighteenmile Creek sediments and controls.

Growth of *C. tentans* was significantly less than the controls in all Eighteenmile Creek sediment samples except from site 8. This reduced growth indicates a toxic response by *C. tentans* to these sediments. And unlike the survival data, *C. tentans* growth was significantly reduced in both duplicates, samples 2 and 2D. *H. azteca* growth was equal to or greater than control growth in all Eighteenmile Creek samples.

Growth was greater than controls for *H. azteca* exposed to sediments 1 and 8, and for *C. tentans* exposed to sediment from site 8. This indicates a non-toxic response to these sediments.

Elutriate Phase Toxicity Test

Scope Of Report

This report presents only the results of sediment elutriate acute toxicity tests.

Test Method

Elutriate solutions were prepared according to U.S. Environmental Protection Agency and U.S. Army Corps of Engineer protocol (USEPA/USACOE, 1991,1992). Toxicity tests with early life stages of *Daphnia magna* (water flea) and *Pimephales promelas* (fathead minnow) were performed according to USEPA protocol (USEPA, 1993).

Test Sediment Information

Test Sediment Source And Date Collected: Refer to Figures 1-1 through 1-4 for locations of sediment sampling stations. Test sediment was collected October 11- 12, 1994.

Method Of Sediment Collection: Samples are collected with a modified Ponar Dredge sampler. The standard stationary screens have been replaced with sliding stainless steel screens. After the Ponar sample is brought to the surface, the sliding screens are opened and excess water is gently poured off the sediment's surface. The upper 3 to 5 cm of sediment is then scooped into a clean stainless steel bucket. Additional Ponar samples are collected and sediment composited into the stainless steel bucket until the predetermined volume of sediment has been collected. This composite sample is then thoroughly mixed using a paddle, and subsampled into the proper containers for chemical, physical, and toxicological testing.

Sediment Handling And Shipping: Sediment samples for chemical, physical and toxicological analysis are placed in coolers with ice immediately after collection. Sediment samples for toxicity testing are packed in ice and either hand-delivered to Avon Field Station or shipped via overnight courier service.

Upon arrival at Avon Field Station, each sample is logged in and assigned a laboratory accession number.

Storage: Sediment samples are stored in the dark at 4° C. All toxicity testing is initiated within two weeks of sample collection.

Disposal: All equipment contacting sediment is rinsed with culture water to remove sediment before washing or disposal. All rinse water (containing sediment) is held in a covered, 115-liter polyethylene tank. After a test is completed, the contents of this tank are allowed to settle for at least seven days. The supernatant is then slowly pumped through a granular activated carbon filter before disposal in the laboratory wastewater system. The sediment remaining in this tank and that

remaining in sample containers is then placed in 19-liter polyethylene pails with twist-lock tops. These pails are labeled as to sediment source and stored in the Hazardous Materials Storage Building. The sediment is then properly disposed of, depending on its contaminant type and concentration.

Culture Water

Same as described in solid phase test.

Test Organisms

Test Organism Source And Culture Procedures: *D. magna* and *P. promelas* are obtained from in-house laboratory cultures maintained under continuous conditions at Avon Field Station. Information on genetic source and culture techniques can be found in Avon Field Station Standard Operating Procedures (AFSBIO.003, 1995; AFSBIO.004, 1995).

Age Of Test Animals

D. magna: Neonates used in these elutriate tests were 24 hours old.

P. promelas: Fathead minnow larvae were 3 to 8 days old.

Summary Of Test Conditions

Table 10-5 is a summary of the test conditions used for the elutriate tests.

Elutriate Preparation Procedure

This procedure follows guidelines developed by USEPA and USACE (1991, 1993) for the dredging programs.

- Remove sediment sample from refrigerator and homogenize using the stainless steel auger and drill press at 500 rpm.

- Transfer 200 ml of sediment to a clean, 1-liter high-form glass beaker, and add 800 ml of Avon Field Station culture water (1:4 sediment-to-water ratio). The sediment is measured by volumetric displacement in a 1,000 ml glass graduated cylinder.

- Add a 75 x 12 mm Teflon stir bar to the 1-liter beaker containing the sediment and water and stir vigorously for 30 minutes on a magnetic stirrer. To ensure complete mixing, stir mixture manually every 10 minutes.

- After the 30 minute mixing period, allow the mixture to settle for one hour.

- After the one hour settling period, carefully siphon the supernatant into four 250 ml plastic centrifuge tubes. Centrifuge at 2,000 rpm for 30 minutes (Relative Centrifugal Field = 920 x g) to reduce the suspended clay fraction remaining suspended in the supernatant.

- Pour supernatant from centrifuge tubes into a 1-liter beaker and use immediately for toxicity test.

Statistical Methods

Statistical analyses were performed using TOXSTAT® 3.4 software (WEST, 1994). All data sets were visually checked for outliers (extreme values) before statistical analysis. LC50s were calculated using appropriate statistical protocol by Probit, Spearman-Karber, and/or Trimmed Spearman-Karber methods.

Results And Discussion

Table 10-6 summarizes mortality data for the Eighteenmile Creek sediment elutriate tests with *D. magna* and *P. promelas*. There was not significant mortality in any of these tests.

The sediment elutriates were still highly colored after centrifugation, and dissolved oxygen concentrations were low. The elutriate samples ranged from brown to black in color before pre-test aeration. This color was likely due to fine colloidal particles. After aeration, the samples were brown-orange to black-orange in color. This orange color change was most likely due to oxidation of iron to iron oxide.

Table 10-5.Summary of acute toxicity test conditions for *D. magna* and *P. promelas* elutriate toxicity tests on Eighteenmile Creek sediment samples.

TEMPERATURE:	25°±1° C
LIGHT QUALITY:	Wide-spectrum fluorescent
ILLUMINANCE:	500 - 1,000 lux
PHOTOPERIOD:	16-hour light: 8-hour dark
TEST TYPE:	Static
TEST DURATION:	48 hours
TEST CHAMBER:	
D. magna	30 ml polystyrene disposable cups
P. promelas	250 ml borosilicate beakers
TEST SOLUTION VOLUME:	
D. magna	25 ml
P. promelas	200 ml
DILUTION WATER and ELUTRIATE PREPARATION:	Avon Field Station culture water
WATER QUALITY:	Temperature, dissolved oxygen and pH daily
ORGANISMS/CHAMBER:	

D. magna	5
P. promelas	10

NUMBER OF REPLICATE CHAMBERS/TREATMENT:

D. magna	4
P. promelas	2

FEEDING: Not fed during test

AERATION: Elutriate samples aerated before test setup, but no aeration was required during Eighteenmile Creek tests to maintain 40% saturation

TEST ENDPOINTS: Mortality, identified as no external movement of test organism after gentle disturbance.

Table 10-6.Summary of Eighteenmile Creek sediment elutriate acute toxicity data for *D. magna* and *P. promelas*.

Sample Number	Date Test Started	Species Tested	Percent Survival at Elutriate Concentrations					
			Control	6.25%	12.5%	25%	50%	100%
1	10/20/94	*D. magna*	100	100	100	100	100	95
1	10/20/94	*P. promelas*	90	100	100	100	95	100
2	10/21/94	*D. magna*	100	100	95	90	100	95
2	10/21/94	*P. promelas*	100	100	100	100	90	95
2D	10/19/94	*D. magna*	100	100	100	100	100	95
2D	10/19/94	*P. promelas*	100	100	100	90	95	100
3	10/19/94	*D. magna*	100	100	95	100	100	100
3	10/19/94	*P. promelas*	100	100	100	90	100	100
4	10/18/94	*D. magna*	100	100	100	100	100	100
4	10/18/94	*P. promelas*	100	100	100	100	100	100
5	10/18/94	*D. magna*	100	100	100	100	100	100
5	10/18/94	*P. promelas*	100	100	100	100	100	100
6	10/17/94	*D. magna*	90	100	95	90	95	95
6	10/17/94	*P. promelas*	100	95	100	100	100	95
8	10/17/94	*D. magna*	90	90	95	90	100	100
8	10/17/94	*P. promelas*	100	100	100	100	100	100

Chapter 11 -Microtox®

Introduction

Sediment samples collected as part of the Eighteenmile Creek study were tested for toxicity to *Photobacterium phosphoreum*. These tests were done to assess the relative toxicity among locations. Both pore water and sediment were tested for all stations.

Materials and Methods

The fifty percent effects concentration (EC50) values were measured for sediment and pore water. The EC50 is the effective concentration of a sample causing a 50% decrease in light output of the test organisms for the exposure period. Whole sediment samples from seven stations (Figures 1-1 through 1-4) were tested using the Large Sample Procedure (LSP) described by the Microbics Corporation (Microbics, 1992a). The highest concentration of sediment tested was 19.74% by volume. Pore water samples were prepared by centrifuging at 2250g for 15 minutes at room temperature. The Microtox® 100% procedure (Microbics, 1992b) was used for testing pore water samples. The highest concentration of pore water tested was 90%.

Results and Discussion

EC50 values are reported for the whole sediment assay in Table 11-1 and for pore water in Table 11-2. All but one sample elicited a response to the test organisms in the LSP sediment test. No relationship between relative toxicity and concentration of contaminants could be established. Except no toxicity was detected at Station No. 1 where no PAH concentration exceeded the detection or quantification concentration. PAHs were detected at all other stations. An association between PAH and whole sediment toxicity to *P. phosphoreum* has been reported (Tay, 1992). Toxicity occurred at Total PAH concentrations greater than 0.51 mg/kg. Total PAH concentrations above quantification limits exceeded this concentration at all stations but Station No.1.

Pore water elicited toxicity at Station Nos. 2 and 3 (Table 11-2). However, confidence intervals were unacceptably broad at these sStations suggesting a problem with the procedure. Because the toxicity of pore water samples was low the more reliable Basic Test Procedure was not done because this test only detects toxicity up to 45% sample.

Table 11-1:Toxicity of whole sediment to *Photobacterium phosphoreum*

Station	EC50 (% sediment)	95% confidence interval
1	>19.74*	
2	0.65	0.56-0.75
2(lab. rep.)	0.41	0.38-0.45
2(field dup.)	0.36	0.36-0.38
3	0.79	0.78-0.81
4	1.27	1.18-1.37
5	0.56	0.51-0.61
6	1.79	1.56-2.04
8	0.51	0.49-0.54

*19.74% was highest concentration tested

Table 11-2:Five and Fifteen Minute *Photobacterium phosphoreum* EC50 Values of Pore Water from Eighteenmile Creek

Station	5 minute EC50* (95% C.I.)	15 minute EC50* (95% C.I.)
1	>90.9	>90.9
2	24.51 (13.2-45.51)	27.67 (14.01-54.65)
2(lab. replicate)	50.12 (13.23-187.77)	55.27 (8.87-344.35)
2(field duplicate)	77.92 (0-1568)	52.56 (1.71-1620)
3	72.74 (2.12-2498)	67.96 (0.38-12156)
4	>90.9	>90.9
5	>90.9	>90.9
6	>90.9	>90.9
8	>90.9	>90.9

*as % pore water

Chapter 12 -Macroinvertebrate Sampling

INTRODUCTION

Macroinvertebrates in bottom sediments were sampled in Olcott Harbor and Eighteenmile Creek by New York State Department of Environmental Conservation personnel in October, 1994. Macroinvertebrates are larger-than-microscopic invertebrate animals that inhabit aquatic habitats; freshwater forms are primarily aquatic insects, worms, clams, snails, and crustaceans. They are favored for use as indicators of environmental quality for several reasons: they are sensitive to environmental impacts; they provide a suitable endpoint for water quality objectives; they are less mobile than fish, and thus cannot avoid discharges; they can indicate effects of spills, intermittent discharges, and lapses in treatment; they are indicators of overall, integrated water quality, including synergistic effects and substances lower than detectable limits; they are abundant in most aquatic systems and are relatively easy and inexpensive to sample; they are able to detect non-chemical impacts to the habitat, such as siltation or thermal changes; they are vital components of the aquatic ecosystem and important as a food source for fish; they are more readily perceived by the public as tangible indicators of water quality; they can often provide an on-site estimate of water quality; they can often be used to identify specific stresses or sources of impairment; they can be preserved and archived for decades, allowing for direct comparison of specimens; they bioaccumulate many contaminants, so that analysis of their tissues is a good monitor of toxic substances in the aquatic food chain.

METHODS

Sampling methods and laboratory methods followed the updated Quality Assurance Workplan for Biological Stream Monitoring in New York State (Bode et al., 1996). Bottom sampling was conducted at the two study sites on October 12, 1994. A standard Ponar bottom grab sampler (Wildlife Supply Company) was employed using a boat-mounted davit and winch. The use of the Ponar grab sampler provides a quantitative sample of soft sediments in rivers or lakes.

The sampler is designed to penetrate the substrate by its own weight, and enclose a portion of the bottom by means of a gravity-activated closing mechanism. The Ponar measures nine inches on each side, enclosing a surface area of 0.56 square feet (0.052 square meters).

The samples were field-sieved in a bucket with a U.S. Standard No. 30 mesh sieve (0.590 mm openings). The contents of the sieve were transferred to a quart jar and preserved with 95% ethyl alcohol to which rose bengal stain had been added. In the laboratory the samples were rinsed with tap water in a U.S. No. 40 standard sieve to remove any fine particles left in the residues from field sieving. The remaining material was removed and placed in a petri dish with water. This portion was examined under a dissecting stereomicroscope and all organisms were removed from the debris. As they were removed, they were sorted into major groups, placed in vials containing 70 percent alcohol, and counted. Samples from Station 4 were quartered prior to sorting; Station 1 samples were sorted in their entirety due to low numbers of organisms in the samples.

All organisms were identified to the species level whenever possible. Chironomids and oligochaetes were slide-mounted and identified using a compound microscope; most other organisms were identified as whole specimens using a dissecting stereomicroscope. The number of individuals in each species, and the total number of individuals in the sample was recorded on a data sheet. All organisms from the subsample were archived, either slide-mounted or preserved in alcohol.

DEVELOPMENT OF ASSESSMENT METHODS

Pooling Ponar samples for data analysis

In the present study, data from the three Ponar samples taken at each site were pooled prior to the calculation of the five indices. This procedure follows the preferred method for treating Ponar data (Simpson et al., 1986). Most indices benefit from the pooling of samples. Ponar samples can have low sample sizes; in the present study, one sample had only 50 individuals. The calculation of species diversity is not recommended for sample sizes less than 100 individuals.

Additionally it is incorrect to average species diversity values from different samples, due to the logarithmic nature of the index. Species richness also benefits from sample pooling, with the total richness usually being a more meaningful measure than average richness. While the pooled samples are listed under "Total", the data for individual Ponar samples are maintained under the "A", "B", and "C" columns of the raw data table.

Analysis of invertebrate data

No standardized procedure exists for the evaluation of invertebrate communities in sediments to determine the influence of contaminants. The major approaches to community analysis include: community structure indices, multivariate analysis or regressions, functional feeding group analysis, ordination or clustering techniques, and the biological indicator approach. These are summarized below:

1. Community structure indices: these are indices that measure the number of species, the number of individuals, and the distribution of individuals among the species. They include richness, diversity, and evenness measures.

2. Multivariate analyses or regressions: these methods attempt to find patterns and correlations between species presence, absence, or abundance and different environmental variables. The most sophisticated procedures require a subset of environmental variables to be available.

3. Functional feeding group analysis: the generalized feeding mode is known for most invertebrates, e.g. filterers, scrapers, shredders, predators. When these are summarized for each sample, the community can be characterized with regard to primary feeding mode, indicating the dominant classes of food items available, e.g. plankton, bacteria, periphyton. Feeding group information generally contributes to the ecological understanding of a community, but may not relate directly to pollutional impacts.

4. Ordination or clustering techniques: these are generally comparative methods for

associating data from one site to another, or one site over time. Clustering may lead to the synthesis of different community types.

5. Biological indicator approach: indicators are generally species that provide an indication of environmental conditions by their presence, absence, or abundance. Groups of species, or assemblages, are recognized to be more valuable and reliable indicators than individual species. Biotic indices extract indicator information from every species in the sample, and provide one of the best of the indicator measures.

Of the above approaches, no single index or method has been shown to be superior in the measurement of effects of environmental variables on biological communities. Recognizing this reality, most methods of biological community analysis now incorporate elements of several approaches into a single multimetric measure. The generalized process of delineating appropriate indices and criteria is summarized below:

1. Compile a database of sample data from a variety of sites, representing a wide range of estimated water quality.

2. Calculate candidate indices for all sites. Several indices should be calculated, and should include most of the major approaches to data analysis.

3. Determine the range for each of the indices. The ranges may be trimmed by eliminating the upper and lower 5% as outliers.

4. Sub-divide the range of values for each index into four sub-ranges. These are the provisional ranges for non-, slight, moderate, and severe impact. This step assumes that both non-impacted and severely impacted sites are included in the database.

5. Evaluate the sub-ranges and the indices for reliability, compare indices at each site to find which indices appear most consistent in assigning impact. Select at least four indices that

appear reliable. Adjust the sub-ranges as necessary for each impact category, to make the indices as consistent as possible at each site.

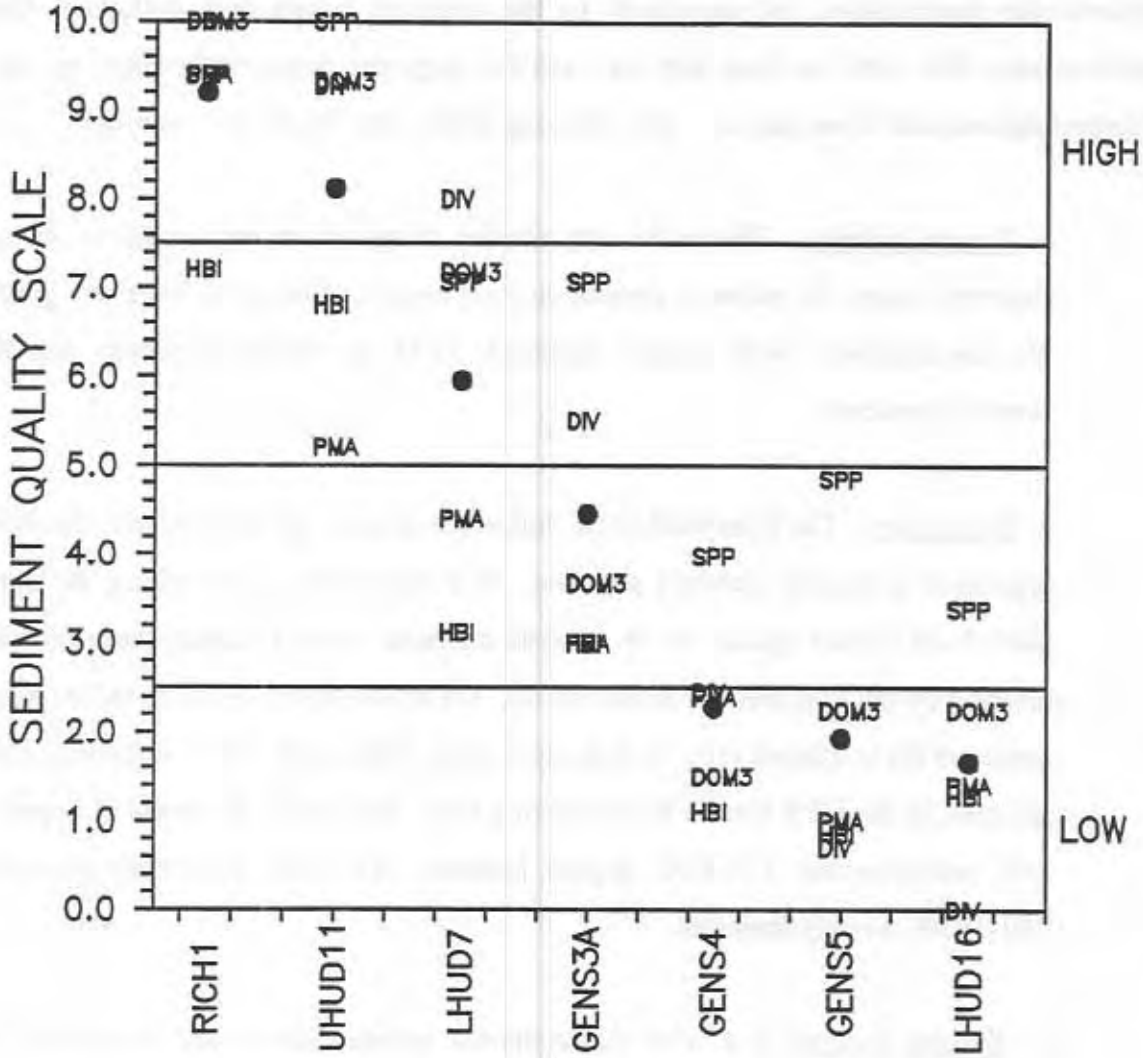
Four data sets were used in the initial criteria-setting process: the Richelieu River, the Upper Hudson River, the Lower Hudson River, and the Genesee River (Figure 12-1). The reference sites in these systems were selected on the basis of the perceived relative health of the invertebrate communities, and secondarily by the perceived impact from pollution. Candidate indices were first tested on these data sets, and the suggested ranges were tested on the Olcott Harbor/Eighteenmile Creek data set. The following indices and criteria were selected:

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

2. Biotic index. The Hilsenhoff Biotic Index is a measure of the pollution tolerance of the organisms to organic (sewage) pollution. 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). Values are listed in Hilsenhoff (1987); additional values are assigned by the NYS Stream Biomonitoring Unit. Ranges for the levels of impact are: 0-7.00, non-impacted; 7.01-8.00, slightly impacted; 8.01-9.00, moderately impacted; and 9.01-10.00, severely impacted.

3. Species diversity is a value that combines species richness and community balance (evenness). Shannon-Wiener diversity values are calculated using the formula in Washington (1984). Expected ranges for sediments in most New York State rivers are: >3.00, non-impacted; 2.51-3.00, slightly impacted; 2.01-2.50, moderately impacted; and 2.00 or less, severely impacted.

Figure 12-1. Biological Assessment Profiles of index values for Ponar samples from four rivers in New York State. RICH= Richelieu R., UHUD= Upper Hudson R., LHUD= Lower Hudson R., GENS= Genesee R. SPP= species richness, DIV= species diversity, HBI= Hilsenhoff Biotic Index, DOM3= % contribution of top three species, PMA= Percent Model Affinity. Values are plotted on a normalized scale of sediment quality.



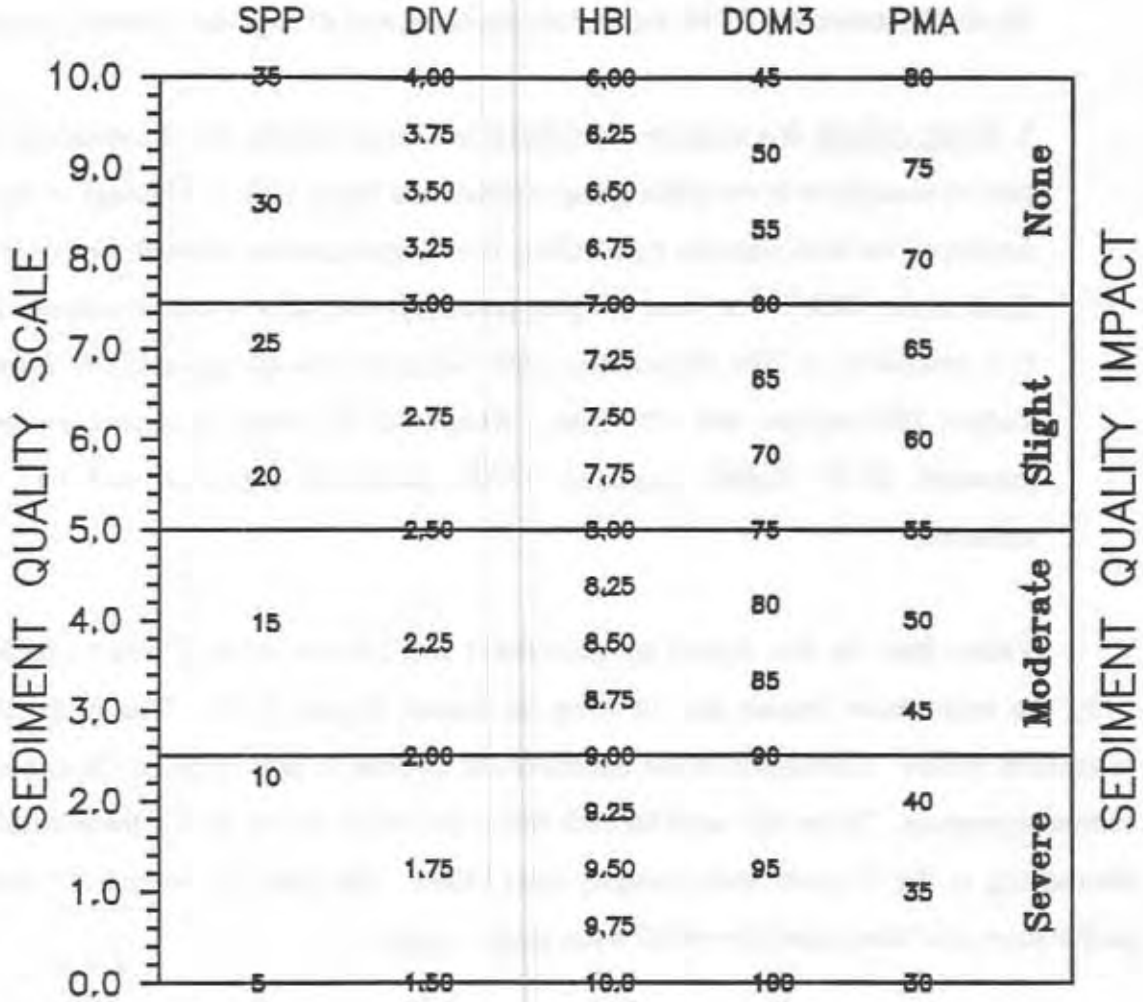
4. Species dominance is a simplified measure of balance or evenness in the community. High dominance by a few species often denotes unstable communities, and impacts favoring a few species. Species dominance 3 is the combined percent contribution of the three most numerous species. Ranges for the levels of impact are: <60, non-impacted; 60-74, slightly impacted; 75-89, moderately impacted; and 90 or greater, severely impacted.

5. Model Affinity is a measure of similarity to a model non-impacted community based on percent abundance in the major groups (Novak and Bode, 1992). Although it was initially developed for kick samples from riffles, it was subsequently adapted for Ponar samples (Bode et al., 1995c). For Ponar samples, percentage similarity is used to measure similarity to a community of 20% oligochaetes, 15% mollusks, 15% crustaceans, 20% insects (non-midge), 20% midges, and 10% other. Ranges for the levels of impact are: >67, non-impacted; 56-67, slightly impacted; 43-55, moderately impacted; and <43, severely impacted.

Values from the five indices are normalized to a 10-point scale of water quality, with 0 being the most severe impact and 10 being no impact (Figure 12-2). This is the biological assessment profile. Conversion of the indices to the 10-scale is accomplished through a table or computer program. The profile score for each site is determined by calculating the selected indices, normalizing to the 10 scale, and averaging these values. The averaged normalized value is the profile score, and determines the overall water quality impact.

Figure 12-2. Derivation of profile values for Ponar sample indices

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



To plot sample data, each site is positioned on the x-axis according to river miles from the mouth, and the scaled values for the five indices are plotted on the common scale. The mean scale value of the four indices is represented by a circle, and represents the assessed impact for each site. SPP= species richness, DIV= species diversity, HBI= Hilsenhoff Biotic Index, DOM3= % contribution of top three species, PMA= percent model affinity.

RESULTS AND DISCUSSION

Overall characterization of the benthos

The benthic invertebrate fauna was dominated almost exclusively by worms at the lake site and by midges and worms at the creek site (Appendix G). Individual Ponar samples contained 50 - 468 organisms, averaging 59 (1135/m^2) at the lake site and 457 (8788/m^2) at the creek site, and 2 - 13 species, averaging 2 at the lake site and 11 at the creek site. The number of organisms, or standing crop at the lake site is considered low, while at the creek site is considered medium, compared to the expected standing crop levels suggested in Simpson et al. (1986): low: <4000/m^2, medium: 8,000-12,000/m^2, and high: 18,000-22,000/m^2. By further comparison, Genesee River standing crops were closest to the medium range, averaging 7134/m^2 (Bode et al., 1995a), and Oswego River standing crops were in the low range, averaging 3846/m^2 (Bode et al., 1995c).

Factors influencing the fauna

Several environmental variables were considered in assessing the resident invertebrate communities in the present sampling. The three primary factors considered as possible components affecting faunal differences between sites were levels of contaminants in the sediments, particle size composition of the sediments, and depth. Since the goal of biological assessment is to determine the level of impact of contaminants on the fauna, biological assessments will be more successful in discerning these effects when the factors of sediment and depth are constant or optimal.

In the present study, the sediment at the lake site (Station No.1) was characterized as an entirely sand substrate, underlaid by bedrock. Sediment particle size analysis showed that the substrate consisted of 93% fine to very fine sand, with small amounts of coarse sand, medium sand, silt, and clay. The low species richness and low biomass was consistent with a poorly graded sand substrate, which would provide a poor habitat for invertebrates. Due to this strong habitat factor, only pronounced effects of contaminants would be discernible using invertebrate communities.

The sediment at the creek site, Station No. 4, was characterized as "dark brown silty or clayey sand with 33% silt or clay". This sediment is considered to be a favorable habitat for invertebrates, and is likely not limiting to the fauna. The depth of both sites in this study was 3.0 meters, and is thus not considered a differentiating factor between the two sites.

Assessment of water/sediment quality in Olcott Harbor

Invertebrate samples from the lake site (Station No.1) contained only two species: the tubificid worm Potamothrix moldaviensis, and the midge Cryptochironomus fulvus gr. Because of the low species richness and low standing crop at this site, the community indices yield little information on sediment quality, all appearing to indicate severe impact (Figure 12-3). The fauna is considered to be controlled primarily by the substrate particle size, and the indices at this site are of little value in assessing sediment quality.

Some ecological information may be gained by examining the ecological preferences and tolerances of the species present. Potamothrix moldaviensis has most frequently been reported from sediments in meso-eutrophic conditions (Griffiths, 1991, Hiltunen, 1967, Lauritsen et al., 1985). Barton (1986) found Potamothrix moldaviensis primarily in silt at depths of 5-10 meters in Lake Ontario. Cook and Johnson (1974) reported Potamothrix moldaviensis from Lake Ontario near the mouth of the Oswego River, indicating moderately polluted conditions. Cryptochironomus fulvus gr. is considered a fairly tolerant midge, often found at sites moderately affected by organic wastes (Simpson et al., 1984). It has been reported from sand and silty sand substrates. At three Hudson River sites it was one of only two species found in fine sand sediments. Thus these two species are most frequently indicators of slight to moderate impact, and reflect the fine sand substrate that few other species inhabit. The fauna at this site was most similar to the Type E model (see Table 12-1), typified by moderate to severe impacts, or strongly influenced by sand substrates. Overall impact at this site is considered slight to moderate.

The silt/sand/clay sediment at Station No. 4 was dominated by the midges Tribelos jucundum, Procladius sp., the worm Limnodrilus hoffmeisteri, and the crustacean Gammarus sp. Two of these, Tribelos jucundum and Gammarus sp., are considered facultative, and two, Procladius sp. and Limnodrilus hoffmeisteri, are considered tolerant. Model affinity showed the fauna to be most similar to Type D (see Table 12-1), which is typified by slight to moderate impact. Overall, the indices from this site were quite consistent with the assessment of slight to moderate impact.

Figure 12-3. Biological Assessment Profile of index values, Olcott Harbor and Eighteenmile Creek. SPP= species richness, DIV= species diversity, HBI= Hilsenhoff Biotic Index, DOM3= % contribution oftop three species, PMA= Percent Model Affinity. Values are plotted on a normalized scale of sediment quality.

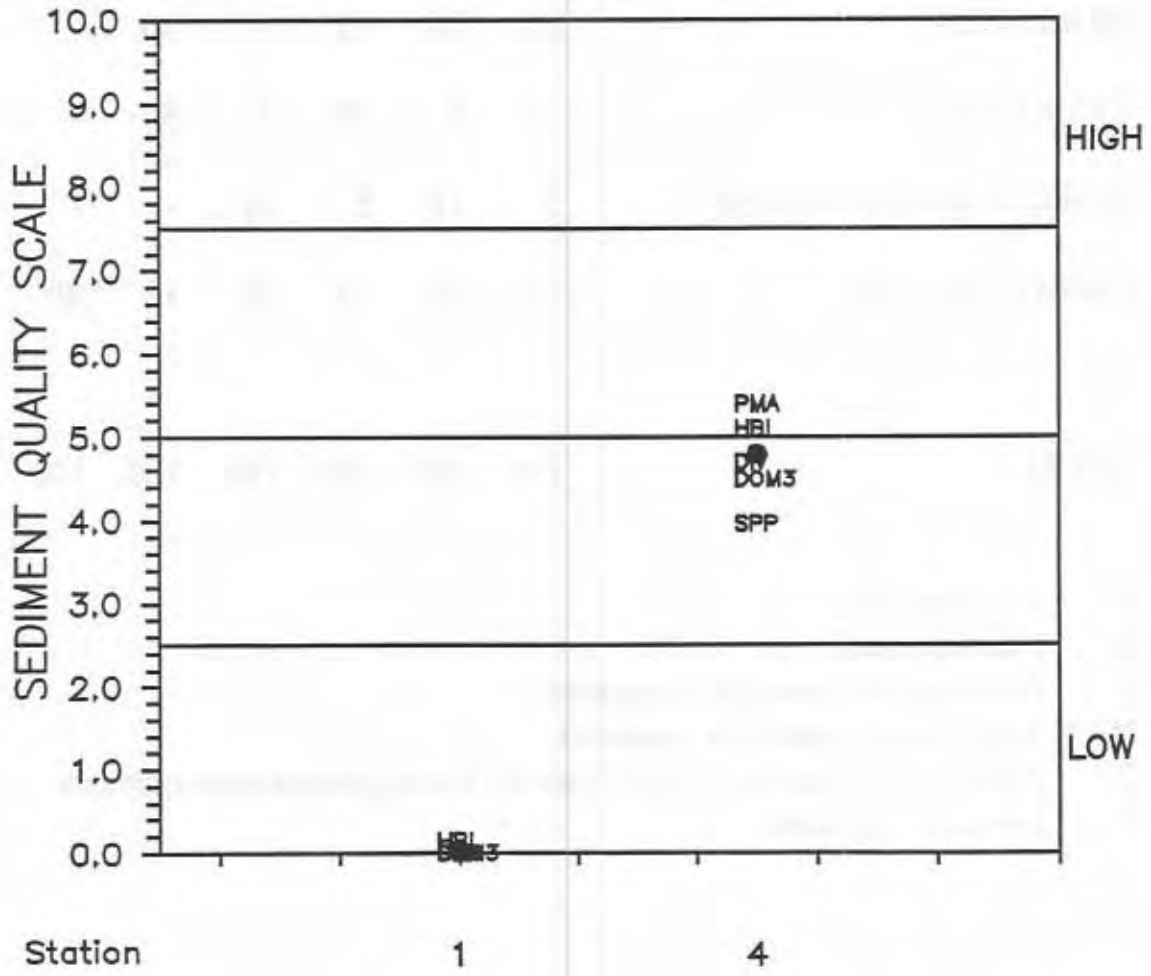


TABLE 12-1. COMMUNITY TYPES FOUND IN BENTHIC INVERTEBRATE PONAR SAMPLES. Organism groups represented by % contribution.

	A	B	C	D	E	F
PLATYHELMINTHES	5	5	-	5	5	-
POLYCHAETA	-	20	-	-	-	-
OLIGOCHAETA	20	30	15	30	70	20
MOLLUSCA	20	20	15	-	10	-
CRUSTACEA	15	5	40	5	5	-
INSECTA (Non-chironomid)	5	10	5	10	-	-
CHIRONOMIDAE	35	10	25	50	10	80
TOTAL	100	100	100	100	100	100

A Non-impacted
B Non-impacted
C Non-impacted to slightly impacted
D Slightly- to moderately impacted
E Moderately impacted, or may indicate homogeneous sand substrate
F Severely impacted

Implications of zebra mussel populations in the Olcott Harbor

Although zebra mussels (MOLLUSCA: Dreissena polymorpha) were not collected in the present study, colonization of Eighteenmile Creek and/or Olcott Harbor to some degree is possible in the future. Zebra mussels first entered the Great Lakes in 1986, and were probably in Lake Ontario near Olcott Harbor by 1991. These prolific mollusks require a hard substrate for attachment, and will attach to most hard substrates greater than 3 cm diameter (Effler and Siegfried, 1994). In addition to biofouling concerns (clogging water intake pipes), there are many possible ecological repercussions to large-scale infestations of zebra mussels. They include:

1) removal of substantial amounts of plankton and suspended particles from the water column, resulting in increased water clarity, increased light transmission, increased photosynthesis and plant growth, and possible negative impact on invertebrate and fish species dependent on the pelagic food web;

2) depletion of dissolved oxygen levels through respiration (Effler and Siegfried, 1994);

3) increased food/energy resource for detritivores through biodeposition of pseudofeces (Stewart and Haynes, 1994);

4) increased habitat diversity for benthic organisms provided by the multi-layered clustering of zebra mussel shells (Stewart and Haynes, 1994); and

5) loss of substantial numbers of resident clams through inundation of zebra mussels covering the shells and growing between the shells.

The probability of occurrence of these ecological repercussions in any waterbody is dependent on the availability of suitable conditions for zebra mussel attachment and survival.

Recommendations and future study needs

The indices and criteria used in the present study were developed for the analysis of Oswego River and Olcott Harbor data, and were based on a database including only four rivers. The enlargement of this database will likely lead to further refinements and improvements of the metrics and criteria. Indices and criteria should ideally be applicable to a wide range of river systems; consequently such a system requires a wide range of samples in its development.

One area of study that should be continued to be investigated in subsequent studies of river bottom benthos is the delineation and characterization of different community types. Community types are models that represent a recurring type of community, one that may be recognized through cluster analysis. Community types were successfully used in large rivers by Griffiths (1991), and in smaller streams by Bode et al. (1995b). Community types can be associated with particular types and degrees of pollution-based impairment. In the Oswego River study, six community types for Ponar samples have been provisionally developed (Bode et al., 1995c). As more data is gathered from different aquatic systems, these models will be supplemented, and their characteristics defined more precisely.

Chapter 13 -Summary/Conclusions

The matrix of investigative techniques employed are believed to have successfully documented the environmental integrity of the sediments and benthos in the Olcott Harbor Area of Concern (AOC). Sediments upstream of the AOC were also evaluated as they may ultimately impact the sediment quality downstream, in the AOC.

The biological and chemical characterizations presented herein are expected to be useful for developing the Remedial Action Plan (RAP) and potential remediation measures, as may be required, in the AOC. Due to the high degree of contamination encountered in sediments located upstream of the AOC, and the potential for downstream migration of these sediments, it is recommended they be recognized in the RAP for the Study Area.

It is anticipated the techniques developed and utilized for this study will be refined and used for future sediment and biological characterization studies. All data collected during this study has been entered into the New York State Great Lakes Sediment Inventory. All data will also be provided to the Environmental Protection Agency's Region 2 office for inclusion into the National Sediment Inventory.

Metals

High concentrations of cadmium (26 ppm), chromium (1,910 ppm), copper (2,340 ppm), lead (7,850 ppm), mercury (2.2 ppm), nickel (523 ppm), and zinc (24,000 ppm) were encountered at Station Nos. 6 and 7. These sites were located in depositional areas upstream of the Burt and Newfane Dams, respectively. Metals levels appeared to increase with depth at Station No. 6, suggesting a prior history of contamination. Peak metals concentrations were highest in the "near-surface" core sample at Station No. 7, suggesting more recent contamination. Additional core

sampling behind these dams is recommended to quantify the extent, and to estimate the volume of contaminated sediments at these sites.

The highest concentrations of mercury and lead encountered during this study were measured at Station Nos. 4a (3.8 ppm) and 2 (291,000 ppm), respectively. The lead concentration observed at Station No. 2 was believed to be an anomaly, as a similarly high concentration was not observed in a corresponding field replicate sample from that site.

Most trace metals results exceeded Persaud's (1993) lowest effect level (LEL) guidance values for at least one or more sample depth at each site sampled. One exception to this finding was at the Lake Ontario sampling site (Station No. 1), where arsenic was the only metal to exceed the LEL guidance value, and only by a slight amount. Sediments at this site were judged to be relatively clean.

Concentrations of trace metals at Station Nos. 3, 4, 4a, 5, and 7 were generally higher in surface samples collected at these sites. Resuspension and transport downstream of highly contaminated sediments from behind the Burt Dam is suspected to be responsible for the trace metal contamination encountered at Station Nos. 5, 4, 4a, and 3.

Pesticides

Very few samples collected were found to have pesticide concentrations greater than reported analytical detection limits. Of the few pesticide compounds detected, 4,4'-DDT and its metabolites were the most common encountered. The highest concentrations of DDT (62 ppb) and DDD (59 ppb) were measured in the 33 cm core collected in Eighteenmile Creek at Station No. 8. The source of these pesticides is unknown, however, they are suspected to be "old" and unmetabolized in nature.

Pesticides encountered at Station Nos. 6, 7, and 8 were highest in the deepest subsamples from these sites. Additional, longer, sediment cores would be necessary to confirm that higher pesticide concentrations do not exist in the deeper sediments at these sites. Data resulting from this additional coring would also be used to evaluate the spatial extent of pesticide contamination and to estimate " bed-loads" or volumes of contaminated sediments at these sites.

PCBs

Nine Surficial Samples, including two replicates, were collected for this study. The analytical results for PCBs ranged from none detected (<.039 ppm) to 1.9 ppm of Aroclor 1242 in the Burt Dam pool. Most of these analytical results exceed the NYSDEC wildlife bioaccumulation guidance values and the Persaud low effects level.

Seven core samples were also collected and subsectioned into 17 subsections. The concentrations of PCBs ranged from essentially none detected for all subsections collected downstream of Burt Dam to 27 ppm of Aroclor 1248 in the Burt Dam pool and 23 ppm of the same Aroclor in Newfane Dam pool. All of the samples collected between the Burt Dam and the Clinton Street Bridge contain PCB concentrations that exceed the NYSDEC wildlife bioaccumulation guidance value and Persaud's low effect level. The lower core subsection from the Burt Dam pool exceeded Persaud's severe effects level.

The concentrations of PCBs in the sediments behind the Burt and Newfane Dams warrant additional monitoring to further characterize the spatial and temporal extent of the PCB levels, given the proximity of the Olcott Harbor AOC.

Dioxin/Furan

A qualitative assessment of the dioxin furan levels from the core subsections collected behind the Burt and Newfane Dams and just downstream of the Clinton Street Bridge would label them as high concentrations. All other subsamples collected for this study exhibit low, background levels, except the lower subsection collected in the Olcott Harbor turning basin, which would be given a moderate level designation.

All the moderate and high levels, noted above, exceeded the NYSDEC wildlife bioaccumulation guidance value. The lower core subsection from the Burt Dam pool also exceeded the NYSDEC human bioaccumulation guidance value.

The dioxin and furan homologs analyzed from this study exhibit a percent abundance pattern that is characteristic of sediment concentrations that is thought to be produced by contamination from multiple combustion sources.

There are enough elevated levels of dioxins and furans behind the Burt and Newfane Dams to warrant further study to better define the spatial and temporal distribution of these contaminants, given the proximity of the Olcott Harbor AOC.

PAHs

The highest total PAH concentration was measured in the surficial sample collected at Station No. 8 (119,130 ppb). Slightly lower total PAH concentrations were measured in the deeper core sample collected at Station No. 8 (0-33 cm., 73,500 ppb) and in the samples collected at Station Nos. 7 (0-30 cm., 27,760 ppb) and 6 (51-62 cm., 18,590 ppb). Considerably lower concentrations were encountered at the other sampling sites.

Total PAH concentrations measured at Station Nos. 8, 7, and 6 did exceed Persaud's lowest effects level (LEL) guidance value of 4,000 ppb (1993). The LEL guidance value is intended to reflect sediments which are clean to marginally polluted and could be tolerated by the majority of benthic organisms. None of the total PAH concentrations measured exceeded Persaud's severe effects level (SEL) guidance values. The SEL guideline for one individual PAH compound, dibenzo(a, h)anthracene (6,994 ppb) was, however, exceeded in the surficial sample collected at Station No. 8 (9,800 ppb). Sediments exceeding the SEL guidance are considered heavily polluted and likely to adversely affect the health of the majority of sediment-dwelling organisms.

The source of the PAH contamination at Station No. 8 is unknown. This site is, however, located downstream of the confluence with the Erie Barge Canal. It is in the Erie Barge Canal where oil spills have been documented by the NYSDEC, Division of Spills Management. Specifically, spills at the J. Ward Reid and Son oil storage facility are suspected as are from other sites along the Canal. It is recommended that additional sampling be performed in the Erie Barge Canal to verify these potential sources. Additional core sampling should also be performed at Station Nos. 7 (Newfane Dam) and 6 (Burt Dam) to delineate the spatial extent of the PAH contamination at these sites.

Mirex/Photomirex

Mirex was analyzed for but not detected in any of the samples submitted to Roy F. Weston, Inc. for analysis. Minimum detection limits for their samples ranged from 0.17 to 0.48 ppb. Analysis of mirex was not performed on the reconnaissance samples collected at Station Nos. 1a and 4a on May 25, 1994. Photomirex was not evaluated as reliable standards could not be obtained.

Octachlorostyrene

Octachlorostyrene was analyzed for but not detected in any of the samples submitted to Roy F. Weston, Inc. for analysis. Minimum detection limits for their samples ranged from 0.17 to 0.48 ppb. Analysis of octachlorostyrene was not performed on the reconnaissance samples from Station Nos. 1a and 4a, collected on May 25, 1994.

Toxicity

Sediment samples from Eighteenmile Creek Station Nos. 1 through 6 were toxic to *C. tentans* larvae. The only Eighteenmile Creek sediment sample that was non-toxic to *C. tentans* larvae was from Station No. 8. None of the Eighteenmile Creek sediment samples were toxic to *H. azteca.*

There was no significant mortality to *Daphnia magna* (water flea) neonates or *P. promelas* (fathead minnow) larvae in any of the Eighteenmile Creek sediment elutriate samples.

Microtox®

All but one sample elicited a response to the test organisms in the LSP sediment test. No relationship between relative toxicity and concentration of contaminants could be established. Except no toxicity was at Station No. 1 where no PAH concentration exceeded the detection or quantification concentration. PAHs were detected at all other stations. An association between PAH and whole sediment toxicity to *P. phosphoreum* has been reported (Tay, 1992). Toxicity occurred at total PAH concentrations greater than 0.51 ppm. Total PAH concentrations above quantification limits exceeded this concentration at all stations but Station No.1.

Pore water elicited toxicity at Station Nos. 2 and 3. However, confidence intervals were unacceptably broad at these Stations suggesting a problem with the procedure.

Macroinvertebrates

Macroinvertebrates in sediments were sampled in Olcott Harbor and Eighteenmile Creek by the Stream Biomonitoring Unit during October, 1994. A Ponar sampler was used to take three bottom samples at each of two sites.

Data analysis used five community indices to assess water quality: species richness, species diversity, biotic index, dominance, and percent model affinity. These five indices were normalized on a common ten-scale and combined into Multimetric Profile Scores.

Based on the application of the indices and criteria selected, and the interpretation of these index values, the invertebrate communities of the sediments of Olcott Harbor and Eighteenmile Creek indicate slight to moderate impact. The lake site assessment is less certain because it is controlled primarily by the substrate of poorly graded sand. The "severely impacted" rating rendered by the index values at this site are not reflective of actual sediment quality.

Subsequent analysis of Ponar data may further refine the metrics and criteria. Community types recognized in the present study may be correlated with specific environmental conditions.

Chapter 14 -QA/QC

Data Quality Requirements and Assessments

Field sampling and laboratory analyses were performed in accordance with approved EPA standard procedures unless otherwise noted in Table 1-3. Data Quality Objectives (DQOs) and acceptance criteria for precision and accuracy are also summarized in Table 1-3. The precision and accuracy criteria presented in that table are based upon historical laboratory results and not field results.

Very little existing data were available to evaluate expected concentrations for those analytes quantified during this study. Data resulting from this study will be useful for evaluating distributions of sediment contaminants. Radiodating of the sediment core collected at Station No. 5 was not successful, therefore no calculation or estimation of depositional rates in the study area was performed.

Complete data packages have been provided with all sample results for this project. Included with the data packages are chain-of-custody records, data results, case narratives, chromatograms (where appropriate), raw and intermediate results, instrument calibration data, and results of quality control evaluations as determined below:

- Precision: Precision can be defined as the relative uncertainty about a given measurement and is determined by replicate analyses. Due to the difficulty in obtaining true, duplicate sediment core samples, none were collected. However, two replicate surficial samples were submitted for laboratory analysis. These samples were collected at the same time and adjacent to each other. Acceptability of sample results was based upon the precision criteria presented in Table 1-3.

- Accuracy: Accuracy can be defined as the absolute uncertainty about the true value. The accuracy or abilities of the laboratory to determine the true values or concentrations of proposed analytes has been evaluated previously by the NYSDEC quality assurance officer during the laboratory contractor selection process. This process includes the required analysis of NYSDEC prepared Performance Evaluation samples and on-site audits by a team of NYSDEC chemists. Laboratory matrix spike/matrix spike duplicate (MS/MSD) samples were analyzed to evaluate the accuracy of each batch of samples submitted for this project. Dioxins were not evaluated in the MS/MSD samples due to high cost associated with this analysis and because rigorous QA/QC procedures are associated with the EPA 1613A analysis. The acceptable accuracy in quantifying those analytes to be examined has been summarized in Table 1-3.

- Blanks: Due to the type of matrix to be sampled (sediments), no field blanks were prepared for analysis. Method blanks were evaluated as a required component of the NYSDEC Analytical Services Protocol for control labs (NYSDEC, 1991, See ASP Exhibit E in Vol. 8).

- Representativeness: It is expected the sediment cores collected will be representative of areas of Eighteenmile Creek and Olcott Harbor that have not been dredged since they were taken only from areas that are outside of the Federal Project maintained (dredged) by the U.S. Army Corps. of Engineers. Surficial samples were also collected only from areas which are not currently dredged. Results from these samples should provide a "snapshot" of ambient conditions for those analytes quantified.

- Comparability: Standard procedures were followed when sampling and analyzing all parameters of concern. As low detection and reporting limits were employed during this study, resulting data should be compatible with data from other investigations.

- Completeness: Completeness can be defined as the percentage of acceptable data necessary to accomplish the study objectives. Due to the high cost of sample analysis and the limited number of samples to be collected, it was important that all QA criteria be strictly adhered to in order to accomplish survey objectives. Successful analysis and reporting of at least five of the seven sediment cores and surficial samples or 71% will define completeness for this aspect of the study. Also any data not meeting minimum QA criteria will be identified.

Sampling Procedures

Most large diameter sediment core sampling was performed from on-board the USEPA R/V Mudpuppy using a four-inch diameter electric vibrocorer (Rossfelder; Model P-4). Vibrocore sampling was performed in accordance with USEPA approved methods. NYSDEC staff received on-board training, and did assist with sample collection during the study. Limited four-inch diameter vibrocoring was performed by NYSDEC staff during the reconnaissance sampling. In addition, small, two-inch push cores were also collected by NYSDEC field personnel.

NYSDEC personnel were responsible for transporting the sediment cores and surficial sediment samples to an on-shore sample processing center provided by Roy Weston, Inc.

Upon acceptance of the above noted sediment samples, the Roy Weston, Inc. representative performed all sample processing, including sediment core subsectioning, removal of samples from

core tubes, homogenization of samples as directed by the NYSDEC representative, placement of sample material in sample containers and packing of samples in coolers, and providing all sample processing materials and supplies necessary for the successful processing of samples. Complete descriptions of the sediment coring and surficial sampling procedures, including sample custody procedures is presented, in detail, in the USEPA approved study QAPP (NYSDEC, 1994a).

Documentation, Data Reduction and Reporting

The laboratory results were reported to NYSDEC in accordance with the requirements of ASP, Exhibit B - Category B Deliverables (NYSDEC, 1991). This is a complete document package which allows for full data validation. Field notes will be kept. Data reduction was performed using a Lotus 1-2-3 spreadsheet. Sample concentrations are reported in mg/kg (ppm) dry weight or µg/kg (ppb) dry weight. All field and laboratory QA/QC results have been reported including any and all field blanks, duplicate analyses, matrix spike and matrix spike duplicates analyzed during this study. An evaluation of the precision, accuracy, and completeness based upon replicate and spike analysis has also been included. All field notes and raw data will be saved in the project file and on floppy disks in Lotus 1-2-3 spreadsheet format.

Data Validation

All data were reviewed by the Principal Investigator to determine its validity. Those data not meeting the previously identified criteria for precision, accuracy, and blank values were reanalyzed where possible, or flagged if additional sample material was not available. Data that have been flagged indicate why they did not meet the minimum QA criteria. Laboratory QA sample evaluation included analysis of surrogate spikes to determine the average percent recovery and standard deviation, and method blanks which were compared to respective batch results. The following statistical equations were utilized to quantify the precision, accuracy and completeness of

laboratory data resulting from this project. Results from these statistical calculations have been used to determine whether data quality requirements presented in Table 1-3 were met.

Precision:

The laboratory precision was evaluated by performing duplicate analyses and comparing results. Matrix spike/matrix spike duplicates (MS/MSD) were utilized for organic parameters. Laboratory duplicate analysis are conducted to evaluate inorganic and conventional parameters. These QC samples were analyzed at a frequency of 1 per batch as required by the ASP Exhibit E (NYSDEC, 1991).

If calculated from duplicate measurements, relative percent difference is used to measure precision:

$$RPD = \frac{(C_1 - C_2)x100\%}{(C_1 + C_2)/2}$$

Where: RPD = relative percent differencee

C_1 = larger of the two observed values

C_2 = smaller of the two observed values

If calculated from three or more replicates, the relative standard deviation rather than RPD is used to determine precision:

$$RSD = \left(\frac{s}{\bar{y}}\right)x100\%$$

Where: RSD = relative standard deviation

s = standard deviation

$\bar{y}$ = mean of replicate analyses

Standard deviation is defined as follows:

$$s = \sqrt{\sum_{i=1}^{n} \frac{(y_i - \bar{y})^2}{n-1}}$$

Where: s = standard deviation

y_i = measured value of the ith replicate

$\bar{y}$ = mean of replicate measurements

n = number of replicates

For measurements, such as pH, where the absolute variation is more appropriate precision is reported as the absolute range, D, of duplicate measurements:

$$D = |m_1 - m_2|$$

where: D = absolute range

m_1 = first measurement

m_2 = second measurement

The standard deviation, s, given above, can also be used.

Accuracy:

Accuracy is quantified by determining the percent recovery of "known" surrogate spike material in samples. Matrix spikes, matrix spike duplicates, reference standards and laboratory blank samples may also be used in the assessment of accuracy. These QC samples are analyzed at the frequency specified in the ASP, Exhibit E (NYSDEC, 1991).

For measurements where matrix spikes are used, the percent recovery is calculated as follows:

$$\%R = 100\% x \left(\frac{S - U}{C_{sa}} \right)$$

where: $\%R$ = percent recovery

S = measured concentration in spiked aliquot

U = measured concentration in unspiked aliquot

C_{sa} = actual concentration of spike added

When a standard reference material (SRM) is used:

$$\%R = 100\% x \left(\frac{C_m}{C_{srm}} \right) 0$$

where: $\%R$ = percent recovery

C_m = measured concentration of SRM

C_{srm} = actual concentration of SRM

Completeness

The completeness of analytical results has been calculated to determine if sufficient analytical results are provided to achieve the project objectives. Completeness was calculated using the following equation:

$$\% \text{ Completeness} = \frac{v}{n} x 100\%$$

where: v = number of valid samples

n = number of valid samples necessary to achieve project objectives

Quality Control Evaluation

Analytical quality control results were evaluated to determine whether the Data Quality Objectives (DQOs) and acceptance criteria for the project were achieved. In general, these objectives and criteria were met.

Using the quality control criteria and methods previously outlined, these evaluations are

summarized below. They are based upon the laboratory case narrative summaries. Laboratory calculations of precision and accuracy have been randomly spot checked.

Inorganics

All sample holding times as required by the methods were met and all preparation blank results were below the required detection limits.

All calibration verification checks, using independent standards, were within the required control limits of 90-110%.

Matrix spike recoveries were within the 75-125% guidance limits.

Analytical precision results, as determined by replicate analyses were within the 20% relative percent difference (RPD) guidance limit.

Metals

All sample holding times as required by the method were met and all preparation blank results were below the required detection limits.

All Initial and Continuing Calibration Blanks (ICB/CCBs) were within control limits except Lead CCB3 -38 µg/l (SDG # L61301). All Initial and Continuing Calibration Verifications (ICV/CCVs) were within control limits. All ICP Interference Check Samples (ICSA and ICSAB) were within control limits as were Laboratory Control Samples (LCS; 80-120%).

All Serial Dilution percent differences were within the USEPA SOW ILM02.1 control limits except for Station No. 5 (0-61 cm) Zn (12.0%) and Station No. 1 (Surficial) Zn (10.3%).

Matrix Spike recoveries were within the 75-125% control limits (exception allowed when sample concentration exceeded the spike added concentration by a factor of four or more) except for the Station No. 5 (0-61 cm) concentration for Pb (42.7%).

All duplicate analyses were within the 20% Relative Percent Difference (RPD) control limits for sample results greater than 5x Reporting Limit, or +/- the Reporting Limits for sample results less than 5x Reporting Limit except for:

All analytical spike recovery analyses were within control limits except for:

Station No.(Depth)	Analyte	Station No. (Depth)	Analyte
1 (Surficial)	As	3 (0-61 cm)	As
3 (203-279cm.)	As	4 (178-287cm.)	As
1 (Surficial)	Se	3 (Surficial)	Se
4 (Surficial)	Se	5 (Surficial)	Se
6 (Surficial)	Se	7 (0-30cm.)	Se
8 (Surficial)	Se	7 (0-30cm.)	Se

PAHs

All required holding times were met and method blanks were below the reporting limits for all analytes.

All blank spike and blank spike duplicate recoveries were within laboratory generated control limits except:

Sample Type	R. Weston Batch #	Analyte	% Recovery (80-120%)
Blank Spike	9409L219	Anthracene	51
Blank Spike Dup	9409L219	Anthracene	56

Compounds Exceeding Laboratory Generated Control Limit of 4%

RFW Batch	Compound	%RPD
9409L219	Ideno(1,2,3-cd)pyrene	6
9409L221	Ideno(1,2,3-cd)pyrene	5

All surrogate recoveries using decafluorobiphenyl were within laboratory generated control limits except:

Station No. (Depth)	% Recovery
2 (0-61cm)	Not calculated (NC)-matrix. inter.
2 (61-117cm)	(NC) -matrix. inter.

Station No. (Depth)	% Recovery

5 (61-244cm)	42
5MS (244-306cm)	146
2(Surficial)	Diluted Out
2D(Surficial)	Diluted Out
3 (Surficial)	Diluted Out
3D(Surficial)	Diluted Out
3D MS(Surficial)	Diluted Out
3D MSD(Surficial)	Diluted Out
4 (Surficial)	Diluted Out
5 (Surficial)	Diluted Out
6 (Surficial)	Diluted Out
6 (0-51cm.)	Diluted Out
6 (51-62)	Diluted Out
7 (0-30cm.)	Diluted Out
7 (30-50cm.)	Diluted Out
8 (Surficial)	Diluted Out
8 LD (Surficial)	Diluted Out
8 (0-33cm.)	Diluted Out
8 LD (0-33cm.)	Diluted Out

All matrix spike (MS) and matrix spike duplicates (MSD) were within laboratory control limits except:

Station No.(Depth)	Compound	MS (%)	MSD Recovery (%)	%RPD
3 (0-61 cm)	Anthracene	55		
3 (0-61 cm)	Naphthalene			16
3 (0-61 cm)	Acenaphthylene			16
3 (0-61 cm)	Fluoranthene			12
3 (0-61 cm)	Benzo(b)fluoranthene			23
3 (0-61 cm)	Benzo(k)fluoranthene			14
3 (0-61 cm)	Dibenzo(a,h)anthracene			15
3 (0-61 cm)	Ideno (1,2,3-cd) pyrene			7
3 (0-61 cm)	Acenaphthene	diluted out		
3 (0-61 cm)	Fluorene	diluted out		
3 (0-61 cm)	Chrysene	diluted out		
5 (244-306 cm.)	Anthracene	123	123	
5 (244-306 cm.)	Benzo(b)fluoranthene	166	269	47
5 (244-306 cm.)	Fluorene		152	31
5 (244-306 cm.)	Benzo(a)anthracene			20
5 (244-306 cm.)	Chrysene			16
5 (244-306 cm.)	Benzo(k)fluoranthene			26
5 (244-306 cm.)	benzo (a) pyrene			32
5 (244-306 cm.)	Dibenzo(a,h)anthracene			24
5 (244-306 cm.)	benzo(g,h,i)perylene			16
5 (244-306 cm.)	Ideno (1,2,3-cd) pyrene			59

Station No.(Depth)	Compound	MS (%)	MSD Recovery (%)	%RPD
3D-Surficial	Benzo (k) fluoranthene	15	10	41
3D-Surficial	Dibenzo(a,h)anthracene	180	172	
3D-Surficial	Benzo(g,h,i)perylene	193		29
3D-Surficial	Naphthalene			31

All initial and continuing standard calibration were within control limits except STD 0.05X (batch 94109L613-Surficial samples 1-6, 8 and cores 6-8) run on 11/07/94 at 19:12 which had benzo (a) pyrene at 15.1% difference.

PCBs

QUALITY ASSURANCE/QUALITY CONTROL

EPA Method SW-846-8080

Two surrogate spikes, tetrachloro-m-xylene and decachlorobiphenyl, are applied to each sample. Acceptable percent recoveries are between 60 and 150%.

Matrix spikes and matrix spike duplicates were run for all three batches of samples. The 60 to 150% recovery guidelines will be used as acceptable evaluation guidelines for these results.

A method blank is also run with each batch of samples. Blank results are acceptable when all analytes are less than the laboratory reporting limits. Positive low level results are also acceptable if they represent less than 10% of the lowest corresponding batch congener result. If any blank result is greater than this 10% level, the analytical data should be noted as suspicious.

NYSDEC ASP Method 91-11

One surrogate spike, tetrachloro-m-xylene, is applied to each sample. The acceptable percent recovery range for the spike material is between 60 and 150%.

A method blank and a method blank spike are run with each batch of samples. Acceptable results for the method blank are the same as for EPA METHOD SW-846-8080.

Acceptable percent recovery ranges for the method blank spike have not yet been established. For this report, 60 to 150% will be used to evaluate the spike congeners percent recovery results.

A matrix spike and a matrix spike duplicate were run with all three batches of samples. The acceptable evaluation guidelines for these percent recovery results will be 60-150%.

QA/QC RESULTS

EPA Method SW-846-8080

Surrogate Spikes - Only one surrogate spike recovery was outside the "acceptable" (60-150%) range. This occurred for the sample from site 7 (the Newfane Dam pool), subsection 0-30 cm, on the primary column for decachlorobiphenyl. Four surrogate spikes were diluted out.

Matrix Spikes - All matrix spike and matrix spike duplicate results were within acceptable control limits.

Blanks - All method blanks were below the analytical reporting levels. All blank spikes and blank spike duplicates were within acceptable control limits.

Surrogate Spikes - 15 of the 41 surrogate recoveries were below the lower advisory limit of 60%. This may indicate that the analytical test is underestimating the actual concentration of PCB congeners.

Matrix Spikes - All matrix spike recoveries were within acceptable limits.

Blanks - The method blank spike recoveries for sample batches 1 and 2 were within acceptable limits. One recovery was elevated for batch 3 for BZ 128. The laboratory blank for sample batch 1 had a detectable level of one congener (BZ 6). This congener was not found in any associated sample extracts.

QA/QC Summary

This PCB data set is of acceptable quality. The congener special analytical technique may, however, be underestimating the actual concentrations if the surrogate spike percent recoveries are an accurate gage.

DIOXINS

The analytical laboratory QA/QC included an internal standard spike as part of each sample and a method blank, also with an internal standard spike added, run with each sample batch[1]. The internal standard spikes consist of 15 carbon-13 and one chlorine-37 labeled isotopes.

For this study, internal standard spikes were added to all 17 sediment samples and the three method blanks. The acceptable percent recoveries for the spiked congeners is 60 to 150%.

---

[1] *Batch 1 consists of core subsections from Olcott Harbor in the Turning Basin (Site 2), Olcott Harbor at the Town of Newfane Marina (Site 3) and in Eighteenmile Creek upstream of the Rte. 18 bridge. Batch 2 consists of core subsections from Eighteenmile Creek downstream of the Burt Dam. Batch 3 consists of core subsections collected from the Burt Dam pool, the Newfane Dam pool, and Eighteenmile Creek downstream of the Clinton Street bridge.*

The desired results from the analysis of a method blank is that all analytes are "less than" the analytical reporting limit. If any "positive" detection of a method blank analyte is less than 10% of the lowest corresponding batch 2,3,7,8-substituted congener result, this would be acceptable. If a positive blank result is greater than 10% of any corresponding batch congener result, that result should be noted as suspicious.

All percent recoveries for the internal standard spikes analyzed for this sediment study were within the acceptable range of 60 to 150%. The analytical results for both method blanks were all reported as "less than" the laboratory reporting limit for each corresponding analyte. These results are indicative of a data set of good quality.

Field Audit

The NYSDEC QA officer conducted a field audit of the project on September 12, 1994. Overall, he found field sampling and subsampling methods acceptable with no deviation from acceptable procedures. The field audit report is presented in Appendix H.

Chapter 15 -References

AFSBIO.003. 1995. Standard Operating Procedure: Culture of *Daphnia magna* Neonates for Aquatic Toxicity Tests. New York State Dept. of Environmental Conservation, Avon Field Station, Avon, NY.

AFSBIO.004. 1995. Standard Operating Procedure: Culture of Fathead Minnow Larvae for Aquatic Toxicity Tests. New York State Dept. of Environmental Conservation, Avon Field Station, Avon, NY.'

Barton, D.R. 1986. Nearshore benthic invertebrates of the Ontario waters of Lake Ontario. J. Great Lakes Res. 12(4):270-280.

Bode, R.W., M.A. Novak, and L.E. Abele. 1995a. Results of macroinvertebrate sampling, Lower Genesee River. Chapter 10 in: Woodfield, K., ed. Lower Genesee River Study, summary of 1992, 1993, and 1994 results. New York State Department of Environmental Conservation Report, 530 pages.

Bode, R.W., M.A. Novak, and L.E. Abele. 1995b. Implementation and testing of biological impairment criteria in flowing waters with suspected nonpoint source pollution. New York State Department of Environmental Conservation Technical Report, 54 pages.

Bode, R.W., M.A. Novak, and L.E. Abele. 1995c. Results of macroinvertebrate sampling, Oswego River. New York State Department of Environmental Conservation Technical Report.

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

Cook, D.G., and M.G. Johnson. 1974. Benthic macroinvertebrates of the St. Lawrence Great Lakes. J. Fish. Res. Board Can. 31:763-782.

DiToro, D.M., C.S. Zarba, D.J. Hansen, W.J. Berry, R.C. Swartz, C.E. Cowan, S.P. Parlou,H.E. Allen, N.A. Thomas, and P.R. Paquin. 1991. Technical basis for establishing sediment quality criteria for nonionic organic chemicals by using equilibrium partitioning. Environmental Toxicology and Chemistry. 10(12):1541-1586.

Estabrooks, F., S. Litten, and B. Anderson. 1994. An investigation of the dioxin/furan concentrations in the sediments of Eighteenmile Creek and the Erie Canal near Lockport, New York. New York State Department of Environmental Conservation Technical Report, 43 pages.

Effler, S.W., and C. Siegfried. 1994. Zebra mussel (Dreissena polymorpha) populations in the Seneca River, New York: impact on oxygen resources. Environ. Sci. Technol. 28:2216-2221.

Erickson, M.D. 1986. Analytical chemistry of pcbs. An Ann Arbor Science Book. Butterworth Publishers.

FERC. 1983. Application for exemption from licensing for the Burt Dam hydroelectric project. Burt Dam Associates.Griffiths, R.W. 1991. Environmental quality assessment of the St. Clair River as reflected by the distribution of benthic macroinvertebrates in 1985. Hydrobiologia 219:143-164.

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

Hiltunen, J.K. 1967. Some oligochaetes from Lake Michigan. Trans. Amer. Microsc. Soc. 86(4):433-454.

Lauritsen, D.D., S.C. Mozley, and D.S. White. 1985. Distribution of oligochaetes in Lake Michigan and comments on their use as indices of pollution. J. Great Lakes Res. 11(1):67-76.

Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the national states and trends program. National Oceanic Atmospheric Administration (NOAA). Technical Memorandum No. 5, OMA52, NOAA National Ocean Service, Seattle, Washington.

Microbics. 1992a. Microtox® Update Manual. Microbics Corporation

Microbics. 1992b. Microtox® Manual Volume II Detailed Protocols. Microbics Corporation

NATO. 1988. International toxicity equivalency factor (I-tef) method of risk assessment for complex mixtures of dioxins and related compounds. North Atlantic Treaty Organization. Report Number 176.NYSDEC. 1991. Analytical services protocol. New York State Department of Environmental Conservation. Division of Water. 1989 Edition. December, 1991 revisions.

NYSDEC. 1993. Technical guidance for screening contaminated sediments. New York State Department of Environmental Conservation. Divisions of Fish and Wildlife and Marine Resources.

NYSDEC. 1994a. Quality assurance plan, Olcott Harbor sediment study. New York State Department of Environmental Conservation. Division of Water.

NYSDEC. 1994b. Interim guidance for freshwater navigational dredging, New York State Department of Environmental Conservation, Division of Water. 47 pages.

NYSDEC. 1996. Draft report, Oswego River sediment study. New York State Department of Environmental Conservation, Division of Water. 147 pages.

Novak, M.A., and R.W. Bode. 1992. Percent model affinity: a new measure of macroinvertebrate community composition. Journal North American Benthological Society 11(1):80-85.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. Ontario Ministry Environment and Energy, ISBN 0-7729-9248-7.

Simpson, K.W., J.P Fagnani, R.W. Bode, D.M. DeNicola, and L.E. Abele. 1986. Organism-substrate relationships in the main channel of the Lower Hudson River. Journal North American Benthological Society 5(1):41-57.

Stewart, T.W., and J.M. Haynes. 1994. Benthic macroinvertebrate communities of southwestern Lake Ontario following invasion of Dreissena. J. Great Lakes Res. 20(2):479-493.

Tay, K.L., K.G. Doe, S.J. Wade, D.A. Vaughn, R.E. Berrigan, and M.J. Moore. 1992. Sediment Bioassessment in Halifax Harbor. Environ. Toxicol. and Chem. 11:1567-1581.

USEPA/USACE. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual). EPA-503/8-91/001. US Environmental Protection Agency and US Army Corps of Engineers, Washington, DC.

USEPA/USACE. 1993. Evaluation of Dredged Material Proposed for Discharge in Inland and Near-Coastal Waters - Testing Manual, DRAFT. US Environmental Protection Agency and US Army Corps of Engineers, Vicksburg, MS.

USEPA. 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fourth Edition). EPA/600/4-90/027F. US Environmental Protection Agency, Washington, DC.

USEPA. 1994. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. EPA/600/R-94/024. Office of Research and Development, Washington, DC.

Washington, H.G. 1984. Diversity, biotic, and similarity indices. WaterResearch 18(6):653-694.

WEST. 1994. Western EcoSystems Technology, Inc, 1402 South Greely Highway, Cheyenne, WY. Authors: WEST, Inc. and David D. Gulley, University of Wyoming.

Zumwalt, D.C., F.J. Dwyer, I.E. Greer, and C.B. Ingersoll. 1994. A water-renewal system that accurately delivers small volumes of water to exposure chamber. Environ. Toxicol. Chem.: 1311-1314.

Appendix A -Radionuclide Results

TELEDYNE
BROWN ENGINEERING
Environmental Service s

CASE NARRATIVE

Work Order 3-3324

Received sediment core 5-2 in plastic liner, divided in 1 foot segments, on 09/14/94. Assigned Teledyne sample numbers 62292 through 62307 to 2 and 4 cm portions of the core as shown on Work Order 3-3324. Assigned analyses of Po-210, Cs-137 and Be-7 for sediment chronology.

Began work segmenting and drying the core samples on 09/15/94. Pulverized and mixed the dried samples using a mortar and pestle. Weighed aliquots of dried sediments into 2 inch diameter planchets for gamma spectral analysis. Performed gamma assays for Cs-137 and Be-7 on high resolution germanium detectors on 09/20/94 and 09/21/94, according to procedure PRO-042-5.

Added Po-208 tracer to 2 gram aliquots of sediment samples and leached in hydrochloric acid in accordance with procedure PRO-062-123. Filtered the samples and plated polonium onto metal disks. Performed alpha spectrometry for Po-210 on 09/20/94 and 09/22/94.

Reported analytical results by FAX on 09/23/94. No positive Cs-137 or Be-7 values were found in the core samples. Therefore, no fallout of these nuclides was detected. Normally Cs-137 is found in sediment samples deposited since 1954. Be-7, because of its short half-life, is normally detected only in sediments deposited within the last year.

The Po-210 analyses all indicate values near 0.5 pCi/gram. These values are commonly produced by the uranium series content of soils and sediments in the earth's crust. No elevated values of Po-210 were found, nor a logarithmic trend with depth, which would indicate fallout of the precursor nuclide, Pb-210. Normally a logarithmic trend of fallout Pb-210 is observed over the last 100 years in core samples from locations exhibiting steady sedimentation.

The radiometric results all indicate that core 5-2 comes from an environment which has not received passive deposition of sediment in recent times. Various processes of sediment movement or water motion could be the cause.

H. Jeter
9/26/94

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

REPORT OF ANALYSIS

RUN DATE 09/23/

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE
3-3324		09/14/94	09/28/94	

MR CHARLES P STEFANOSKY
ROY F WESTON, INC
208 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19341-1313

SEDIMENT/SILT

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M °	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% °	LAB.
62292	CORE 5-2 0-4	CM	09/12	1130			BE-7	L.T. 7. E-01		09/20			4
							CS-137	L.T. 8. E-02		09/20			4
62293	CORE 5-2 10-12	CM	09/12	1130			BE-7	L.T. 6. E-01		09/20			4
							CS-137	L.T. 8. E-02		09/20			4
62294	CORE 5-2 20-22	CM	09/12	1130			BE-7	L.T. 7. E-01		09/20			4
							CS-137	L.T. 9. E-02		09/20			4
62295	CORE 5-2 35-37	CM	09/12	1130			BE-7	L.T. 5. E-01		09/20			4
							CS-137	L.T. 6. E-02		09/20			4
62296	CORE 5-2 50-52	CM	09/12	1130			BE-7	L.T. 5. E-01		09/20			4
							CS-137	L.T. 6. E-02		09/20			4
62297	CORE 5-2 65-67	CM	09/12	1130			BE-7	L.T. 7. E-01		09/20			4
							CS-137	L.T. 9. E-02		09/20			4
62298	CORE 5-2 80-82	CM	09/12	1130			BE-7	L.T. 5. E-01		09/21			4
							CS-137	L.T. 6. E-02		09/21			4
62299	CORE 5-2 95-97	CM	09/12	1130			BE-7	L.T. 7. E-01		09/21			4
							CS-137	L.T. 9. E-02		09/21			4
62300	CORE 5-2 6-8	CM	09/12	1130			PO-210	6.4 +-1.0 E-01		09/20			6
62301	CORE 5-2 15-17	CM	09/12	1130			PO-210	4.5 +-0.9 E-01		09/20			6

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

REPORT OF ANALYSIS

RUN DATE 09/23/94

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE
3-3324		09/14/94	09/28/94	2

MR CHARLES P STEFANOSKY
ROY F WESTON, INC
208 WELSH POOL ROAD
FICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19341-1313

SEDIMENT/SILT

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	START TIME	STOP DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/GM DRY)	NUCL-UNIT-% U/M *	MID-COUNT TIME DATE	MID-COUNT TIME TIME	VOLUME - UNITS ASH-WGHT-% *	LAB.
62302	CORE 5-2 25-27 CM		09/12	1130			PO-210	4.1 +-0.7 E-01		09/20			6
62303	CORE 5-2 45-47 CM		09/12	1130			PO-210	4.1 +-1.0 E-01		09/22			6
62304	CORE 5-2 65-67 CM		09/12	1130			PO-210	4.8 +-1.0 E-01		09/22			6
62305	CORE 5-2 95-97 CM		09/12	1130			PO-210	4.2 +-0.7 E-01		09/22			6
62306	CORE 5-2 150-152 CM		09/12	1130			PO-210	4.8 +-1.0 E-01		09/22			6
62307	CORE 5-2 211-213 CM		09/12	1130			PO-210	3.3 +-0.7 E-01		09/22			6

LAST PAGE OF REPORT

J Guenther
APPROVED BY J. GUENTHER 09/22/94

2 - GAS LAB. 3 - RADIO CHEMISTRY LAB. 4 - GE(LI) GAMMA SPEC LAB. 5 - TRITIUM GAS/L.S. LAB. 6 - ALPHA SPEC LAB.

Appendix B - E.C. Jordan Sediment Sampling Results

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

APPLICATION FOR

EXEMPTION FROM LICENSING

FOR

THE BURT DAM HYDROELECTRIC PROJECT

BY

BURT DAM ASSOCIATES

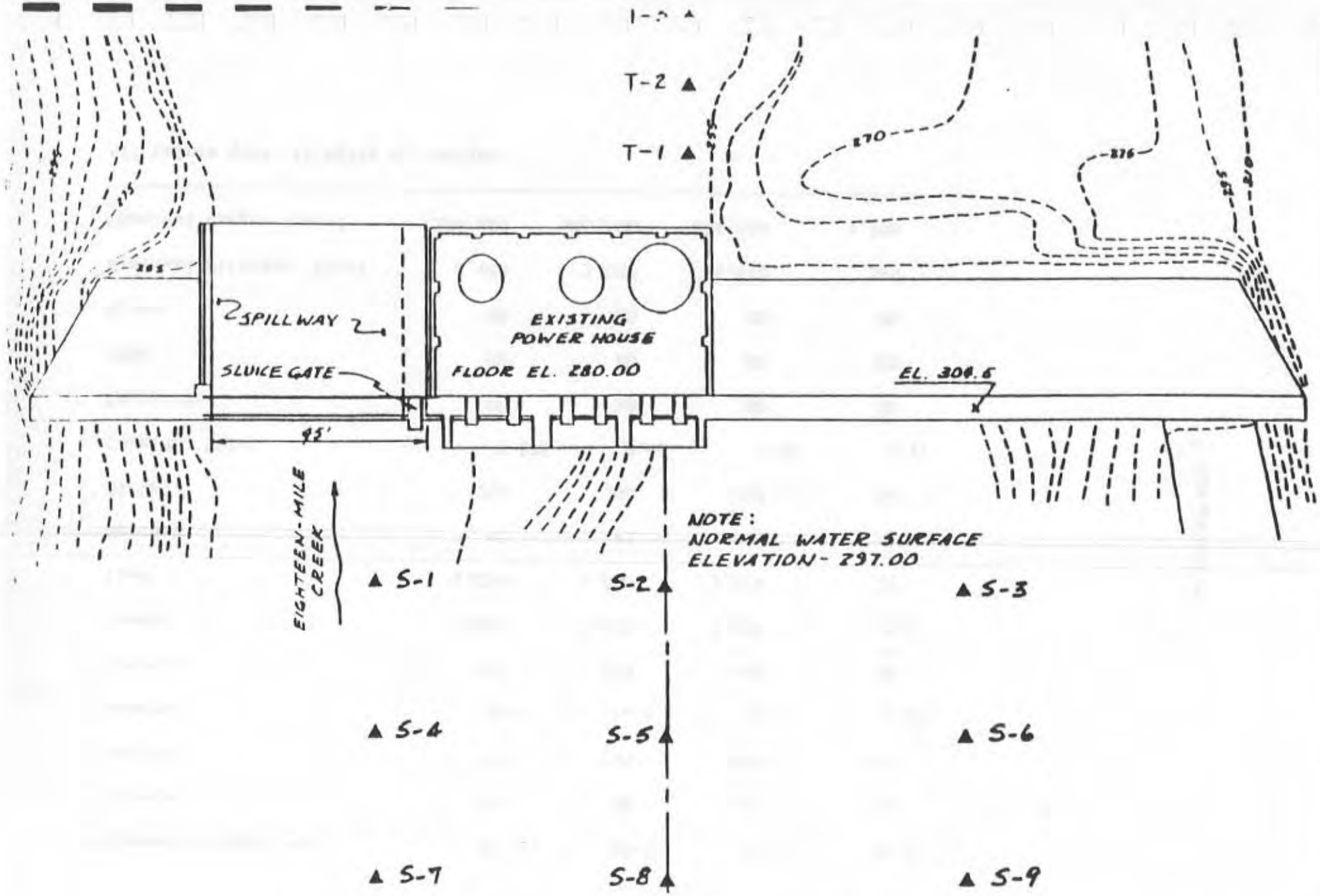


FIGURE E-1
SEDIMENT SAMPLE LOCATIONS

E.C.JORDAN CO.

TABLE E-4

SUMMARY OF ANALYTICAL DATA FOR SEDIMENT COMPOSITE SAMPLES

Parameter/Sample No.	SC-1	SC-2	SC-3	TC-1
Arsenic	34	38	25	15
Barium	350	340	420	140
Cadmium	10.6	12.9	11.6	0.13
Chromium	990	870	980	18
Copper	1,480	1,000	1,030	8.3
Lead	3,050	2,040	1,770	21
Mercury	<1	<1	<1	<1
Nickel	350	380	380	40
Cyanide, Total	0.075	0.06	0.96	0.21
Pesticides	ND	ND	ND	ND
PCBs	ND	ND	ND	ND
Mirex	ND	ND	ND	ND
Kjeldahl Nitrogen, Total	6,180	5,930	6,410	325
Chemical Oxygen Demand	286,000	265,000	284,000	9,700

All values given in mg/kg dry weight.

Appendix C - Pesticide/PCB Aroclor Results

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 20:13 Page: 1

10

	Cust ID:	11294-1-SURF		11294-1-SURF		11194-2-SURF		11194-2-SURF		11194-2DSURF		11194-2DSURF	
Sample Information	RFW#:	001		001		002		002		003		003	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	1.00		1.00		1.00		1.00		1.00		1.00	
	Units:	ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2	
Surrogate:	Tetrachloro-m-xylene	88	%	90	%	100	%	98	%	88	%	95	%
Surrogate:	Decachlorobiphenyl	100	%	98	%	88	%	82	%	80	%	80	%
			fl		fl		fl		fl		fl		fl
alpha-BHC		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
beta-BHC		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
delta-BHC		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
gamma-BHC (Lindane)		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
Heptachlor		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
Aldrin		2.0	U	2.0	U	2.0	U	2.0	U	2.7	J	3.3	
Heptachlor epoxide		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
Endosulfan I		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
Dieldrin		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
4,4'-DDE		3.9	U	3.9	U	3.6	J	2.8	J	8.7		8.7	
Endrin		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
Endosulfan II		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
4,4'-DDD		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
Endosulfan sulfate		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
4,4'-DDT		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
Methoxychlor		20	U	20	U	20	U	20	U	33	U	33	U
Endrin ketone		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
Endrin aldehyde		3.9	U	3.9	U	4.0	U	4.0	U	6.7	U	6.7	U
alpha-Chlordane		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
gamma-Chlordane		2.0	U	2.0	U	2.0	U	2.0	U	3.3	U	3.3	U
Toxaphene		200	U	200	U	200	U	200	U	330	U	330	U
Aroclor-1016		39	U	39	U	40	U	40	U	67	U	67	U
Aroclor-1221		79	U	79	U	79	U	79	U	130	U	130	U
Aroclor-1232		39	U	39	U	40	U	40	U	67	U	67	U
Aroclor-1242		39	U	39	U	40	U	40	U	67	U	67	U
Aroclor-1248		39	U	39	U	40	U	40	U	67	U	67	U
Aroclor-1254		39	U	39	U	40	U	40	U	67	U	67	U
Aroclor-1260		39	U	39	U	40	U	40	U	67	U	67	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out I= Interference. NA= Not Applicable *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 18:10 Page: 11

	Cust ID:	11194-3-SURF	11194-3-SURF	11294-3DSURF	11294-3DSURF	11294-3DSURF	11294-3DSURF
Sample Information	RFW#:	004	004	005	005	005 MS	005 MS
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	92 %	100 %	88 %	92 %	100 %	95 %
Surrogate:	Decachlorobiphenyl	105 %	112 %	85 %	92 %	98 %	100 %
		fl	fl	fl	fl	fl	fl
alpha-BHC		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
beta-BHC		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
delta-BHC		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
gamma-BHC (Lindane)		3.2 U	3.2 U	3.9 U	3.9 U	112 %	96 %
Heptachlor		3.2 U	3.2 U	3.9 U	3.9 U	116 %	72 %
Aldrin		3.2 U	3.2 U	3.9 U	3.9 U	80 %	88 %
Heptachlor epoxide		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
Endosulfan I		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
Dieldrin		6.4 U	6.4 U	7.8 U	7.8 U	96 %	244 * %
4,4'-DDE		11	19	7.0 J	18	17	18
Endrin		6.4 U	6.4 U	7.8 U	7.8 U	128 %	122 %
Endosulfan II		5.8 J	12	7.8 U	7.8 U	7.7 U	7.7 U
4,4'-DDD		6.4 U	6.4 U	7.8 U	7.8 U	7.7 U	7.7 U
Endosulfan sulfate		6.4 U	6.4 U	7.8 U	7.8 U	7.7 U	7.7 U
4,4'-DDT		6.4 U	6.4 U	7.8 U	7.8 U	90 %	108 %
Methoxychlor		32 U	32 U	39 U	39 U	38 U	38 U
Endrin ketone		6.4 U	6.4 U	7.8 U	7.8 U	7.7 U	7.7 U
Endrin aldehyde		6.4 U	6.4 U	7.8 U	7.8 U	7.7 U	7.7 U
alpha-Chlordane		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
gamma-Chlordane		3.2 U	3.2 U	3.9 U	3.9 U	3.8 U	3.8 U
Toxaphene		320 U	320 U	390 U	390 U	380 U	380 U
Aroclor-1016		64 U	64 U	78 U	78 U	77 U	77 U
Aroclor-1221		130 U	130 U	160 U	160 U	150 U	150 U
Aroclor-1232		64 U	64 U	78 U	78 U	77 U	77 U
Aroclor-1242		64 U	64 U	78 U	78 U	77 U	77 U
Aroclor-1248		460	580	390	530	520	950
Aroclor-1254		160	290	140	250	340	600
Aroclor-1260		64 U	64 U	78 U	78 U	77 U	77 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 11:29 Page: 3

12

	Cust ID:	11294-3DSURF	11294-3DSURF	11294-4-SURF	11294-4-SURF	11294-5-SURF	11294-5-SURF
Sample Information	RFW#:	005 MSD	005 MSD	006	006	007	007
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	102 %	108 %	90 %	102 %	102 %	105 %
Surrogate:	Decachlorobiphenyl	102 %	105 %	102 %	108 %	110 %	108 %
alpha-BHC		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
beta-BHC		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
delta-BHC		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
gamma-BHC (Lindane)		118 %	110 %	3.8 U	3.8 U	3.6 U	3.6 U
Heptachlor		122 %	86 %	3.8 U	3.8 U	3.6 U	3.6 U
Aldrin		94 %	64 %	3.8 U	3.8 U	3.6 U	3.6 U
Heptachlor epoxide		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
Endosulfan I		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
Dieldrin		110 %	258 * %	7.7 U	7.7 U	7.2 U	7.2 U
4,4'-DDE		5.4 J	15	16	36	7.9	18
Endrin		136 %	132 %	7.7 U	7.7 U	7.2 U	7.2 U
Endosulfan II		7.7 U	7.7 U	7.7 U	7.7 U	7.2 U	7.2 U
4,4'-DDD		7.7 U	7.7 U	7.7 U	7.7 U	7.2 U	7.2 U
Endosulfan sulfate		7.7 U	7.7 U	7.7 U	7.7 U	7.2 U	7.2 U
4,4'-DDT		96 %	120 %	7.7 U	7.7 U	7.2 U	7.2 U
Methoxychlor		38 U	38 U	38 U	38 U	36 U	36 U
Endrin ketone		7.7 U	7.7 U	7.7 U	7.7 U	7.2 U	7.2 U
Endrin aldehyde		7.7 U	7.7 U	7.7 U	7.7 U	7.2 U	7.2 U
alpha-Chlordane		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
gamma-Chlordane		3.8 U	3.8 U	3.8 U	3.8 U	3.6 U	3.6 U
Toxaphene		380 U	380 U	380 U	380 U	360 U	360 U
Aroclor-1016		77 U	77 U	77 U	77 U	72 U	72 U
Aroclor-1221		150 U	150 U	150 U	150 U	140 U	140 U
Aroclor-1232		77 U	77 U	77 U	77 U	72 U	72 U
Aroclor-1242		77 U	77 U	77 U	77 U	72 U	72 U
Aroclor-1248		410	350	630	960	420	600
Aroclor-1254		130	370	230	390	210	240
Aroclor-1260		77 U	77 U	77 U	77 U	72 U	72 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 11:29 Page: 4

13

	Cust ID:	11194-6-SURF		11194-6-SURF		11194-060020		11194-060020		11194-620END		11194-620END	
Sample Information	RFW#:	008		008		009		009		010		010	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	1.00		1.00		1.00		1.00		1.00		1.00	
	Units:	ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2	
Surrogate:	Tetrachloro-m-xylene	90	%	100	%	80	%	90	%	90	%	92	%
Surrogate:	Decachlorobiphenyl	115	%	120	%	110	%	115	%	90	%	92	%
alpha-BHC		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
beta-BHC		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
delta-BHC		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
gamma-BHC (Lindane)		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Heptachlor		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Aldrin		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Heptachlor epoxide		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Endosulfan I		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Dieldrin		12	U	12	U	9.7	U	9.7	U	11	U	11	U
4,4'-DDE		18		62		9.7	U	9.7	U	280		87	
Endrin		12	U	12	U	9.7	U	9.7	U	11	U	11	U
Endosulfan II		12	U	12	U	9.7	U	9.7	U	11	U	11	U
4,4'-DDD		12	U	12	U	9.7	U	9.7	U	11	U	11	U
Endosulfan sulfate		12	U	12	U	9.7	U	9.7	U	11	U	11	U
4,4'-DDT		12		46		9.7	U	9.7	U	21		130	
Methoxychlor		58	U	58	U	49	U	49	U	56	U	56	U
Endrin ketone		12	U	12	U	9.7	U	9.7	U	11	U	11	U
Endrin aldehyde		12	U	12	U	9.7	U	9.7	U	11	U	11	U
alpha-Chlordane		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
gamma-Chlordane		5.8	U	5.8	U	4.9	U	4.9	U	5.6	U	5.6	U
Toxaphene		580	U	580	U	490	U	490	U	560	U	560	U
Aroclor-1016		120	U	120	U	97	U	97	U	110	U	110	U
Aroclor-1221		230	U	230	U	190	U	190	U	220	U	220	U
Aroclor-1232		120	U	120	U	97	U	97	U	110	U	110	U
Aroclor-1242		120	U	120	U	97	U	97	U	110	U	110	U
Aroclor-1248		1900		2500		1800		3300		20000		23000	
Aroclor-1254		590		970		620		1000		110	U	110	U
Aroclor-1260		120	U	120	U	97	U	97	U	720		980	

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 11:29 Page: 4

Cust ID:	11194-620END	11194-620END	11294-070012	11294-070012	11294-070012	11294-070012
Sample Information RFW#:	010 DL	010 DL	011	011	011 DL	011 DL
Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
D.F.:	10.0	10.0	1.00	1.00	10.0	10.0
Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate: Tetrachloro-m-xylene	0 D %	0 D %	60 %	82 %	0 D %	0 D %
Surrogate: Decachlorobiphenyl	0 D %	0 D %	178 * %	125 %	0 D %	0 D %
alpha-BHC	56 U	56 U	5.0 U	5.0 U	50 U	50 U
beta-BHC	56 U	56 U	5.0 U	5.0 U	50 U	50 U
delta-BHC	56 U	56 U	5.0 U	5.0 U	50 U	50 U
gamma-BHC (Lindane)	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Heptachlor	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Aldrin	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Heptachlor epoxide	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Endosulfan I	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Dieldrin	110 U	110 U	9.9 U	9.9 U	99 U	99 U
4,4'-DDE	110 U	110 U	9.9 U	9.9 U	99 U	99 U
Endrin	110 U	110 U	9.9 U	9.9 U	99 U	99 U
Endosulfan II	110 U	110 U	9.9 U	9.9 U	99 U	99 U
4,4'-DDD	110 U	110 U	31	39	99 U	99 U
Endosulfan sulfate	110 U	110 U	9.9 U	9.9 U	99 U	99 U
4,4'-DDT	110 U	110 U	9.9 U	9.9 U	99 U	99 U
Methoxychlor	560 U	560 U	50 U	50 U	500 U	500 U
Endrin ketone	110 U	110 U	9.9 U	9.9 U	99 U	99 U
Endrin aldehyde	110 U	110 U	9.9 U	9.9 U	99 U	99 U
alpha-Chlordane	56 U	56 U	5.0 U	5.0 U	50 U	50 U
gamma-Chlordane	56 U	56 U	5.0 U	5.0 U	50 U	50 U
Toxaphene	5600 U	5600 U	500 U	500 U	5000 U	5000 U
Aroclor-1016	1100 U	1100 U	99 U	99 U	990 U	990 U
Aroclor-1221	2200 U	2200 U	200 U	200 U	2000 U	2000 U
Aroclor-1232	1100 U	1100 U	99 U	99 U	990 U	990 U
Aroclor-1242	1100 U	1100 U	99 U	99 U	990 U	990 U
Aroclor-1248	27000 D	31000 D	18000	25000	23000 D	33000 D
Aroclor-1254	1100 U	1100 U	99 U	99 U	990 U	990 U
Aroclor-1260	1000 JD	1800 D	360	930	540 JD	1500 D

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Dolmar L Tocchini 11/14/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 11:29 Page: 6

15

Sample Information	Cust ID:	11294-712END	11294-712END	11294-712END	11294-712END	11294-8-SURF	11294-8-SURF
	RFW#:	012	012	012 DL	012 DL	013	013
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	10.0	10.0	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	65 %	90 %	0 D %	0 D %	78 %	92 %
Surrogate:	Decachlorobiphenyl	I %	I %	0 D %	0 D %	72 %	92 %
		fl	fl	fl	fl	fl	fl
alpha-BHC		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
beta-BHC		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
delta-BHC		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
gamma-BHC (Lindane)		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Heptachlor		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Aldrin		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Heptachlor epoxide		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Endosulfan I		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Dieldrin		8.5 U	8.5 U	85 U	85 U	8.4 U	8.4 U
4,4'-DDE		36	120	85 U	85 U	8.4 U	8.4 U
Endrin		8.5 U	8.5 U	85 U	85 U	8.4 U	8.4 U
Endosulfan II		8.5 U	8.5 U	85 U	85 U	8.4 U	8.4 U
4,4'-DDD		8.5 U	8.5 U	85 U	85 U	9.2	9.2
Endosulfan sulfate		8.5 U	8.5 U	85 U	85 U	8.4 U	8.4 U
4,4'-DDT		16	130	85 U	85 U	7.5 J	90
Methoxychlor		43 U	43 U	430 U	430 U	42 U	42 U
Endrin ketone		8.5 U	8.5 U	85 U	85 U	8.4 U	8:4 U
Endrin aldehyde		8.5 U	8.5 U	85 U	85 U	8.4 U	8.4 U
alpha-Chlordane		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
gamma-Chlordane		4.3 U	4.3 U	43 U	43 U	4.2 U	4.2 U
Toxaphene		430 U	430 U	4300 U	4300 U	420 U	420 U
Aroclor-1016		85 U	85 U	850 U	850 U	84 U	84 U
Aroclor-1221		170 U	170 U	1700 U	1700 U	170 U	170 U
Aroclor-1232		85 U	85 U	850 U	850 U	84 U	84 U
Aroclor-1242		85 U	85 U	850 U	850 U	84 U	84 U
Aroclor-1248		12000	16000	24000 D	22000 D	1200	2800
Aroclor-1254		85 U	85 U	850 U	850 U	84 U	84 U
Aroclor-1260		560	780	940 D	1300 D	190	540

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Deborah L. Koeltzel 11/14/94

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 18:10 Page 1

	Cust ID:	11294-800END		11294-800END		11294-800END		11294-800END		PBLKRI		PBLKRI	
Sample Information	RFW#:	014		014		014 DL		014 DL		94GP0874-MB1		94GP0874-MB1	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	1.00		1.00		10.0		10.0		1.00		1.00	
	Units:	ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2	
Surrogate: Tetrachloro-m-xylene		65	%	95	%	0 D	%	0 D	%	82	%	92	%
Surrogate: Decachlorobiphenyl		92	%	102	%	0 D	%	0 D	%	92	%	102	%
alpha-BHC		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
beta-BHC		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
delta-BHC		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
gamma-BHC (Lindane)		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Heptachlor		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Aldrin		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Heptachlor epoxide		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Endosulfan I		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Dieldrin		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
4,4'-DDE		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
Endrin		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
Endosulfan II		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
4,4'-DDD		59		69		60	U	60	U	3.3	U	3.3	U
Endosulfan sulfate		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
4,4'-DDT		62		160		40	JD	180	D	3.3	U	3.3	U
Methoxychlor		30	U	30	U	300	U	300	U	17	U	17	U
Endrin ketone		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
Endrin aldehyde		6.0	U	6.0	U	60	U	60	U	3.3	U	3.3	U
alpha-Chlordane		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
gamma-Chlordane		3.0	U	3.0	U	30	U	30	U	1.7	U	1.7	U
Toxaphene		300	U	300	U	3000	U	3000	U	170	U	170	U
Aroclor-1016		60	U	60	U	600	U	600	U	33	U	33	U
Aroclor-1221		120	U	120	U	1200	U	1200	U	67	U	67	U
Aroclor-1232		60	U	60	U	600	U	600	U	33	U	33	U
Aroclor-1242		60	U	60	U	600	U	600	U	33	U	33	U
Aroclor-1248		4400		6400		8600	D	10000	D	33	U	33	U
Aroclor-1254		60	U	60	U	600	U	600	U	33	U	33	U
Aroclor-1260		270		510		310	JD	500	JD	33	U	33	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

P and 20

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9999-00 Report Date: 11/14/94 11:29 Page: 8

	Cust ID:	PBLKRI BS		PBLKRI BS		PBLKRI BSD		PBLKRI BSD	
Sample Information	RFW#:	94GP0874-MB1		94GP0874-MB1		94GP0874-MB1		94GP0874-MB1	
	Matrix:	SOIL		SOIL		SOIL		SOIL	
	D.F.:	1.00		1.00		1.00		1.00	
	Units:	ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2	
Surrogate:	Tetrachloro-m-xylene	85	%	90	%	78	%	75	%
Surrogate:	Decachlorobiphenyl	98	%	100	%	95	%	92	%
alpha-BHC		1.7	U	1.7	U	1.7	U	1.7	U
beta-BHC		1.7	U	1.7	U	1.7	U	1.7	U
delta-BHC		1.7	U	1.7	U	1.7	U	1.7	U
gamma-BHC (Lindane)		108	%	100	%	102	%	90	%
Heptachlor		98	%	94	%	92	%	86	%
Aldrin		94	%	108	%	86	%	92	%
Heptachlor epoxide		1.7	U	1.7	U	1.7	U	1.7	U
Endosulfan I		1.7	U	1.7	U	1.7	U	1.7	U
Dieldrin		113	%	104	%	107	%	95	%
4,4'-DDE		3.3	U	3.3	U	3.3	U	3.3	U
Endrin		125	%	111	%	121	%	100	%
Endosulfan II		3.3	U	3.3	U	3.3	U	3.3	U
4,4'-DDD		3.3	U	3.3	U	3.3	U	3.3	U
Endosulfan sulfate		3.3	U	3.3	U	3.3	U	3.3	U
4,4'-DDT		100	%	102	%	98	%	95	%
Methoxychlor		17	U	17	U	17	U	17	U
Endrin ketone		3.3	U	3.3	U	3.3	U	3.3	U
Endrin aldehyde		3.3	U	3.3	U	3.3	U	3.3	U
alpha-Chlordane		1.7	U	1.7	U	1.7	U	1.7	U
gamma-Chlordane		1.7	U	1.7	U	1.7	U	1.7	U
Toxaphene		170	U	170	U	170	U	170	U
Aroclor-1016		33	U	33	U	33	U	33	U
Aroclor-1221		67	U	67	U	67	U	67	U
Aroclor-1232		33	U	33	U	33	U	33	U
Aroclor-1242		33	U	33	U	33	U	33	U
Aroclor-1248		33	U	33	U	33	U	33	U
Aroclor-1254		33	U	33	U	33	U	33	U
Aroclor-1260		33	U	33	U	33	U	33	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/06/94 18:21 Page: 9

Cust ID:	91294-020024	91294-020024	91294-224END	91294-224END	91294-030024	91294-030024
Sample Information RFW#:	001	001	002	002	003	003
Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate: Tetrachloro-m-xylene	85 %	82 %	82 %	75 %	80 %	78 %
Surrogate: Decachlorobiphenyl	82 %	85 %	75 %	72 %	98 %	95 %
alpha-BHC	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
beta-BHC	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
delta-BHC	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
gamma-BHC (Lindane)	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Heptachlor	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Aldrin	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Heptachlor epoxide	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Endosulfan I	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Dieldrin	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
4,4'-DDE	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
Endrin	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
Endosulfan II	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
4,4'-DDD	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
Endosulfan sulfate	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
4,4'-DDT	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
Methoxychlor	31 U	31 U	31 U	31 U	33 U	33 U
Endrin ketone	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
Endrin aldehyde	6.1 U	6.1 U	6.3 U	6.3 U	6.6 U	6.6 U
alpha-Chlordane	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
gamma-Chlordane	3.1 U	3.1 U	3.1 U	3.1 U	3.3 U	3.3 U
Toxaphene	310 U	310 U	310 U	310 U	330 U	330 U
Aroclor-1016	61 U	61 U	63 U	63 U	66 U	66 U
Aroclor-1221	120 U	120 U	130 U	130 U	130 U	130 U
Aroclor-1232	61 U	61 U	63 U	63 U	66 U	66 U
Aroclor-1242	61 U	61 U	63 U	63 U	66 U	66 U
Aroclor-1248	61 U	61 U	63 U	63 U	66 U	66 U
Aroclor-1254	61 U	61 U	63 U	63 U	66 U	66 U
Aroclor-1260	61 U	61 U	63 U	63 U	66 U	66 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/06/94 18:21 Page: 40

	Cust ID:	91294-030024	91294-030024	91294-030024	91294-030024	91294-032470	91294-032470
Sample Information	RFW#:	003 MS	003 MS	003 MSD	003 MSD	004	004
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	85 %	78 %	95 %	82 %	92 %	78 %
Surrogate:	Decachlorobiphenyl	88 %	100 %	95 %	100 %	95 %	100 %
		fl	fl	fl	fl	fl	fl
alpha-BHC		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
beta-BHC		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
delta-BHC		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
gamma-BHC (Lindane)		76 %	76 %	92 %	84 %	3.5 U	3.5 U
Heptachlor		68 %	76 %	80 %	82 %	3.5 U	3.5 U
Aldrin		70 %	198 * %	82 %	242 * %	3.5 U	3.5 U
Heptachlor epoxide		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
Endosulfan I		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
Dieldrin		76 %	174 * %	88 %	251 * %	7.0 U	7.0 U
4,4'-DDE		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
Endrin		83 %	81 %	100 %	87 %	7.0 U	7.0 U
Endosulfan II		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
4,4'-DDD		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
Endosulfan sulfate		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
4,4'-DDT		78 %	79 %	90 %	84 %	7.0 U	7.0 U
Methoxychlor		33 U	33 U	33 U	33 U	35 U	35 U
Endrin ketone		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
Endrin aldehyde		6.6 U	6.6 U	6.5 U	6.5 U	7.0 U	7.0 U
alpha-Chlordane		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
gamma-Chlordane		3.3 U	3.3 U	3.3 U	3.3 U	3.5 U	3.5 U
Toxaphene		330 U	330 U	330 U	330 U	350 U	350 U
Aroclor-1016		66 U	66 U	65 U	65 U	70 U	70 U
Aroclor-1221		130 U	130 U	130 U	130 U	140 U	140 U
Aroclor-1232		66 U	66 U	65 U	65 U	70 U	70 U
Aroclor-1242		66 U	66 U	65 U	65 U	70 U	70 U
Aroclor-1248		66 U	66 U	65 U	65 U	70 U	70 U
Aroclor-1254		66 U	66 U	65 U	65 U	70 U	70 U
Aroclor-1260		66 U	66 U	65 U	65 U	70 U	70 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/06/94 18:21 Page: 3

	Cust ID:	91294-037080	91294-037080	91294-380END	91294-380END	91294-040024	91294-040024
Sample Information	RFW#:	005	005	006	006	007	007
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	88 %	85 %	80 %	80 %	78 %	78 %
Surrogate:	Decachlorobiphenyl	98 %	102 %	108 %	100 %	88 %	90 %
		fl	fl	fl	fl	fl	fl
alpha-BHC		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
beta-BHC		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
delta-BHC		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
gamma-BHC (Lindane)		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Heptachlor		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Aldrin		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Heptachlor epoxide		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Endosulfan I		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Dieldrin		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
4,4'-DDE		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
Endrin		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
Endosulfan II		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
4,4'-DDD		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
Endosulfan sulfate		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
4,4'-DDT		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
Methoxychlor		43 U	43 U	32 U	32 U	34 U	34 U
Endrin ketone		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
Endrin aldehyde		8.6 U	8.6 U	6.4 U	6.4 U	6.8 U	6.8 U
alpha-Chlordane		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
gamma-Chlordane		4.3 U	4.3 U	3.2 U	3.2 U	3.4 U	3.4 U
Toxaphene		430 U	430 U	320 U	320 U	340 U	340 U
Aroclor-1016		86 U	86 U	64 U	64 U	68 U	68 U
Aroclor-1221		170 U	170 U	130 U	130 U	140 U	140 U
Aroclor-1232		86 U	86 U	64 U	64 U	68 U	68 U
Aroclor-1242		86 U	86 U	64 U	64 U	68 U	68 U
Aroclor-1248		86 U	86 U	64 U	64 U	68 U	68 U
Aroclor-1254		86 U	86 U	64 U	64 U	68 U	68 U
Aroclor-1260		86 U	86 U	64 U	64 U	68 U	68 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/06/94 18:21 Page: 12

	Cust ID:	91294-042480	91294-042480	91294-480END	91294-480END	PBLKMW	PBLKMW
Sample Information	RFW#:	008	008	009	009	94GP0760-MB1	94GP0760-MB1
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	80 %	80 %	78 %	80 %	78 %	80 %
Surrogate:	Decachlorobiphenyl	92 %	95 %	82 %	100 %	100 %	102 %
		fl	fl	fl	fl	fl	fl
alpha-BHC		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
beta-BHC		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
delta-BHC		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
gamma-BHC (Lindane)		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Heptachlor		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Aldrin		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Heptachlor epoxide		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Endosulfan I		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Dieldrin		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
4,4'-DDE		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
Endrin		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
Endosulfan II		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
4,4'-DDD		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
Endosulfan sulfate		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
4,4'-DDT		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
Methoxychlor		32 U	32 U	26 U	26 U	17 U	17 U
Endrin ketone		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
Endrin aldehyde		6.5 U	6.5 U	5.2 U	5.2 U	3.3 U	3.3 U
alpha-Chlordane		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
gamma-Chlordane		3.2 U	3.2 U	2.6 U	2.6 U	1.7 U	1.7 U
Toxaphene		320 U	320 U	260 U	260 U	170 U	170 U
Aroclor-1016		65 U	65 U	52 U	52 U	33 U	33 U
Aroclor-1221		130 U	130 U	100 U	100 U	67 U	67 U
Aroclor-1232		65 U	65 U	52 U	52 U	33 U	33 U
Aroclor-1242		65 U	65 U	52 U	52 U	33 U	33 U
Aroclor-1248		65 U	65 U	52 U	52 U	33 U	33 U
Aroclor-1254		65 U	65 U	52 U	52 U	33 U	33 U
Aroclor-1260		65 U	65 U	52 U	52 U	33 U	33 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/06/94 18:21 Page: 5

13

Sample Information	Cust ID:	PBLKMW BS	PBLKMW BS	PBLKMW BSD	PBLKMW BSD
	RFW#:	94GP0760-MB1	94GP0760-MB1	94GP0760-MB1	94GP0760-MB1
	Matrix:	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	80 %	80 %	78 %	78 %
Surrogate:	Decachlorobiphenyl	108 %	108 %	102 %	105 %
alpha-BHC		1.7 U	1.7 U	1.7 U	1.7 U
beta-BHC		1.7 U	1.7 U	1.7 U	1.7 U
delta-BHC		1.7 U	1.7 U	1.7 U	1.7 U
gamma-BHC (Lindane)		84 %	88 %	80 %	84 %
Heptachlor		76 %	82 %	74 %	80 %
Aldrin		78 %	202 * %	76 %	206 * %
Heptachlor epoxide		1.7 U	1.7 U	1.7 U	1.7 U
Endosulfan I		1.7 U	1.7 U	1.7 U	1.7 U
Dieldrin		92 %	94 %	86 %	90 %
4,4'-DDE		3.3 U	3.3 U	3.3 U	3.3 U
Endrin		98 %	90 %	93 %	88 %
Endosulfan II		3.3 U	3.3 U	3.3 U	3.3 U
4,4'-DDD		3.3 U	3.3 U	3.3 U	3.3 U
Endosulfan sulfate		3.3 U	3.3 U	3.3 U	3.3 U
4,4'-DDT		81 %	89 %	81 %	88 %
Methoxychlor		17 U	17 U	17 U	17 U
Endrin ketone		3.3 U	3.3 U	3.3 U	3.3 U
Endrin aldehyde		3.3 U	3.3 U	3.3 U	3.3 U
alpha-Chlordane		1.7 U	1.7 U	1.7 U	1.7 U
gamma-Chlordane		1.7 U	1.7 U	1.7 U	1.7 U
Toxaphene		170 U	170 U	170 U	170 U
Aroclor-1016		33 U	33 U	33 U	33 U
Aroclor-1221		67 U	67 U	67 U	67 U
Aroclor-1232		33 U	33 U	33 U	33 U
Aroclor-1242		33 U	33 U	33 U	33 U
Aroclor-1248		33 U	33 U	33 U	33 U
Aroclor-1254		33 U	33 U	33 U	33 U
Aroclor-1260		33 U	33 U	33 U	33 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L221 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/26/94 10:16 Page: 1

10

	Cust ID:	91294-050024		91294-050024		91294-052496		91294-052496		91294-569END		91294-569END	
Sample Information	RFW#:	011		011		012		012		013		013	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	D.F.:	1.00		1.00		1.00		1.00		1.00		1.00	
	Units:	ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2		ug/Kg		ug/Kg Col 2	
Surrogate:	Tetrachloro-m-xylene	100	%	102	%	102	%	112	%	112	%	120	%
Surrogate:	Decachlorobiphenyl	78	%	95	%	78	%	102	%	90	%	108	%
			fl		fl		fl		fl		fl		fl
alpha-BHC		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
beta-BHC		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
delta-BHC		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
gamma-BHC (Lindane)		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Heptachlor		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Aldrin		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Heptachlor epoxide		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Endosulfan I		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Dieldrin		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
4,4'-DDE		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
Endrin		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
Endosulfan II		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
4,4'-DDD		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
Endosulfan sulfate		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
4,4'-DDT		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
Methoxychlor		30	U	30	U	31	U	31	U	30	U	30	U
Endrin ketone		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
Endrin aldehyde		6.0	U	6.0	U	6.2	U	6.2	U	6.1	U	6.1	U
alpha-Chlordane		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
gamma-Chlordane		3.0	U	3.0	U	3.1	U	3.1	U	3.0	U	3.0	U
Toxaphene		300	U	300	U	310	U	310	U	300	U	300	U
Aroclor-1016		60	U	60	U	62	U	62	U	61	U	61	U
Aroclor-1221		120	U	120	U	120	U	120	U	120	U	120	U
Aroclor-1232		60	U	60	U	62	U	62	U	61	U	61	U
Aroclor-1242		60	U	60	U	62	U	62	U	61	U	61	U
Aroclor-1248		60	U	60	U	62	U	62	U	61	U	61	U
Aroclor-1254		60	U	60	U	62	U	62	U	61	U	61	U
Aroclor-1260		60	U	60	U	62	U	62	U	61	U	61	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L221 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/26/94 10:16 Page: 2

Cust ID:	91294-569END	91294-569END	91294-569END	91294-569END	PBLKQK	PBLKQK
Sample Information RFW#:	013 MS	013 MS	013 MSD	013 MSD	94GP0835-MB1	94GP0835-MB1
Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
D.F.:	1.00	1.00	1.00	1.00	1.00	1.00
Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate: Tetrachloro-m-xylene	98 %	105 %	98 %	108 %	85 %	92 %
Surrogate: Decachlorobiphenyl	88 %	100 %	75 %	100 %	92 %	100 %
	fl	fl	fl	fl	fl	fl
alpha-BHC	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
beta-BHC	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
delta-BHC	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
gamma-BHC (Lindane)	116 %	110 %	108 %	110 %	1.7 U	1.7 U
Heptachlor	110 %	100 %	112 %	100 %	1.7 U	1.7 U
Aldrin	108 %	102 %	106 %	100 %	1.7 U	1.7 U
Heptachlor epoxide	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
Endosulfan I	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
Dieldrin	112 %	111 %	110 %	110 %	3.3 U	3.3 U
4,4'-DDE	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
Endrin	127 %	137 %	125 %	135 %	3.3 U	3.3 U
Endosulfan II	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
4,4'-DDD	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
Endosulfan sulfate	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
4,4'-DDT	94 %	98 %	95 %	97 %	3.3 U	3.3 U
Methoxychlor	31 U	31 U	31 U	31 U	17 U	17 U
Endrin ketone	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
Endrin aldehyde	6.2 U	6.2 U	6.2 U	6.2 U	3.3 U	3.3 U
alpha-Chlordane	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
gamma-Chlordane	3.1 U	3.1 U	3.1 U	3.1 U	1.7 U	1.7 U
Toxaphene	310 U	310 U	310 U	310 U	170 U	170 U
Aroclor-1016	62 U	62 U	62 U	62 U	33 U	33 U
Aroclor-1221	120 U	120 U	120 U	120 U	67 U	67 U
Aroclor-1232	62 U	62 U	62 U	62 U	33 U	33 U
Aroclor-1242	62 U	62 U	62 U	62 U	33 U	33 U
Aroclor-1248	62 U	62 U	62 U	62 U	33 U	33 U
Aroclor-1254	62 U	62 U	62 U	62 U	33 U	33 U
Aroclor-1260	62 U	62 U	62 U	62 U	33 U	33 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Roy F. Weston, Inc. - Gulf Coast Laboratories
PESTICIDE/PCBs BY GC, CLP LIST

RFW Batch Number: 9409L221 Client: NYSDEC-Olcott Work Order: 01667-010-001-0001-00 Report Date: 10/26/94 10:16 Page: 3

Sample Information	Cust ID:	PBLKQK BS	PBLKQK BS	PBLKQK BSD	PBLKQK BSD
	RFW#:	94GP0835-MB1	94GP0835-MB1	94GP0835-MB1	94GP0835-MB1
	Matrix:	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.00	1.00	1.00	1.00
	Units:	ug/Kg	ug/Kg Col 2	ug/Kg	ug/Kg Col 2
Surrogate:	Tetrachloro-m-xylene	80 %	88 %	88 %	100 %
Surrogate:	Decachlorobiphenyl	80 %	85 %	75 %	95 %
alpha-BHC		1.7 U	1.7 U	1.7 U	1.7 U
beta-BHC		1.7 U	1.7 U	1.7 U	1.7 U
delta-BHC		1.7 U	1.7 U	1.7 U	1.7 U
gamma-BHC (Lindane)		100 %	86 %	114 %	104 %
Heptachlor		86 %	80 %	98 %	90 %
Aldrin		92 %	90 %	108 %	104 %
Heptachlor epoxide		1.7 U	1.7 U	1.7 U	1.7 U
Endosulfan I		1.7 U	1.7 U	1.7 U	1.7 U
Dieldrin		100 %	84 %	113 %	96 %
4,4'-DDE		3.3 U	3.3 U	3.3 U	3.3 U
Endrin		103 %	100 %	115 %	115 %
Endosulfan II		3.3 U	3.3 U	3.3 U	3.3 U
4,4'-DDD		3.3 U	3.3 U	3.3 U	3.3 U
Endosulfan sulfate		3.3 U	3.3 U	3.3 U	3.3 U
4,4'-DDT		93 %	90 %	103 %	100 %
Methoxychlor		17 U	17 U	17 U	17 U
Endrin ketone		3.3 U	3.3 U	3.3 U	3.3 U
Endrin aldehyde		3.3 U	3.3 U	3.3 U	3.3 U
alpha-Chlordane		1.7 U	1.7 U	1.7 U	1.7 U
gamma-Chlordane		1.7 U	1.7 U	1.7 U	1.7 U
Toxaphene		170 U	170 U	170 U	170 U
Aroclor-1016		33 U	33 U	33 U	33 U
Aroclor-1221		67 U	67 U	67 U	67 U
Aroclor-1232		33 U	33 U	33 U	33 U
Aroclor-1242		33 U	33 U	33 U	33 U
Aroclor-1248		33 U	33 U	33 U	33 U
Aroclor-1254		33 U	33 U	33 U	33 U
Aroclor-1260		33 U	33 U	33 U	33 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of Advisory limits.

Appendix D - PAH Results

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9 Report Date: 11/22/94 08:23 Page: 1

	Cust ID:	11294-1-SURF	11194-2-SURF	11194-2DSURF	11194-3-SURF	11294-3DSURF	11294-3DSURF
Sample Information	RFW#:	001	002	003	004	005	005 MS
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	1.0	10.0	10.0	10.0	10.0	10.0
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Decafluorobiphenyl		79 %	D %	D %	D %	D %	D %
Naphthalene		24 U	510	530	360 J	460 U	100 %
Acenaphthene		50 U	490 U	810 U	810 U	960 U	D %
Acenaphthylene		50 U	490 U	810 U	910	960 U	84 %
Fluorene		6.0 U	59 U	84 J	98 U	120 U	73 %
Phenanthrene		20 U	210	430	700	220 J	D %
Anthracene		3.0 U	50	100	140	47 J	64 %
Fluoranthene		24 U	420	680	640	500	D %
Pyrene		12 U	390	710	540	470	D %
Benzo(a)anthracene		2.0 J	190	360	240	200	D %
Chrysene		24 U	1600	820	1700	300 J	D %
Benzo(b)fluoranthene		3.8 J	840	690	410	460	D %
Benzo(k)fluoranthene		1.6 J	120	190	150	160	15 * %
Benzo(a)pyrere		2.4 J	170	310	250	220	D %
Dibenzo(a,h)anthracene		20 U	200 U	330 U	330 U	400 U	180 * %
Benzo(g,h,i)perylene		12 U	120 U	200 U	200 U	230 U	193 * %
Indeno(1,2,3-cd)pyrene		6.0 U	2500	1500	82 J	470	D %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9 Report Date: 11/22/94 08:23 Page: 2

	Cust ID:	11294-3DSURF	11294-4-SURF	11294-5-SURF	11194-6-SURF	11194-060020	11194-620END
Sample Information	RFW#:	005 MSD	006	007	008	009	010
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	10.0	10.0	10.0	10.0	10.0	10.0
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Decafluorobiphenyl		D %	D %	D %	D %	D %	D %
		fl	fl	fl	fl	fl	fl
Naphthalene		73 %	650	740	2300	1300	1700
Acenaphthene		D %	970 U	880 U	1500 U	1200 U	3600
Acenaphthylene		77 %	970 U	880 U	1500 U	1200 U	1400 U
Fluorene		85 %	120 U	110 U	170 U	140 U	170 U
Phenanthrene		D %	450	190 J	660	550	2200
Anthracene		58 %	84	44 J	110	88	190
Fluoranthene		D %	610	420 U	1400	220 J	1900
Pyrene		D %	670	380	1500	1100	3000
Benzo(a)anthracene		D %	290	190	640	490	530
Chrysene		D %	480	300 J	1100	400 J	2800
Benzo(b)fluoranthene		D %	520	470	1100	800	1500
Benzo(k)fluoranthene		10 * %	190	120	530	370	510
Benzo(a)pyrene		D %	310	200	880	570	1600
Dibenzo(a,h)anthracene		172 * %	290 J	210 J	590 U	490 U	570 U
Benzo(g,h,i)perylene		144 %	240	170 J	350 U	290 U	330 U
Indeno(1,2,3-cd)pyrene		D %	530	410	1800	790	560

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9410L613 Client: NYSDEC-Olcott Work Order: 01667-010-001-9 Report Date: 11/22/94 08:23 Page: 3

	Cust ID:	11294-070012	11294-712END	11294-8-SURF	11294-8-SURF	11294-800END	11294-800END
Sample Information	RFW#:	011	012	013	013 DL	014	014 DL
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	10.0	10.0	10.0	50.0	10.0	50.0
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg

Decafluorobiphenyl	D	% fl	D	% fl	D	% fl	D	% fl	D	% fl	D	% fl
Naphthalene	4100		550		22000		NA		9700		NA	
Acenaphthene	1600		1100	U	1000	U	NA		9600		NA	
Acenaphthylene	2400		1700		1000	U	NA		750	U	NA	
Fluorene	950		430		700		NA		90	U	NA	
Phenanthrene	4000		1200		10000		NA		8100		NA	
Anthracene	1100		300			E	2000			E	1800	
Fluoranthene	2700		1800		21000		NA		11000		NA	
Pyrene	4400		2700			E	18000		9500		NA	
Benzo(a)anthracene	530		380			E	8700			E	4300	
Chrysene	3400		520	U	15000		NA		6600		NA	
Benzo(b)fluoranthene	770		1300		4600		NA			E	4000	
Benzo(k)fluoranthene	550		450		930		NA			E	2100	
Benzo(a)pyrene	1400		1200		2400		NA			E	3700	
Dibenzo(a,h)anthracene	510	U	450	U	9800		NA		3000		NA	
Benzo(g,h,i)perylene	300	U	260	U	6200		NA		1600		NA	
Indeno(1,2,3-cd)pyrene	630		540		2400		NA		2500		NA	

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

 12

	Cust ID:	BLK		BLK BS		BLK BSD	
Sample Information	RFW#:	94GP0875-MB1		94GP0875-MB1		94GP0875-MB1	
	Matrix:	SOIL		SOIL		SOIL	
	D.F.:	1.0		1.0		1.0	
	Units:	ug/Kg		ug/Kg		ug/Kg	
Decafluorobiphenyl		79	%	65	%	84	%
Naphthalene		20	U	73	%	71	%
Acenaphthene		42	U	67	%	60	%
Acenaphthylene		42	U	70	%	68	%
Fluorene		5.0	U	78	%	70	%
Phenanthrene		17	U	90	%	85	%
Anthracene		2.5	U	71	%	68	%
Fluoranthene		20	U	99	%	92	%
Pyrene		10	U	98	%	93	%
Benzo(a)anthracene		4.0	U	96	%	92	%
Chrysene		20	U	96	%	96	%
Benzo(b)fluoranthene		4.5	U	100	%	94	%
Benzo(k)fluoranthene		2.5	U	109	%	105	%
Benzo(a)pyrene		2.5	U	78	%	80	%
Dibenzo(a,h)anthracene		17	U	102	%	98	%
Benzo(g,h,i)perylene		10	U	101	%	97	%
Indeno(1,2,3-cd)pyrene		5.0	U	94	%	94	%

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0 Report Date: 09/30/94 15:20 Page: 1

Sample Information													
Cust ID:	OL094-91294-020024		OL094-91294-224END		OL094-91294-030024		OL094-91294-030024		OL094-91294-030024		OL094-91294-032470	
RFW#:	001		002		003		003 MS		003 MSD		004	
Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
D.F.:	10.0		10.0		10.0		10.0		10.0		10.0	
Units:	ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Decafluorobiphenyl	I	% fl	I	% fl	106	% fl	54	% fl	65	% fl	59	% fl
Naphthalene	370	U	390	U	400	U	67	%	79	%	420	U
Acenaphthene	760	U	800	U	830	U	D	%	D	%	870	U
Acenaphthylene	760	U	1500		830	U	65	%	77	%	870	U
Fluorene	92	U	57	J	45	J	D	%	D	%	110	U
Phenanthrene	250	J	400		330	U	92	%	90	%	350	U
Anthracene	45	J	70		50	U	54	%	62	%	53	U
Fluoranthene	330	J	640		400	U	66	%	76	%	420	U
Pyrene	420		710		200	U	94	%	97	%	210	U
Benzo(a)anthracene	74	U	330		80	U	76	%	82	%	84	U
Chrysene	370	U	390	U	400	U	D	%	D	%	420	U
Benzo(b)fluoranthene	220		350		150		80	%	102	%	140	
Benzo(k)fluoranthene	87		150		50	U	75	%	87	%	53	U
Benzo(a)pyrene	140		230		50	U	71	%	81	%	53	U
Dibenzo(a,h)anthracene	310	U	330	U	340	U	85	%	99	%	360	U
Benzo(g,h,i)perylene	180	U	190	U	200	U	78	%	84	%	210	U
Indeno(1,2,3-cd)pyrene	92	U	96	U	100	U	72	%	78	%	110	U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0 Report Date: 09/30/94 15:20 Page: 2

Sample Information							
Cust ID:	OL094-91294-037080	OL094-91294-380END	OL094-91294-040024	OL094-91294-042480	OL094-91294-480END	BLK	
RFW#:	005	006	007	008	009	94GP0761-MB1	
Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
D.F.:	10.0	10.0	10.0	10.0	10.0	1.0	
Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	
Decafluorobiphenyl	56 %	78 %	74 %	102 %	114 %	132 %	
	fl	fl	fl	fl	fl	fl	
Naphthalene	510 U	380 U	410 U	390 U	310 U	20 U	
Acenaphthene	1100 U	790 U	850 U	730 J	650 U	42 U	
Acenaphthylene	1100 U	790 U	850 U	810 U	650 U	42 U	
Fluorene	130 U	96 U	100 U	98 U	79 U	5.0 U	
Phenanthrene	420 U	320 U	340 U	320 U	260 U	17 U	
Anthracene	64 U	48 U	51 U	49 U	39 U	2.5 U	
Fluoranthene	510 U	380 U	410 U	390 U	310 U	20 U	
Pyrene	260 U	190 U	200 U	200 U	160 U	10 U	
Benzo(a)anthracene	100 U	76 U	82 U	78 U	63 U	4.0 U	
Chrysene	510 U	380 U	410 U	390 U	310 U	20 U	
Benzo(b)fluoranthene	96 J	160	330	250	200	4.5 U	
Benzo(k)fluoranthene	64 U	48 U	51 U	49 U	39 U	2.5 U	
Benzo(a)pyrene	64 U	48 U	51 U	49 U	39 U	2.5 U	
Dibenzo(a,h)anthracene	440 U	330 U	350 U	330 U	270 U	17 U	
Benzo(g,h,i)perylene	260 U	190 U	200 U	200 U	160 U	10 U	
Indeno(1,2,3-cd)pyrene	130 U	96 U	140	66 J	79 U	5.0 U	

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9409L219 Client: NYSDEC-Olcott Work Order: 01667-010-001-0 Report Date: 09/30/94 15:20 Page: 3

	Cust ID:	BLK BS	BLK BSD
Sample Information	RFW#:	94GP0761-MB1	94GP0761-MB1
	Matrix:	SOIL	SOIL
	D.F.:	1.0	1.0
	Units:	ug/Kg	ug/Kg
Decafluorobiphenyl		114 %	108 %
Naphthalene		93 %	87 %
Acenaphthene		79 %	74 %
Acenaphthylene		65 %	69 %
Fluorene		84 %	79 %
Phenanthrene		94 %	90 %
Anthracene		50 %	56 %
Fluoranthene		82 %	78 %
Pyrene		87 %	88 %
Benzo(a)anthracene		83 %	85 %
Chrysene		92 %	88 %
Benzo(b)fluoranthene		94 %	87 %
Benzo(k)fluoranthene		98 %	92 %
Benzo(a)pyrene		60 %	62 %
Dibenzo(a,h)anthracene		98 %	93 %
Benzo(g,h,i)perylene		94 %	89 %
Indeno(1,2,3-cd)pyrene		86 %	81 %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Roy F. Weston, Inc. - Gulf Coast Laboratories
PAHs BY HPLC

RFW Batch Number: 9409L221 Client: NYSDEC-Olcott Work Order: 01667-010-001-0 Report Date: 10/29/94 11:02 Page: 1

10

	Cust ID:	91294-050024	91294-052496	91294-569END	91294-569END	91294-569END	BLK
Sample Information	RFW#:	011	012	013	013 MS	013 MSD	94GP0833-MB1
	Matrix:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	D.F.:	5.0	5.0	5.0	5.0	5.0	1.0
	Units:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Decafluorobiphenyl		76 %	42 * %	71 %	146 * %	70 %	110 %
Naphthalene		180 U	190 U	190 U	89 %	82 %	20 U
Acenaphthene		360 U	390 U	390 U	68 %	68 %	42 U
Acenaphthylene		360 U	390 U	390 U	77 %	76 %	42 U
Fluorene		44 U	47 U	46 U	111 %	152 * %	5.0 U
Phenanthrene		150 U	150 U	150 U	114 %	119 %	17 U
Anthracene		22 U	23 U	23 U	122 * %	123 * %	2.5 U
Fluoranthene		180 U	190 U	190 U	89 %	92 %	20 U
Pyrene		88 U	94 U	93 U	102 %	102 %	10 U
Benzo(a)anthracene		35 U	38 U	37 U	93 %	114 %	4.0 U
Chrysene		180 U	190 U	190 U	97 %	114 %	20 U
Benzo(b)fluoranthene		430	440	390	166 * %	269 * %	4.5 U
Benzo(k)fluoranthene		1.8 J	1.3 J	0.93 J	94 %	123 %	2.5 U
Benzo(a)pyrene		8.5 J	6.9 J	7.4 J	78 %	108 %	2.5 U
Dibenzo(a,h)anthracene		150 U	160 U	160 U	98 %	125 %	17 U
Benzo(g,h,i)perylene		88 U	94 U	93 U	113 %	133 %	10 U
Indeno(1,2,3-cd)pyrene		99	110	100	178 * %	97 %	5.0 U

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

11

Sample Information	Cust ID:	BLK BS	BLK BSD
	RFW#:	94GP0833-MB1	94GP0833-MB1
	Matrix:	SOIL	SOIL
	D.F.:	1.0	1.0
	Units:	ug/Kg	ug/Kg
Decafluorobiphenyl		107 %	110 %
Naphthalene		96 %	100 %
Acenaphthene		94 %	96 %
Acenaphthylene		97 %	100 %
Fluorene		99 %	103 %
Phenanthrene		98 %	106 %
Anthracene		88 %	90 %
Fluoranthene		99 %	102 %
Pyrene		101 %	102 %
Benzo(a)anthracene		103 %	106 %
Chrysene		102 %	106 %
Benzo(b)fluoranthene		104 %	107 %
Benzo(k)fluoranthene		112 %	116 %
Benzo(a)pyrene		90 %	94 %
Dibenzo(a,h)anthracene		102 %	106 %
Benzo(g,h,i)perylene		98 %	104 %
Indeno(1,2,3-cd)pyrene		95 %	100 %

U= Analyzed, not detected. J= Present below detection limit. B= Present in blank. NR= Not requested. NS= Not spiked.
%= Percent recovery. D= Diluted out. I= Interference. NA= Not Applicable. *= Outside of EPA CLP QC

Appendix E - Growth and Survival Data

Sediment Source: 18-Mile Creek, Olcott Harbor
Dates Test Conducted: October 14-24, 1994

Station Number	Exposure Number	Species	Number Organisms Recovered	Date Weighed	Foil Weight (g)	Foil + Organism Weight (g)	Total Dry Weight (g)	Weight per Organism (mg)
Control A	1-1	HA	5	03/08/95	1.3469	1.3474	0.00046	0.092
	1-10	HA	10	03/08/95	1.351	1.3518	0.00079	0.079
	1-25	HA	10	03/14/95	1.3111	1.312	0.00094	0.094
	1-33	HA	8	03/14/95	1.3127	1.3135	0.00074	0.093
2D	1-14	HA	8	03/08/95	1.3539	1.3546	0.00069	0.086
	1-27	HA	7	03/14/95	1.3201	1.3208	0.00068	0.097
	1-31	HA	10	03/14/95	1.3284	1.3294	0.00107	0.107
	1-37	HA	8	03/14/95	1.3439	1.3448	0.00091	0.114
3	1-2	HA	10	03/08/95	1.3415	1.3426	0.00113	0.113
	1-6	HA	9	03/08/95	1.3408	1.3415	0.00066	0.073
	1-12	HA	9	03/08/95	1.3599	1.3605	0.00066	0.073
	1-22	HA	10	03/14/95	1.3132	1.3139	0.00074	0.074
5	1-7	HA	9	03/08/95	1.3514	1.3521	0.00068	0.076
	1-15	HA	10	03/08/95	1.3374	1.3382	0.00085	0.085
	1-19	HA	8	03/14/95	1.3145	1.3152	0.00069	0.086
	1-26	HA	5	03/14/95	1.325	1.3255	0.00045	0.090
8	1-3	HA	10	03/08/95	1.3458	1.3473	0.00154	0.154
	1-13	HA	9	03/08/95	1.3525	1.3537	0.00112	0.124
	1-17	HA	10	03/14/95	1.3187	1.3198	0.00107	0.107
	1-36	HA	7	03/14/95	1.341	1.3419	0.00096	0.137
Control A	1-4	CT	9	03/08/95	1.3475	1.3643	0.01674	1.860
	1-23	CT	10	03/14/95	1.3066	1.3214	0.01474	1.474
	1-30	CT	10	03/14/95	1.3163	1.3318	0.01552	1.552
	1-34	CT	10	03/14/95	1.3333	1.3515	0.01820	1.820

20	1-21	CT	15	03/14/95	1.314	1.3244	0.01039	0.693
	1-29	CT	10	03/14/95	1.3164	1.3267	0.01022	1.022
	1-35	CT	10	03/14/95	1.3485	1.3584	0.00991	0.991
	1-38	CT	6	03/14/95	1.3402	1.3473	0.00716	1.193
3	1-5	CT	10	03/08/95	1.3446	1.3536	0.00896	0.896
	1-11	CT	9	03/08/95	1.3565	1.3656	0.00915	1.017
	1-20	CT	10	03/14/95	1.3169	1.3247	0.00772	0.772
	1-28	CT	9	03/14/95	1.3194	1.3263	0.00692	0.769
5	1-8	CT	10	03/08/95	1.3505	1.3602	0.00963	0.963
	1-18	CT	9	03/14/95	1.3322	1.3413	0.00911	1.012
	1-24	CT	10	03/14/95	1.3071	1.3148	0.00772	0.772
	1-40	CT	9	03/14/95	1.3402	1.3471	0.00686	0.762
8	1-9	CT	9	03/08/95	1.3515	1.3671	0.01554	1.727
	1-16	CT	10	03/08/95	1.3142	1.3386	0.02444	2.444
	1-32	CT	9	03/14/95	1.3309	1.3512	0.02033	2.259
	1-39	CT	10	03/14/95	1.3362	1.3582	0.02199	2.199
Control B	2-1	HA	10	03/14/95	1.3411	1.3419	0.00081	0.081
	2-10	HA	9	03/14/95	1.3586	1.3593	0.00068	0.076
	2-25	HA	10	03/15/94	1.3647	1.3656	0.00090	0.090
	2-33	HA	10	03/15/94	1.3613	1.3621	0.00084	0.084
1	2-7	HA	10	03/14/95	1.322	1.323	0.00094	0.094
	2-15	HA	10	03/14/95	1.3555	1.3566	0.00102	0.102
	2-19	HA	10	03/15/94	1.358	1.359	0.00098	0.098
	2-26	HA	10	03/15/94	1.3605	1.3614	0.00091	0.091
2	2-14	HA	9	03/14/95	1.3553	1.356	0.00067	0.074
	2-27	HA	10	03/15/94	1.3581	1.3589	0.00083	0.083
	2-31	HA	8	03/15/94	1.3587	1.3594	0.00072	0.090
	2-37	HA	8	03/15/94	1.364	1.3646	0.00057	0.071

4	2-2	HA	9	03/14/95	1.3435	1.3443	0.00086	0.096
	2-6	HA	6	03/14/95	1.3279	1.3284	0.00047	0.078
	2-12	HA	10	03/14/95	1.3546	1.3555	0.00088	0.088
	2-22	HA	8	03/15/94	1.3609	1.3617	0.00079	0.099
6	2-3	HA	9	03/14/95	1.3454	1.346	0.00058	0.064
	2-13	HA	10	03/14/95	1.3564	1.3573	0.00094	0.094
	2-17	HA	6	03/15/94	1.3605	1.361	0.00046	0.077
	2-36	HA	9	03/15/94	1.3576	1.3583	0.00068	0.076
Control B	2-4	CT	11	03/14/95	1.3226	1.3397	0.01708	1.553
	2-23	CT	10	03/15/94	1.358	1.3772	0.01921	1.921
	2-30	CT	9	03/15/94	1.3624	1.379	0.01667	1.852
	2-34	CT	10	03/15/94	1.3662	1.3821	0.01588	1.588
1	2-8	CT	9	03/14/95	1.3243	1.3338	0.00949	1.054
	2-18	CT	4	03/15/94	1.3596	1.3658	0.00623	1.558
	2-24	CT	9	03/15/94	1.3626	1.3709	0.00829	0.921
	2-40	CT	9	03/15/94	1.3655	1.3735	0.00791	0.879
2	2-21	CT	0	03/15/94	1.3609	1.3609	0.00000	??
	2-29	CT	10	03/15/94	1.3585	1.37	0.01144	1.144
	2-35	CT	0	03/15/94	1.3631	1.363	-0.00008	??
	2-38	CT	0	03/15/94	1.3614	1.3614	0.00000	??
4	2-5	CT	10	03/14/95	1.3456	1.3563	0.01075	1.075
	2-11	CT	8	03/14/95	1.3569	1.3669	0.00997	1.246
	2-20	CT	8	03/15/94	1.358	1.3668	0.00888	1.110
	2-28	CT	10	03/15/94	1.3603	1.3701	0.00985	0.985
6	2-9	CT	8	03/14/95	1.3618	1.3706	0.00883	1.104
	2-16	CT	9	03/14/95	1.3541	1.3645	0.01040	1.156
	2-32	CT	8	03/15/94	1.364	1.3727	0.00868	1.085
	2-39	CT	9	03/15/94	1.3582	1.3706	0.01242	1.380

Appendix F - Water Chemistry

Olcott Harbor 1994
Chemical Analysis

Bioassay 10/14-10/24/94						
Sample	Date	pH	Alkalinity ppm $CaCo_3$	Conductivity Uhmos	Hardness ppm $CaCO_3$	Ammonia ppm NH_3
Olcott Control #1	10/14	7.80	129.0	382	153.8	0.62
Olcott Harbor #1	10/14	8.20	108.5	360	137.6	<0.085
Olcott Harbor #2	10/14	7.90	111.0	374	140.0	1.16
Olcoot Harbor #2D	10/14	7.89	112.0	372	141.2	1.30
Olcott Harbor #3	10/14	7.94	111.0	376	141.0	0.65
Olcott Harbor #4	10/14	7.93	110.5	371	140.8	0.62
Olcott Harbor #5	10/14	8.00	108.0	369	139.6	0.38
Olcott Harbor #6	10/14	7.79	118.5	375	142.2	1.60
Olcott Harbor #8	10/14	7.99	111.0	367	142.0	0.60
Olcott Control #2	10/14	7.84	128.5	381	152.8	0.64
Lab Water	10/14	8.05	104.5	369	133.4	<0.085
Olcott Control #1	10/24	7.92	115.0	374	143.4	0.17
Olcott Harbor #1	10/24	8.06	111.0	369	140.7	0.098
Olcott Harbor #2	10/24	8.30	122.0	385	150.0	0.22
Olcott Harbor #2D	10/24	8.10	119.0	383	148.8	0.22
Olcott Harbor #3	10/24	8.08	115.0	376	143.6	0.12
Olcott Harbor #4	10/24	8.04	117.0	378	146.8	0.16
Olcott Harbor #5	10/24	8.13	117.0	379	146.8	0.13
Olcott Harbor #6	10/24	7.94	118.0	382	146.4	0.35
Olcott Harbor #8	10/24	8.08	119.0	389	153.0	0.11
Olcott Control #2	10/24	7.87	114.0	375	141.6	0.18
Lab Water	10/24	7.92	107.0	354	136.0	<0.085

Appendix G - Invertebrates in Ponar Samples

Invertebrates in Ponar samples, collected October 12, 1994, from Olcott Harbor (Station 1) and Eighteenmile Creek (Station 4).

SPECIES	STATION 1 - LAKE				STATION 4 - CREEK			
	A	B	C	T	A	B	C	T
PLATYHELMINTHES								
Undetermined Turbellaria	.	.	.	.	.	.	4	4
NEMERTEA								
Prostoma graecense (=rubrum)	.	.	.	.	4	.	.	4
ANNELIDA								
OLIGOCHAETA								
Tubificidae								
Limnodrilus hoffmeisteri	.	.	.	.	96	128	160	384
Potamothrix moldaviensis	48	73	50	171	.	.	.	.
MOLLUSCA								
GASTROPODA								
Hydrobiidae								
Amnicola limosa	.	.	.	.	.	.	4	4
PELECYPODA								
Sphaeriidae								
Pisidium sp.	.	.	.	.	4	12	20	36
Sphaerium sp.	.	.	.	.	20	.	4	24
ARTHROPODA								
CRUSTACEA								
AMPHIPODA								
Gammaridae								
Gammarus sp.	.	.	.	.	44	84	8	136
INSECTA								
ODONATA								
Coenagrionidae								
Enallagma sp.	.	.	.	.	.	4	.	4
TRICHOPTERA								
Leptoceridae								
Oecetis sp.	.	.	.	.	.	4	4	8
DIPTERA								
Ceratopogonidae								
Undetermined Ceratopogonidae	.	.	.	.	4	.	4	8
Chironomidae								
Tanypodinae								
Procladius sp.	.	.	.	.	42	49	22	113
Chironominae								
Chironomus sp.	.	.	.	.	4	4	31	39
Cryptochironomus fulvus gr.	2	2	1	5	13	8	13	34
Dicrotendipes fumidus	.	.	.	.	.	12	4	16
Tribelos jucundum	.	.	.	.	221	163	174	558
NUMBER OF INDIVIDUALS	50	75	51	176	452	468	452	1372
SPECIES RICHNESS	2	2	2	2	10	10	13	15
DIVERSITY	*	*	*	0.19	*	*	*	2.44
HBI	*	*	*	9.94	*	*	*	7.15
PONAR PMA	*	*	*	23	*	*	*	57
DOM3	*	*	*	100	*	*	*	79

Appendix H - NYSDEC Field Audit

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Langdon Marsh
Commissioner

MEMORANDUM

To: Bruce Garabedian

From: Larry Bailey

Date: October 5, 1994

Subject: Olcott Harbor Project Field Audit Report

On September 12, 1994, I accompanied you, Jim Swart, and Bernadette Andersen to Olcott, NY to conduct a field audit of the sediment core sampling portion of the Olcott Harbor Project.

Sampling was accomplished using a vibracorer on the USEPA Great Lakes Research Vessel "Mudpuppy". The boat was staff by 3 people from the USEPA Diluth office. As each core was taken, it was then transported back to shore, where it was sectioned and subsampled. The only problem encountered with the coring was that no sediment was found in the lake at the end of the harbor outlet. Sampling locations where identified using both Loran and GPS positioning systems. No deviations in accepatable procedures where noted during the collection of the cores.

The sectioning and subsampling of the cores was performed on shore by DEC staff and staff from Roy F. Weston, Inc., a DEC contractor laboratory. Sectioning was accomplished by first identifing physical horizons in the core and then determining the depth of the horizon. Subsampling was then accomplished by combining several aliquots taken between the identified horizons. These subsamples where then shipped to Weston's Lionville, PA laboratory for further processing. No deviations from acceptable procedures were noted during the sectioning and subsampling of the cores.

Overall, I was very impressed by the capabilities of you, your DEC team, and the EPA and Weston staff.

If you have any questions, please contact me.