Department of Environmental Conservation

Division of Water

Final Report

Eighteenmile Creek Sediment Study

Summary of August 17-20 and November 3, 1998 Results

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New York State Department of Environmental Conservation
George E. Pataki, Governor Erin M. Crotty, Commissioner

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Executive Summary

A limited sediment sampling program was conducted as a follow up to the 1994, NYSDEC sediment sampling conducted on Eighteenmile Creek and Olcott Harbor (NYSDEC, 1998a). Study results are intended to satisfy some of the sampling recommendations presented in the August 1997 Eighteenmile Creek Remedial Action Plan (NYSDEC, 1997). Specifically, sampling results presented herein provide sediment data to further delineate the spatial and temporal extent of the sediment contamination identified as a result of the 1994 sampling. Sediment data were also gathered at sites where none were previously collected but where data were needed to fully evaluate the study area.

Sediment cores and surficial sediment samples were collected at a total of twelve sites on the Eighteenmile Creek, its tributaries and the New York State Erie Barge Canal. All sediment sampling was performed on August 17 to 20, 1998. Additional water column sampling, to evaluate sediment transport from the Erie Barge Canal into Eighteenmile Creek and through Eighteenmile into the Olcott Harbor Area of Concern (AOC) was conducted on November 3, 1998.

Sediment samples were evaluated for several chemical parameters including heavy metals, PCBs, chlorinated pesticides, PAHs and dioxins and furans. Water column samples were evaluated for total and filtered concentrations of the same parameters. Sediment toxicity tests were performed using surficial sediment samples collected for chemical analyses. These test results provide both quantitative and qualitative information useful for evaluating the biological integrity of the waterbodies studied.

Project funding was provided by a grant from the EPA's Great Lakes National Program Office (GLNPO). Field crews from the NYSDEC's central office in Albany, NY performed the sediment sampling. Staff from the NYSDEC's Region 9 office completed the water column sampling.

High concentrations of trace metals were found in sediment core samples taken upstream of the Burt Dam (cadmium, 20.1 ppm; chromium, 1,490 ppm; copper, 2,450 ppm; lead, 4,490 ppm; nickel, 997 ppm; silver, 8 ppm and zinc, 15,100 ppm). These concentrations were measured in sediment core subsections ranging from 28 to 90 cm deep. Similar trace metal concentrations were found in samples collected upstream of the Newfane Dam. These findings are comparable to those observed during the 1994 NYSDEC sampling. Radiodating results suggest this contamination may be due to historic (middle 1950's to early 1960's) industrial practices, discharges or spills.

An elevated level of Mirex (380 ppb) was encountered in Eighteenmile Creek at a location (Station No. 9) upstream of the New York State Erie Barge Canal's confluence.

The highest PCB concentration measured (25.85 ppm) was in Eighteenmile Creek sediments collected in the depositional pool created upstream of the Burt Dam (Station No. 6F). High PCB concentrations (24.93 ppm) were also observed in Eighteenmile Creek diversion channel sediments downstream of the abandoned Flintkote site (Station No. 12). Additional sampling near the Flintkote site seems warranted due to the elevated results encountered.

Dioxin and furan concentrations measured at several sampling locations were elevated (tetra through octa dioxin and furan homolog totals greater than 2,500 and 750 ppt, respectively). Calculated 2,3,7,8- TCDD toxic equivalencies exceeded the NYSDEC human bioaccumulation guidance at Station Nos. 6E (Burt Dam) and 12 (Eighteenmile Creek at abandoned Flintkote site).

Ten-day solid phase toxicity testing showed reduced growth in surficial sediments from upstream of the Newfane Dam (Station No. 7ABC).

Unfortunately, no high flow storm events occurred during the study. It was planned that water column sampling be performed during a period of high sediment resuspension. As total and filtered water sampling was not performed during such conditions, no sediment transport calculations were made.

Contaminated sediments were confirmed as the primary source of contamination responsible for inclusion of a segment of the Erie Canal and Eighteenmile Creek on the NYSDEC Priority Waterbodies List (PWL). This list details waterbodies with impaired usage. Additionally, this report will be forwarded to the NYSDEC's Division of Environmental Remediation for their evaluation of remedial needs.

Acknowledgments

This study was funded by a grant from the Environmental Protection Agency's Great Lakes National Program Office (Grant No. GL985728-01-1). Report review and editing was performed by Bernadette Anderson and is greatly appreciated.

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Chapter 1 – Introduction

A limited sediment sampling program was conducted as a follow up to the 1994, NYSDEC sediment sampling conducted on Eighteenmile Creek and Olcott Harbor (NYSDEC, 1998a). Study results are intended to satisfy some of the data collection objectives and recommendations presented in the August 1997 Eighteenmile Creek Remedial Action Plan (NYSDEC, 1997). Specifically, sampling results presented herein provide sediment data to further delineate the spatial and temporal extent of the sediment contamination identified as a result of the 1994 sampling. Sediment samples were also collected at sites where none were previously collected but where data were needed to fully evaluate the study area. Source identification of PCBs and other contaminants to Eighteenmile Creek, as recommended in the Remedial Action Plan, was conducted, as was an evaluation of Erie Barge Canal sediments.

It was thought, based upon the previous NYSDEC sampling, the more highly contaminated sediments deposited behind the Burt Dam were migrating downstream, passing over the Dam and through the hydroelectric generating facility during high flow, scour conditions. Sediments migrating past the Burt Dam were suspected to be settling out downstream, in the slow moving waters within the Olcott Harbor Area of Concern (AOC). One of the objectives of this study was to evaluate this transport mechanism.

Data Usage

Concentrations of dioxins, furans, PCBs, PAHs, organochlorine pesticides, and heavy metals in sediments were evaluated. Surficial sediment toxicity within the study area was also evaluated, as was sediment grain size, total organic carbon (TOC) and total volatile solids (TVS). Three sediment cores were radiodated to establish the chronology of contamination in the Erie Canal and in the depositional pools created by the Burt and Newfane Dams.

Data generated from this study will be provided to the USEPA for inclusion in their National Sediment Inventory database. Study results will also be provided to the Eighteenmile Creek Remedial Action Committee.

Field Study

This study provides information on the levels of contamination for organic chemicals and trace metals. By collecting cores as well as surficial samples, a chronological history of chemical deposition can be depicted. Surficial sediment data provides information on the current spatial variability of contamination within the study area, as well as the potential chemical bioavailability.

Sediment samples were collected at twelve sites. Four specific areas of interest were evaluated along with miscellaneous sampling sites. The four areas of interest included the depositional pools created upstream of the Burt and Newfane Dams, the Erie Barge Canal and a location near the abandoned Flintkote site (Eighteenmile Creek). A map of the study area, including the sampling stations is presented in Figure 1.

It was planned that three discrete subsections from each core be analyzed. Additional cores were collected where well-defined horizons were not observed, if short cores were obtained, or if cores contained very coarse granular material. Surficial sediment samples were generally collected adjacent to each of the sediment core sampling sites. A complete description of all sampling locations is summarized in the Sampling Station Summary (Table 1-1). Additional information regarding the types of samples collected (core vs. surficial) and the analyses performed at each location is presented in the Field Sampling Summary (Table 1-2).

Analytes evaluated (Table 1-3) from both the core and surficial samples included heavy metals; chlorinated pesticides; PCB congeners; dioxins/furans; PAHs; total organic carbon; total volatile solids and total solids. Particle size analyses were performed on the surficial samples. Solid phase toxicity testing was performed using a portion of the surficial sediment sample collected from three sampling areas. Subsamples were taken from three sediment cores (Station Nos. 6c, 7c and 8a) and submitted for radiodating analysis. Radiodating results are used to establish the chronology of deposition and associated contamination at a site.

Sediment cores were collected in two areas previously sampled (depositional pools upstream of Burt and Newfane Dams) as part of the 1994 NYSDEC Eighteenmile Creek/Olcott Harbor Sediment Study (NYSDEC, 1998a).

Limited water column sampling was conducted to evaluate the sediment flux and associated contaminant transport into and through the study area. Total and suspended solids along with chemical parameters were evaluated in water samples from the Erie Canal's overflow into Eighteenmile Creek and also at the Burt Dam.

Sediment data resulting from the 1994 NYSDEC sampling showed higher contaminant concentrations in the surficial samples downstream of the Burt Dam. The highest contaminant concentrations upstream of the Burt Dam were found in the deeper core samples and not in the surficial sediments.

The majority of the Eighteenmile Creek flow during dry weather is due to flow augmentation from the New York State Erie Barge Canal. It was intended that this sampling be performed during a high flow, storm event. Such an event did not occur. It was expected, under such conditions that elevated water column suspended solids concentrations would be encountered. Field staff from the NYSDEC Region 9 Office (Buffalo, NY) performed this sampling during the dewaterating of the New York State Erie Barge Canal.

Of particular interest for this study was the depositional pool created behind the Burt Dam. Sampling in this area was conducted with the express purpose of obtaining 4 cores, longer in length than the 62-cm. core previously collected there (NYSDEC, 1998a). Some of the highest arsenic, cadmium, chromium, copper, nickel, DDT and PCB concentrations were measured in the 51-62 cm section of the core (Station No. 6) from that site. For this study it was necessary to collect cores longer than 62 cm, to determine if higher concentrations would be found below this depth.

Previous sampling behind the Burt Dam was conducted from onboard a rubber raft, which was difficult to hold stationary while coring. Sampling during this survey was conducted using two flat- bottom aluminum skiffs tied together to form a work platform. Spuds were also used to hold the work platform stationary during coring.

Contaminant summaries along with general conclusions regarding contaminant concentrations in the areas sampled have been drawn. An evaluation of the toxicity of the bottom sediments within the study area was also conducted and is summarized.

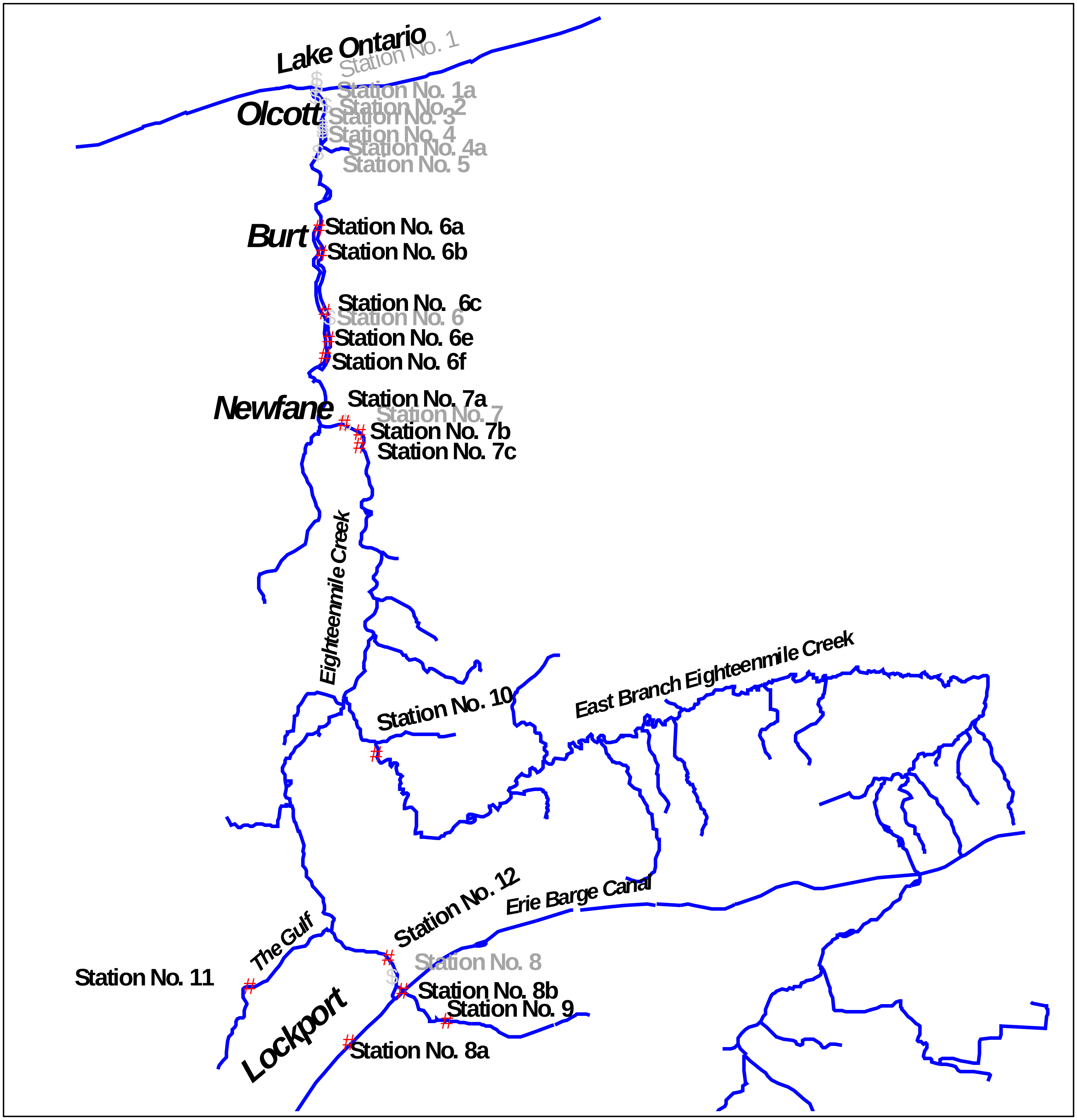


Figure 1-1. Study Area and Sampling Stations

(Previous sampling stations [NYSDEC, 1998a] shown in gray)

Table 1-1. Sampling Station Summary

Eighteenmile Creek Sediment Study

Station No.	Water body	Sampling Location	Sample Collection Date	Sample Collection Time	Water Column Depth (m)	Coordinates (1) (Lat./Long.) (Deg.-Min.-Sec.)
6A	Eighteenmile Ck.	Water sample from Burt Dam turbine discharge	03-Nov-98	13:25	NA	43-18-49 78-42-56
6B	Eighteenmile Ck.	In Burt Dam pool, approx. 50 m downstream of Burt Rd. Bridge	18-Aug-98	16:15	10	43-18-33 78-42-53
6C	Eighteenmile Ck.	In Burt Dam pool, approx. 100 m upstrm. of Burt Rd. Bridge	18-Aug-98	19:40	2.4	43-17-55 78-42-46
6E	Eighteenmile Ck.	In pool created upstream of Burt Dam	18-Aug-98	14:15	2	43-17-38 78-42-43
6F	Eighteenmile Ck.	In pool created upstream of Burt Dam	18-Aug-98	13:00	0.8	43-17-26 78-42-46
7A	Eighteenmile Ck.	In pool created upstream of Newfane Dam	19-Aug-98	11:30	1.3	43-16-43 78-42-26
7B	Eighteenmile Ck.	In pool created upstream of Newfane Dam	19-Aug-98	14:10	1.1	43-16-37 78-42-11
7C	Eighteenmile Ck.	In pool created upstream of Newfane Dam	19-Aug-98	13:00	0.1	43-16-29 78-42-11
13	Eighteenmile Ck.	Blind field duplicate of sample from 7ABC	19-Aug-98	14:30	NA	NA
8A	New York State Erie Barge Canal	Between Prospect and 13 th. St. Bridges, East end of concrete bulkhead, N. side of canal,	20-Aug-98	11:45	1	43-09-59 78-41-57
8B	New York State Erie Barge Canal	Water sample from overflow weir to Eighteenmile Creek	03-Nov-98	11:27	0.1	43-10-34 78-41-12
9	Eighteenmile Ck.	30 m upstrm. E. Remick Pkwy., dry sample from exposed 12 in. clay tile pipe at end of st. near apartments	17-Aug-98	16:30	0	43-10-16 78-40-30
10	Eighteenmile Ck.- East Branch	30 m upstream of Rt. 104 Bridge	18-Aug-98	09:00	0.5	43-13-08 78-41-44
11	The Gulf	40 m upstream of Niagara St. Bridge	17-Aug-98	18:00	0.5	43-10-33 78-43-27
12	Eighteenmile Ck.	Diversion Channel, 100m dnstrm. of William St. crossing, next to abandoned Flint Kote building	19-Aug-98	18:00	0.1	43-10-56 78-41-25

Note: (1)- Reference Datum is NAD83

Table 1-2. Field Sampling Summary

Eighteenmile Creek Sediment Study

Station	Water body	Date	Sediment Cores Collected	Surficial Sediment Samples Collected
6A	Eighteenmile Ck.	03-Nov-98	Water sample collected- chemistry of total and dissolved phases	
6B	Eighteenmile Ck.	18-Aug-98	None collected	Chemistry & Toxicity on composite from Station Nos. 6B, 6C, 6E & 6F
6C	Eighteenmile Ck.	18-Aug-98	Chemistry- 10 Sections, Radiodating	Chemistry & Toxicity on composite from Station Nos. 6B, 6C, 6E & 6F
6E	Eighteenmile Ck.	18-Aug-98	Chemistry- 4 Sections	Chemistry & Toxicity on composite from Station Nos. 6B, 6C, 6E & 6F
6F	Eighteenmile Ck.	18-Aug-98	Chemistry- 5 Sections	Chemistry & Toxicity on composite from Station Nos. 6B, 6C, 6E & 6F
7A	Eighteenmile Ck.	19-Aug-98	Chemistry- 4 Sections	Chemistry & Toxicity on composite from Station Nos. 7A, 7B & 7C
7B	Eighteenmile Ck.	19-Aug-98	Chemistry- 3 Sections	Chemistry & Toxicity on composite from Station Nos. 7A, 7B & 7C
7C	Eighteenmile Ck.	19-Aug-98	Chemistry- 3 Sections, Radiodating	Chemistry & Toxicity on composite from Station Nos. 7A, 7B & 7C
13	Eighteenmile Ck.	19-Aug-98	None collected	Chemistry- Blind field duplicate of Sample 7ABC
8A	New York State Erie Barge Canal	20-Aug-98	Chemistry- 10 Sections, Radiodating,	Toxicity
8B	New York State Erie Barge Canal	03-Nov-98	Water sample collected- chemistry of total and dissolved phases	
9	Eighteenmile Ck.	17-Aug-98	None collected	Chemistry
10	Eighteenmile Ck.- East Branch	18-Aug-98	None collected	Chemistry
11	The Gulf	17-Aug-98	None collected	Chemistry
12	Eighteenmile Ck.	19-Aug-98	Chemistry- 2 Sections	None collected

Materials and Methods

Most of the open water sampling was conducted using one or two flat- bottom aluminum skiffs, tied together to create a work platform. The Erie Barge Canal sediment samples were collected with an electric vibrocorer from onboard the NYSDEC's Sediment Assessment and Management Section's twenty-four foot pontoon boat. Two and one half-inch diameter hand push cores were collected at the remainder of the sites. A Standard Ponar® was used to collect surficial sediments.

All sediment samples were collected in slow moving backwaters or depositional areas. Sediment cores collected from these locations can be used to evaluate historical depositional patterns. Radiodating of cores was performed at three locations (Burt and Newfane Dams and Erie Barge Canal) to determine chronological deposition of contaminants.

Sediment Cores

A total of 8 sediment cores were collected for this study. Sediment cores were typically subsectioned into 2 to 5 sub-samples for analysis. Due to the significance of the Burt Dam and Erie Barge Canal sampling locations (Station Nos. 6C and 8A, respectively) ten sub-samples were evaluated from cores collected there. Subsampling was based upon visible determination of sediment stratification. Individual striations or horizons were treated as discrete subsamples. Where cores were short or visually homogeneous (no striations observed) they were subsectioned into three subsections. This was done to provide sufficient quantity of sample material for analytical evaluation. All samples were composited over the entire length of each respective subsection. Sediment core subsections were analyzed for those parameters identified in Table 1-3.

Sediment core radiodating is a useful tool as it can provide an assessment of the chronological deposition of contaminants at a site. Radioisotope analyses (cesium-137, beryllium-7 and lead-210) were performed on subsamples of sediment cores collected at three locations during this study. This evaluation was conducted on cores from the depositional pools created upstream of the Burt and Newfane Dams (Station Nos. 6C and 7C, respectively) and the Erie Barge Canal (Station No. 8A). All radiodating was performed at the Rensselaer Polytechnic Institute (RPI).

Surficial Samples

Surficial sediment samples were collected at locations adjacent to the sediment coring sites previously identified. Surficial samples were also collected at five locations where sediment cores were not collected. Surficial samples provide a representation of current, ambient conditions in the biologically active zone. A stainless steel Ponar Dredge® was used for sample collection. Samples were analyzed for many of the same parameters as the core sub-samples (see Table 1-3).

Toxicity Testing

Solid phase toxicity tests were performed using a portion of the surficial sediment collected at three sites (see Table 1-2). These tests were performed using epibenthic test species that live in the sediment-pore water interface. Sediment is placed in a beaker and dilution water is exchanged above the sediment. Solid phase tests simulate the effects of in-place sediments on indigenous aquatic organisms. Test species selected for this study include *Hyalella azteca* and C*hironomus tentans*. Data resulting from this test can be used to evaluate the potential toxicity from undisturbed sediment deposits or from dredge spoil material.

Table 1-3. Sediment Analytical Methods

Eighteenmile Creek Sediment Study

PARAMETER	RESPONSIBLE LAB	STANDARD METHOD	PRECISION	ACCURACY	---CALIBRATION--- INITIAL	ONGOING	BLANKS	DETECTION LIMIT (mg/kg) [1]	REPORTING LIMIT (mg/kg) [1]
Radioisotope Dating: 7- Beryillum, 137-Cesium, 210-Lead	RPI	gamma spectroscopy	± 10%	± 5%	ANNUAL	WEEKLY	BIWEEKLY	---	MDA=0.l pCi/g
Dioxins / Furans 2,3,7,8-Substituted Congeners and tetra thru octa homolog totals	Quanterra	EPA-1613B	± 40%*	± 40%*	when necessary	DAILY	PER METHOD	---	1-10 pg/g
			*(BASED ON EPA-8290; STUDY NOT DONE FOR EPA-1613)						
Organochlorine Pesticides (HRMS)	Quanterra	HRMS-2	± 60%	± 40%	when necessary	DAILY	1/ batch or 20 (max.)	25 ng/kg	100 ng/kg
PCB Congeners (HRMS)	Quanterra	HRMS-1	± 60%	± 40%	when necessary	DAILY	1/ batch or 20 (max.)	---	20-100 pg/g
Metals								as Solids	as Solids
Aluminum, Total (as Al)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	4.5	20.0
Arsenic, Total (as As)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	5.3	20.0
Cadmium, Total (as Cd)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.4	2.0
Chromium, Total, (as Cr)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.7	3.0
Copper, Total (as Cu)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.6	2.0
Iron, Total (as Fe)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.7	3.0
Lead, Total (as Pb)	RECRA	EPA-239.2 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	4.2	20.0
Hg (Total)	Brooks Rand	EPA-1631	± 25% RPD	± 25%	DAILY	EVERY 10 SAMP.	2 per batch	2 ng/g	5 ng/g
Hg (Methyl)	Brooks Rand	EPA-1630	± 25% RPD	± 25%	DAILY	EVERY 10 SAMP.	2 per batch	0.005 ng/g	0.01 ng/g
Nickel, Total (as Ni)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	1.5	6.0
Silver, Total (as Ag)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.7	3.0
Zinc, Total (as Zn)	RECRA	EPA-200.7 CLP-M	± 20% RPD	± 20%	DAILY	EVERY 10 SAMP.	EVERY 10 SAMP.	0.2	0.8
PAHs (HRMS)	Quanterra	HRGC/HRMS	± 20% RPD	30-150%	6 pt. crv	EVERY 10 SAMP.	1/ batch or 20 (max.)	---	50-60 ng/g
TOC	RECRA	9060 W/ LLOYD KAHN (SEE APPENDIX A)	± 20% RPD	± 20%	ICV/CCV 15%			20.0	20.0
TVS	RECRA	ASTM D2216-80		PER METHOD		NA		0.1%	0.01 %
Toxicity Testing- Solid Phase Test	Aquatec	10-day whole sediment survival and growth toxicity test [midge (Chironomus tentans) and amphipod (Hayalella azteca)] EPA, 1994. Methods for measuring the toxicity and bioaccumulation of sediment associated contaminants with freshwater invertibrates Method 100.1 (EPA/600/R-94/024)							

1- Unless otherwise noted

* ICP detection and quantification limit highly dependent on operating conditions and plasma position.

Chapter 2 - Metals

Sediment trace metal concentrations were determined in accordance with the standard analytical methods previously summarized in Table 1-3. Complete trace metals results are presented in Appendices A and B. Trace metals data are included in Appendix A while low-level mercury and monomethylmercury results are summarized in Appendix B. All results are reported in parts per million (ppm) or parts per billion (ppb) dry-weight basis.

Selected analytical results from these field surveys are shown in Figures 2-1A through 2-1L, as are NYSDEC sediment guidance values (1999a) where developed. Only trace metal concentrations exceeding analytical detection limits are presented.

The NYSDEC sediment guidance is useful for evaluating the potential toxicity of sediments to benthic organisms. This guidance reflects the lower of the Persaud et al. (1993) or Long and Morgan (1990) guidance values where both exist. The Persaud sediment guidance values define the "lowest effect level" (LEL) and "severe effect level" (SEL) while the Long and Morgan guidance defines the "Effects Range-Low" (ER-L) and "Effects Range-Median" (ER-M) levels. The ER-L and ER-M from Long and Morgan are compared with the LEL and SEL from Persaud in the NYSDEC guidance.

Upon review of the data presented in Figures 2-1A through 2-1L, it can be seen that all individual trace metal LEL screening values were exceeded at several sampling stations. The LEL screening values indicate the sediment contaminant levels that can be tolerated by the majority of benthic organisms but still cause toxicity to a few species. Sediment contaminant concentrations greater than the LEL but less than the SEL are considered marginally to significantly polluted (Persaud et al. 1993).

Sediment SEL screening values are also shown and were exceeded for many of the trace metals sampled. Trace metals exceeding the SEL values include cadmium (20.1 ppm), chromium (1,490 ppm), copper (2,450 ppm), lead (4,490 ppm), mercury (10.1 ppm), nickel (997 ppm), silver (8 ppm) and zinc (15,100 ppm). The SEL indicates the concentration at which pronounced disturbance of the sediment-dwelling community can be expected (Persaud et al. 1993).

With the exception of arsenic, the highest trace metal concentrations observed during this study were found in sediment samples taken from the depositional pools created upstream of the Burt and Newfane Dams (Station Nos. 6BCEF, 6C, 6E, 6F and 7ABC, 7A, 7B and 7C, respectively).

Within the Burt Dam depositional pool, the highest trace metals concentrations were generally found in the deeper sections of the sediment cores collected there. Similar findings were observed during previous sampling at this location (NYSDEC, 1998a). Earlier sampling was based upon the evaluation of only one core (Station No. 6) with two subsamples (0-51 cm and 51-62 cm depths). The highest trace metals were found in the 51-62 cm subsample and it was unknown if higher concentrations would be found in deeper sediments at that site.

One of the objectives of this study was to collect a longer (deeper) core in this area to verify the depth at which the peak trace metals concentrations occurred. This objective was satisfied with the collection of a 99-cm core at Station No. 6C. Station No. 6C was located very near the 1994 sampling site (Station No. 6). Analyses were conducted on ten subsections

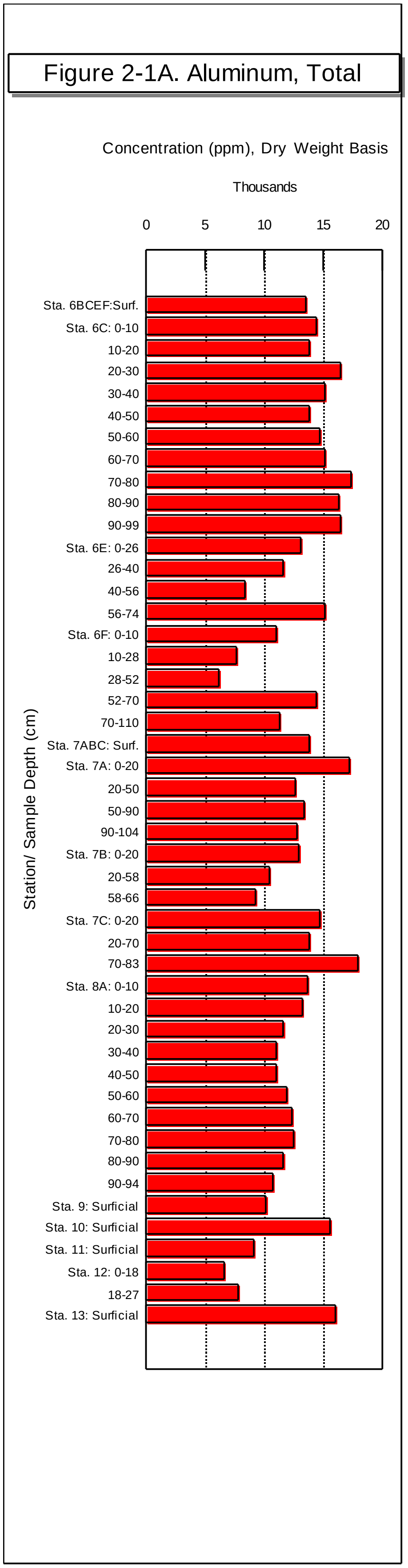


Figure 2-1A. Aluminum, Total

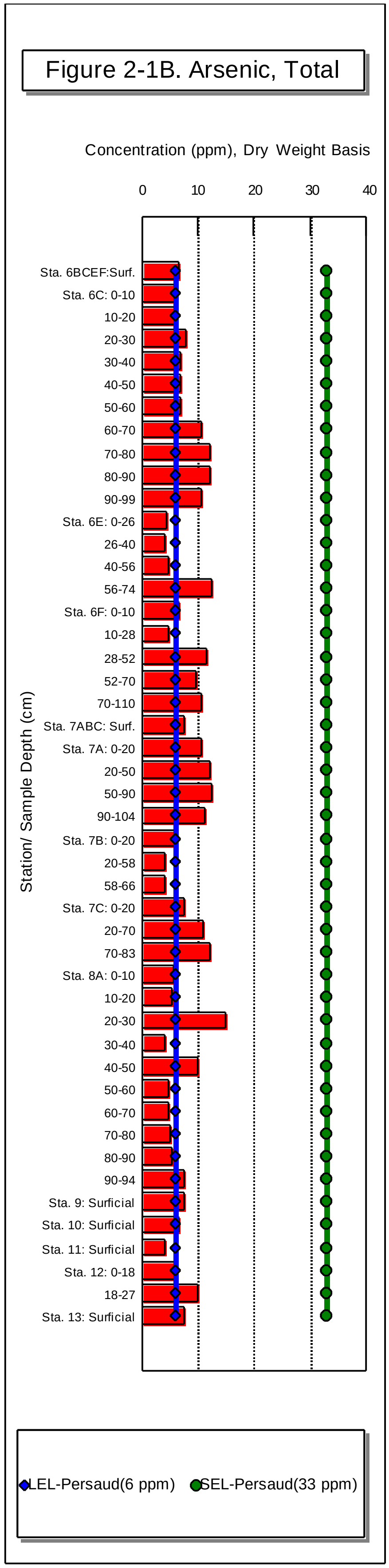


Figure 2-1B. Arsenic, Total

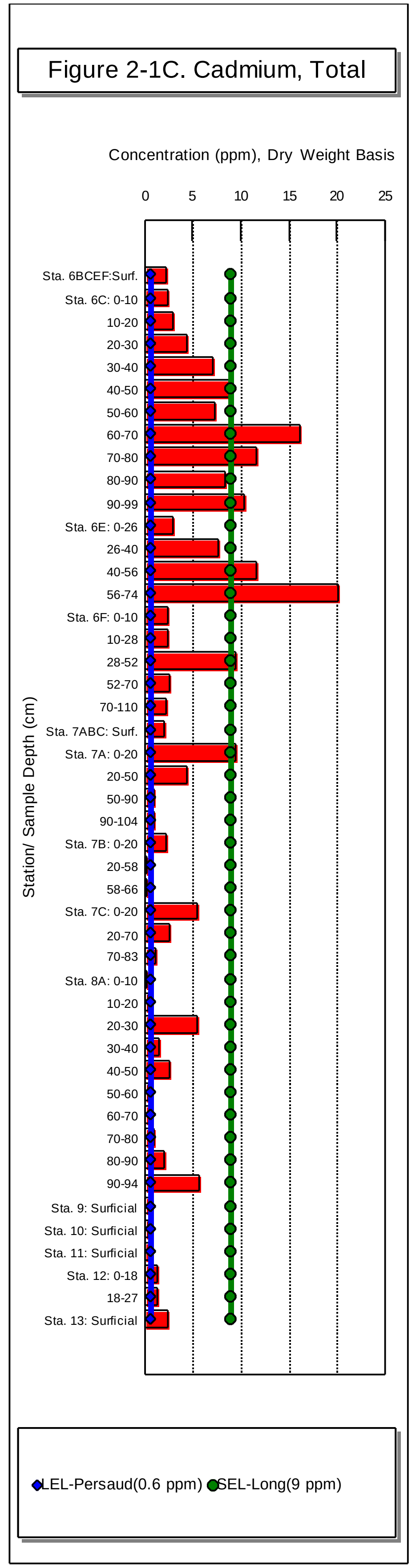


Figure 2-1C. Cadmium, Total

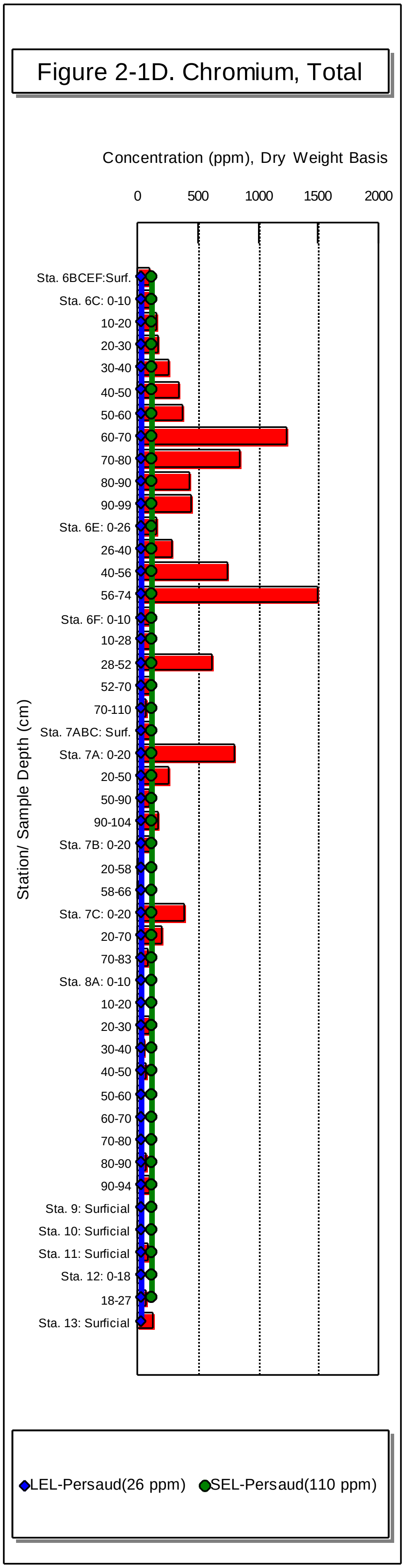


Figure 2-1D. Chromium, Total
Concentration (ppm), Dry Weight Basis
0
500
1000
1500
2000
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud(26 ppm)
SEL-Persaud(110 ppm)

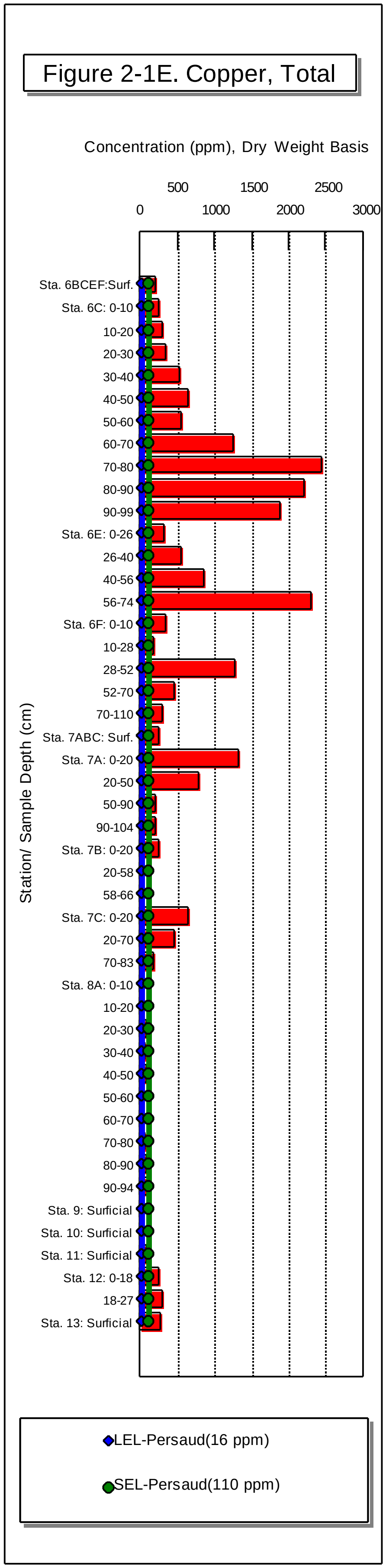


Figure 2-1E. Copper, Total
Concentration (ppm), Dry Weight Basis
500
1500
2500
0
1000
2000
3000
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud(16 ppm)
SEL-Persaud(110 ppm)

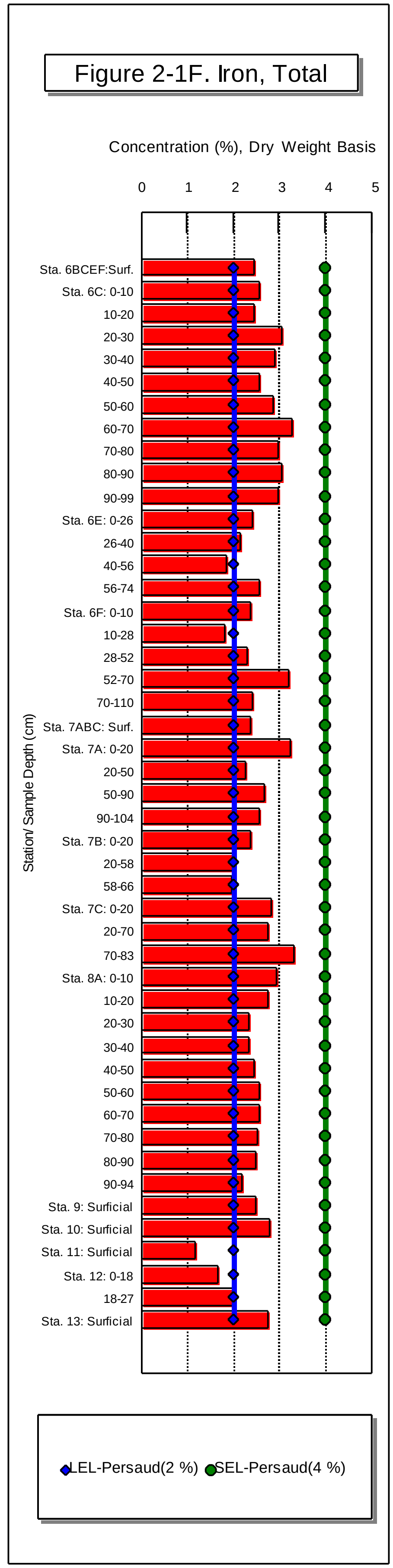


Figure 2-1F. Iron, Total
Concentration (%), Dry Weight Basis
0
1
2
3
4
5
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud(2 %)
SEL-Persaud(4 %)

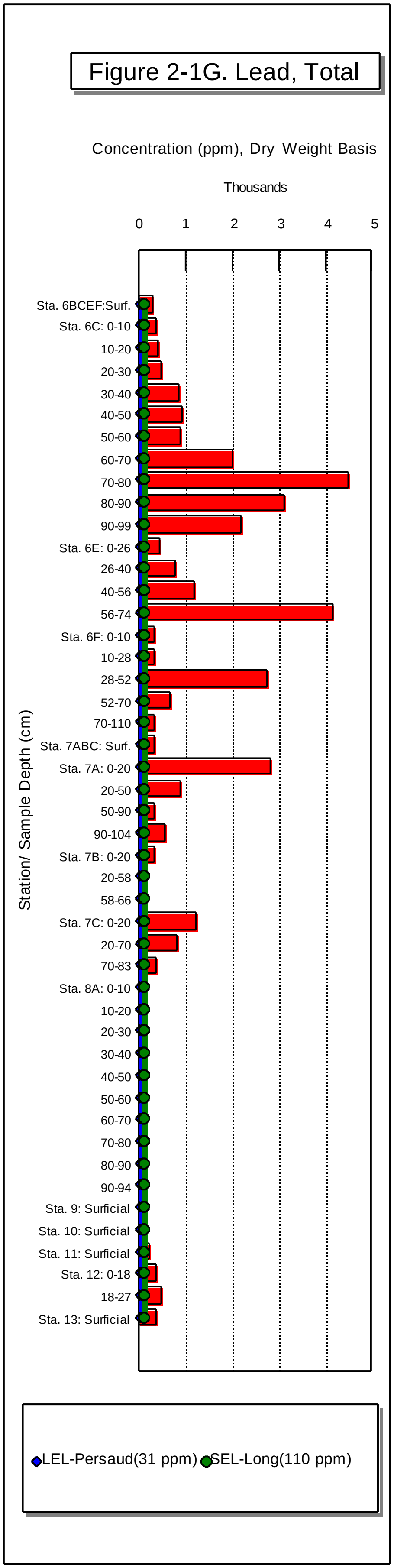


Figure 2-1G. Lead, Total
Concentration (ppm), Dry Weight Basis
Thousands
0 1 2 3 4 5
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud(31 ppm) SEL-Long(110 ppm)

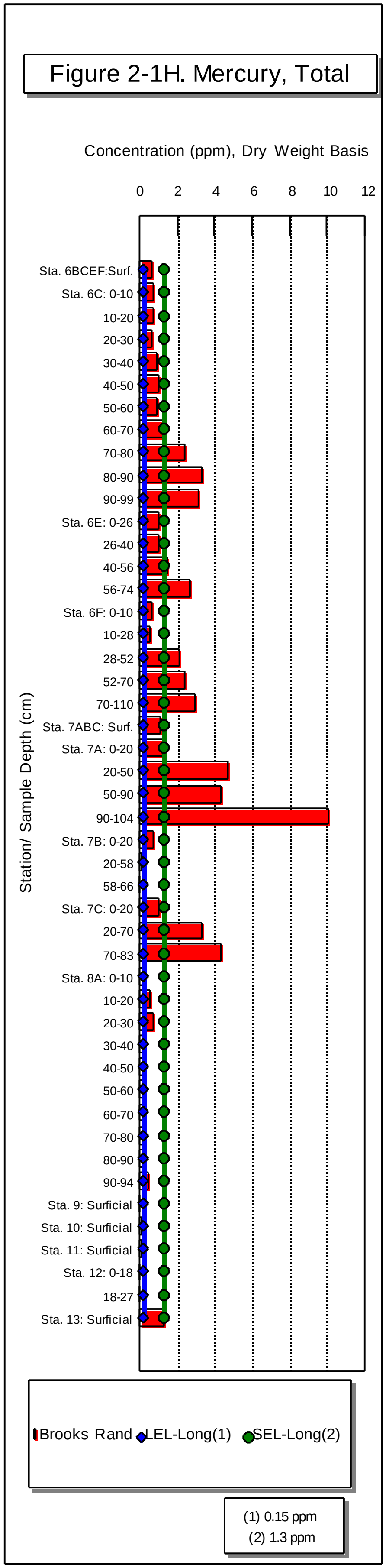


Figure 2-1H. Mercury, Total
Concentration (ppm), Dry Weight Basis
0 2 4 6 8 10 12
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
Brooks Rand LEL-Long(1) SEL-Long(2)
(1) 0.15 ppm
(2) 1.3 ppm

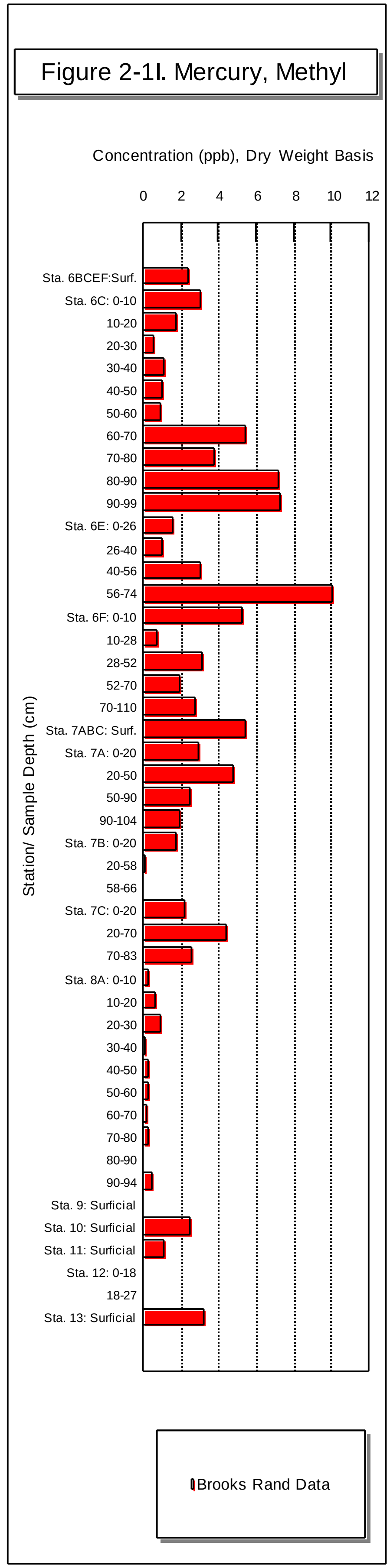


Figure 2-1I. Mercury, Methyl
Concentration (ppb), Dry Weight Basis
0 2 4 6 8 10 12
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
Brooks Rand Data

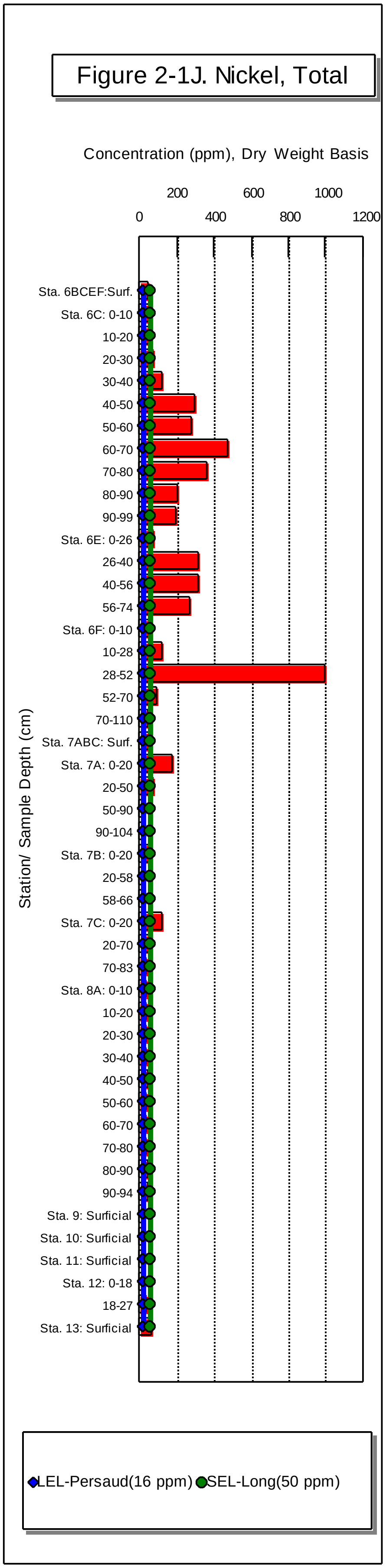


Figure 2-1J. Nickel, Total
Concentration (ppm), Dry Weight Basis
0
200
400
600
800
1000
1200
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud(16 ppm)
SEL-Long(50 ppm)

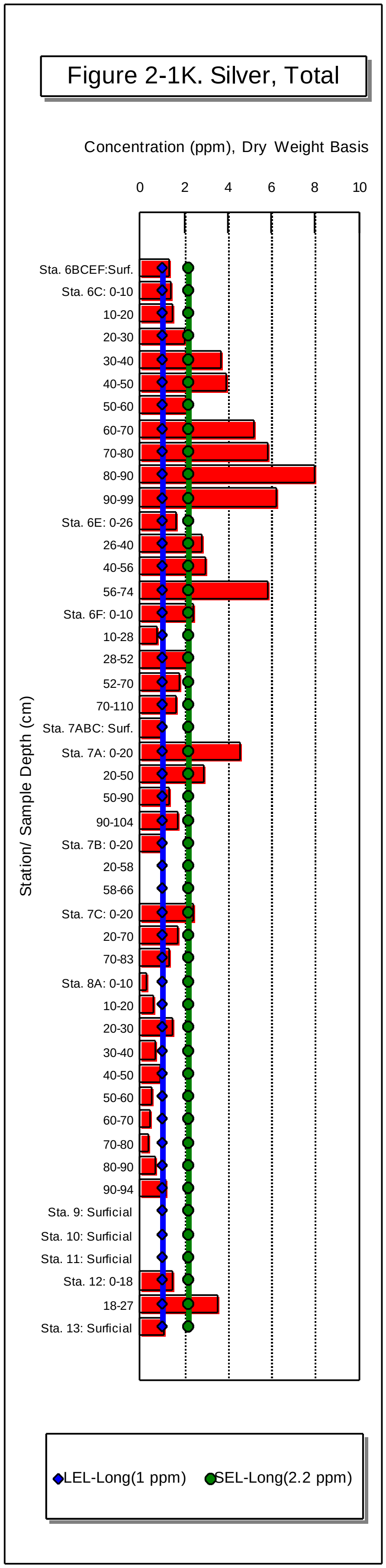


Figure 2-1K. Silver, Total
Concentration (ppm), Dry Weight Basis
0
2
4
6
8
10
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Long(1 ppm)
SEL-Long(2.2 ppm)

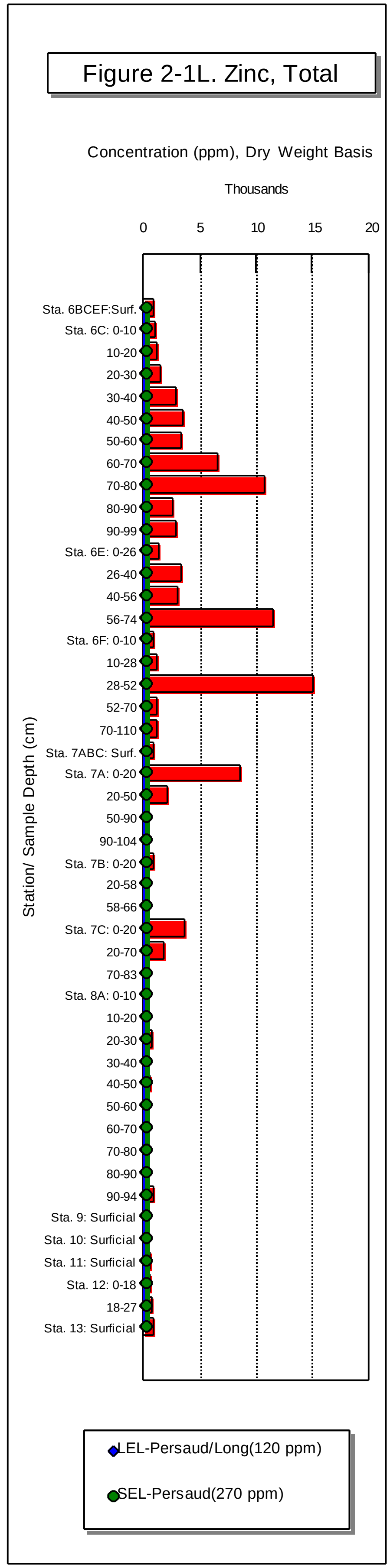
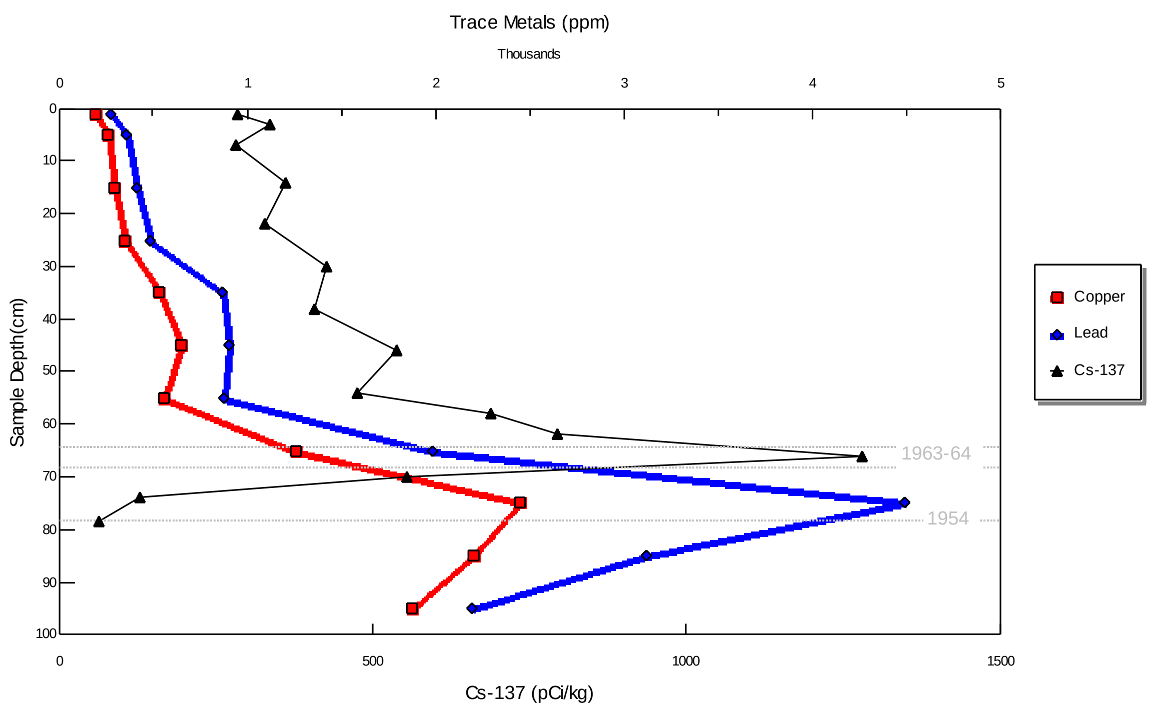


Figure 2-1L. Zinc, Total
Concentration (ppm), Dry Weight Basis
Thousands
0
5
10
15
20
Station/ Sample Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
10-28
28-52
52-70
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
Sta. 13: Surficial
LEL-Persaud/Long(120 ppm)
SEL-Persaud(270 ppm)

from the core collected there. Maximum cadmium (16.2 ppm), chromium (12,400 ppm), iron (32,900 ppm) and nickel (478 ppm) concentrations were observed in the 60- 70 cm subsample. Peak aluminum (17,400 ppm), arsenic (12.3 ppm), copper (2,450 ppm), lead (4,490 ppm) and zinc (10, 800 ppm) were seen in the 70- 80 cm subsample and the highest mercury (3.31 ppm) and silver (8.0 ppm) concentrations were found in the 80- 90 cm sample depth.

In an effort to better understand the historic distribution of contaminants at this site radionuclide dating techniques were employed. These results are presented in Figure 2-2.

Figure 2-2. Chronology of Trace Metals Deposition in Sediments Upstream of The Burt Dam
Station No. 6C



The cesium dating results presented in Figure 2-2 show the maximum copper and lead concentrations at Station No. 6C occur in sediments deposited sometime between the middle 1950's and early 1960's (70- 80 cm subsample). Recent trace metal concentrations, as measured in the surface sediments, are considerably lower than the buried, peak concentrations.

Maximum trace metals concentrations at Station No. 6E (with the exception of nickel) were found in the deepest subsample (56- 74 cm) collected there. The highest concentrations observed at this site were similar to the maximum concentrations reported at Station No. 6C.

Peak trace metals concentrations observed further upstream in the Burt Dam depositional pool (Station No. 6F) were generally found closer to the surface (28- 52 cm). The nickel (997 ppm) and zinc (15,100 ppm) concentrations observed at this site were the highest measured during this study. The source of these metals is unknown.

It is unknown why the maximum concentrations observed at Station No. 6F were found closer to the surface (28-52 cm subsample). One hypothesis is that the net depositional rate at this site is lower, due to its location in the shallower, faster moving waters at the upstream end of the depositional pool created by the Burt Dam.

Station Nos.7ABC, 7A, 7B and 7C were located within the depositional pool upstream of the Newfane Dam. Although the highest concentrations of several metals were found further downstream, in the Burt Dam pool, very high concentrations of several trace metals were encountered at these sites. Trace metals of particular concern include cadmium (9.5 ppm), chromium (798 ppm), copper (1,330), lead (2,840 ppm), mercury (10.1 ppm), nickel (178 ppm), silver (4.6 ppm[1]) and zinc (8,640 ppm). All of these metals exceeded their respective SEL concentrations (see Figure 2-1 for SEL values).

Radiodating of a sediment core from the Newfane Dam pool (Station No. 7C) was also performed ***(complete radiodating results are presented in Appendix H).*** Peak cesium-137 concentrations occurred in the 20-24 cm section and correspond to the middle 1960s. As discussed previously, peak metals concentrations in the core collected further downstream, in the Burt Dam pool (Station No. 6C) generally correspond with the period from the middle 1950s to the middle 1960s (see Figure 2-2). It is hypothesized that, if the source of these metals is upstream of both dams, peak metals in the Station No. 7C core (Newfane Dam) would correspond to the same period (middle 1950s to middle 1960s). If this hypothesis is correct, peak cadmium, chromium, copper, lead, nickel, silver and zinc at Station No. 7C would be expected to occur in the 20-32 cm depth and not in the 0-20 cm depth as shown in Figures 2-1C, D, E, G, J, K and L, respectively. Unfortunately, sediments from the 20-32 cm depth at Station No. 7C were not evaluated separately but included in the 20-70 cm core sample. Collection and finer subsectioning of a core from Station No.7C would be necessary to determine the depth of peak metals concentrations.

High-resolution total and monomethyl mercury was evaluated during this study by the Brooks Rand Ltd. laboratory. These results are shown in figures 2-1H and 2-1I, respectively. Monomethyl mercury was evaluated due to its high bioaccumulative potential in fish. The highest mercury concentration observed during this study (10.1 ppm) was measured at Station No. 7A (Newfane Dam pool). It should be noted, however, this concentration occurred in the deepest subsample (90- 104 cm) at that site. The maximum concentration of monomethyl mercury (10.1 ppb) was observed at Station No. 6E (Burt Dam pool, 56- 74 cm.).

The highest concentrations of several metals in the Newfane Dam pool occurred at the upstream end of the pool. This observation was made for the following metals, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc. With the exception of mercury, peak concentrations were found in the near-surface subsample (0-20 cm) at Station No. 7A.

Trace metals concentrations were generally lower at sampling sites located upstream of the Burt and Newfane Dam depositional pools. Although lower, trace metals exceeding their respective SEL concentrations included copper (Station No. 12), lead (Station Nos. 8A, 11 and 12), silver (Station No. 12) and zinc (Station Nos. 8A, 11 and 12).

[1] -Parameter was between IDL and contract required detection limit.

Chapter 3 - Pesticides

Organochlorine pesticides were evaluated using high resolution, GC/MS methods.

Many samples were found to have pesticide concentrations greater than their Persaud LEL guidance values (Persaud et al. 1993).

Several pesticides, including DDT and its metabolites, chlordane, dieldrin and mirex were measured at concentrations greater than their respective LEL guidance values. Sample concentrations that exceeded their detection limits, along with their respective guidance values are summarized in Table 3-1. None of the pesticides evaluated exceeded their SEL values (Persaud et al. 1993). Complete results of all pesticides analyzed are presented in Appendix C.

Sediment guidance values used are *the Ontario Ministry of the Environment and Energy's Guidelines for the Protection and Management of Aquatic Sediments* (Persaud et al. 1993). The Persaud guidance values define the Lowest Effect Level (LEL) and Severe Effect Level (SEL) of contaminants to benthic organisms. The SEL values are calculated using the sample's organic carbon content.

Of the few pesticides shown in Table 3-1, DDT and its metabolites exceeded their LEL guidance value (Persaud et al., 1993) most often. These data are presented graphically in Figure 3-1.

It can be seen, upon review of Figure 3-1, that the highest concentrations of total DDT (sum of DDT + DDD + DDE) occur in the depositional pool created by the Burt Dam (Station Nos. 6C, E and F). Additionally, the highest total DDT concentrations at these sites are found in the deeper sediments. This suggests the total DDT at these sites is reflective of historic contamination and is not the result of a recent application. This hypothesis is supported by the radiodating results from the sediment core collected at Station No. 6C (see figure 2-2). These results show sediments in the 70- 80 cm sample were deposited in the early 1960's or earlier. The high ratios of DDD (36 ppb) and DDE (33.7 ppb) to total DDT (72.4 ppb) at Station No. 6C (70- 80 cm depth) also suggest this sample may be reflective of a metabolized or old DDT application.

Mirex results have also been presented graphically (Figure 3-2) to illustrate the elevated concentration encountered in the surficial sediments at Station No. 9 (380 ppb). Although this concentration exceeds the Persaud (1993) LEL guidance value (7 ppb), it is below the SEL guidance value (2,067 ppb). Mirex, a chlorinated pesticide used in the control of fire ants, was banned by the USEPA in 1976. It was also marketed, under the trade name Dechlorane, as a flame retardant and plasticizer and may have been used in the plastics, paint and textile industries (Hetling, 1978). It is recommended that additional, limited sampling be performed at this location to further define the spatial and temporal extent of the mirex contamination there.

Chlordane and dieldrin were also found at concentrations exceeding their LEL guidance values, but only at a small number of locations.

With the exceptions of the DDT, chlordane and mirex, which were found in the surface and near-surface sediments at Station Nos. 9 and 12, most of the pesticides exceeding their LEL guidance values (Table 3-1) were encountered in deeper sediments. Contaminants found in deeper sediments are less biologically available and therefore, less likely to bioaccumulate.

Table 3-1. Sediment Samples Exceeding Pesticide Guidance Values

Eighteenmile Creek Sediment Study

All concentrations ppb (dry weight) unless otherwise noted

DDT and Metabolites

		----Sample Concentration----			-------------------DDT + DDD + DDE-------------------			
					Sample	Persaud Sediment Guidelines		
Station No.	**Depth(cm)**	**DDT**	**DDD**	**DDE**	**Concentration**	**LEL (7ppb)**	**SEL (12 µg/ g OC)**	**TOC(%)**
6BCEF	Surficial	1.06	3.66	5.499	10.22	7	724	6.03
6C	0-10	1.56	2.59	4.465	8.62	7	163	1.36
6C	30-40	2.58	2.23	6.19	11	7	503	4.19
6C	40-50	0.53	1.69	6.39	8.61	7	1,093	9.11
6C	50-60	0.78	1.8	7.51	10.09	7	1,153	9.61
6C	60-70	2.8	10.5	19.73	33.03	7	1,042	8.68
6C	70-80	2.7	36	33.7	72.4	7	583	4.86
6C	80-90	6.7	13.4	38.9	59	7	1,162	9.68
6C	90-99	1.2	5.4	23.2	29.8	7	418	3.48
6E	0-26	0.74	2.75	4.5	7.99	7	1,752	14.6
6E	26-40	0.98	2.15	6.5	9.63	7	799	6.66
6E	40-56	1.69	8.4	12.47	22.56	7	684	5.7
6E	56-74	2.5	72	41.7	116.2	7	182	1.52
6F	0-10	4.32	4.6	5.71	14.63	7	226	1.88
6F	28-52	1.9	34.7	37.3	73.9	7	604	5.03
7ABC	Surficial	0.96	3.78	4.178	8.92	7	851	7.09
7A	0-20	1.21	7.7	14.68	23.59	7	542	4.52
7A	20-50	0.39	2.24	7.72	10.35	7	314	2.62
7B	0-20	0.98	6.3	7.56	14.84	7	136	1.13
7B	20-58	0.8	7.2	8.18	16.18	7	253	2.11
7C	0-20	0.89	4.3	5.59	10.78	7	251	2.09
8A	20-30	8.45	3.21	2.95	14.61	7	475	3.96
8A	30-40	0.32	4.9	6.8	12.02	7	337	2.81
8A	90-94	0.56	2.35	12.63	15.54	7	1,464	12.2
9	Surficial	3.41	2.27	3.12	8.8	7	191	1.59
12	0-18	24.3	27.9	9.35	61.55	7	157	1.31
12	18-27	3.5	16.3	5.34	25.14	7	456	3.8

Chlordane

		Sample		Persaud Guidelines	
Station No.	Depth(cm)	Concentration	TOC(%)	LEL	SEL (6 µg/ g OC)
6C	60-70	8.25	8.68	7	520.8
6C	70-80	20.4	4.86	7	291.6
6E	56-74	19.7	1.52	7	91.2
6F	28-52	10.6	5.03	7	301.8
9	Surficial	34.18	1.59	7	95.4

Dieldrin

		Sample		Persaud Guidelines	
Station No.	Depth(cm)	Concentration	TOC(%)	LEL	SEL (91 µg/ g OC)
6C	60-70	7.6	8.68	2	7,899
6C	70-80	36	4.86	2	4,423
6E	40-56	14	5.7	2	5,187
6E	56-74	68	1.52	2	1,383
6F	28-52	8.6	5.03	2	4,577

Mirex

		Sample		Persaud Guidelines	
Station No.	Depth(cm)	Concentration	TOC(%)	LEL	SEL (130 µg/ g OC)
9	Surficial	380	1.59	7	2,067

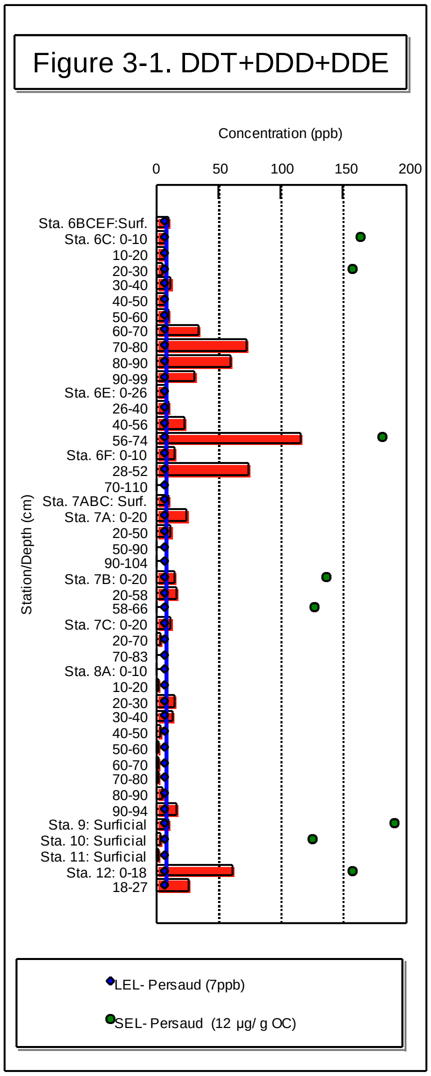


Figure 3-1. DDT+DDD+DDE
Concentration (ppb)
0
50
100
150
200
Station/Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
28-52
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
LEL- Persaud (7ppb)
SEL- Persaud (12 µg/ g OC)

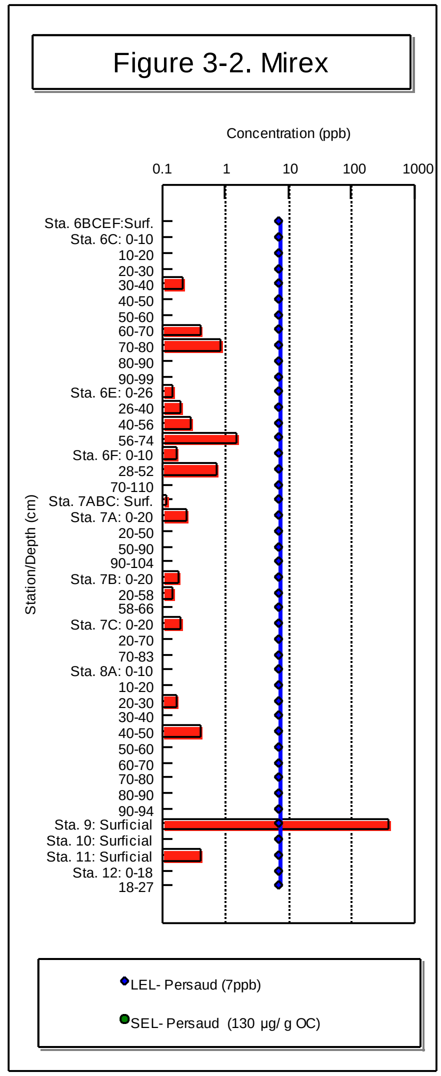


Figure 3-2. Mirex
Concentration (ppb)
0.1
1
10
100
1000
Station/Depth (cm)
Sta. 6BCEF:Surf.
Sta. 6C: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-99
Sta. 6E: 0-26
26-40
40-56
56-74
Sta. 6F: 0-10
28-52
70-110
Sta. 7ABC: Surf.
Sta. 7A: 0-20
20-50
50-90
90-104
Sta. 7B: 0-20
20-58
58-66
Sta. 7C: 0-20
20-70
70-83
Sta. 8A: 0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-94
Sta. 9: Surficial
Sta. 10: Surficial
Sta. 11: Surficial
Sta. 12: 0-18
18-27
LEL- Persaud (7ppb)
SEL- Persaud (130 µg/ g OC)

Chapter 4 - Polychlorinated Biphenyls

The PCB results were evaluated using two independent sediment assessment protocols, which are presented in Table 4-1. One set of assessment values were developed within the New York State Department of Environmental Conservation (Division of Fish and Wildlife) and are documented in a 1999 publication, Technical Guidance for Screening Contaminated Sediments (1999a). 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 protocol 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 5^{th} (lowest-effect) and 95^{th} (severe-effect) percentiles of the database. The severe effect guidance is a function of organic carbon concentration.

Analytical summaries along with guidance values are presented in Table 4-1. Complete analytical results are shown in Appendix D.

Forty-four of the forty-six analytical results exceed NYSDEC's (1999a) human bioaccumulation guidance values. The majority of these results (37) also exceed NYSDEC's (1999a) wildlife bioaccumulation guidance values and Persaud's No- (39) and Low- (37) Effects Levels. This is not surprising since these guidance values are low enough that most measurable quantities of PCBs are likely to exceed one or several of these guidance values. Additionally, the upper sub-sample (0-18 cm) collected at Station No. 12 (Eighteenmile Creek diversion channel below the Williams St. Dump) had a PCB concentration (24.93 ppm) that exceeded Persaud's Severe-Effect Level (6.94 ppm).

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

Eighteenmile Creek Sediment Study

All concentrations ppm dry weight basis, unless otherwise noted

Station No.	Location	Sample Depth (cm)	Analytical Results (Sum of Congeners)	TOC(%)	NYSDEC Technical Bioaccumulation Guidance (1) Human (0.0008 µg/gOC)	NYSDEC Technical Bioaccumulation Guidance (1) Wildlife (1.4 µg/gOC)	Persaud's Provisional Sediment Guidlines (2) NEL (0.01 ppm)	Persaud's Provisional Sediment Guidlines (2) LEL (0.07 ppm)	Persaud's Provisional Sediment Guidlines (2) SEL (530 µg/ gOC)
6BCEF	Eighteenmile Ck., Burt Dam	Surficial	0.68	6.03	0.000048	0.0844	0.01	0.07	31.96
6C	Eighteenmile Ck., Burt Dam	0-10	0.42	1.36	0.000011	0.0190	0.01	0.07	7.21
6C	Eighteenmile Ck., Burt Dam	10-20	0.32	4.23	0.000034	0.0592	0.01	0.07	22.42
6C	Eighteenmile Ck., Burt Dam	20-30	0.92	1.31	0.000010	0.0183	0.01	0.07	6.94
6C	Eighteenmile Ck., Burt Dam	30-40	1.32	4.19	0.000034	0.0587	0.01	0.07	22.21
6C	Eighteenmile Ck., Burt Dam	40-50	2.01	9.11	0.000073	0.1275	0.01	0.07	48.28
6C	Eighteenmile Ck., Burt Dam	50-60	1.96	9.61	0.000077	0.1345	0.01	0.07	50.93
6C	Eighteenmile Ck., Burt Dam	60-70	10.61	8.68	0.000069	0.1215	0.01	0.07	46.00
6C	Eighteenmile Ck., Burt Dam	70-80	12.56	4.86	0.000039	0.0680	0.01	0.07	25.76
6C	Eighteenmile Ck., Burt Dam	80-90	1.67	9.68	0.000077	0.1355	0.01	0.07	51.30
6C	Eighteenmile Ck., Burt Dam	90-99	1.25	3.48	0.000028	0.0487	0.01	0.07	18.44
6E	Eighteenmile Ck., Burt Dam	0-26	1.06	14.6	0.000117	0.2044	0.01	0.07	77.38
6E	Eighteenmile Ck., Burt Dam	26-40	1.88	6.66	0.000053	0.0932	0.01	0.07	35.30
6E	Eighteenmile Ck., Burt Dam	40-56	10.28	5.7	0.000046	0.0798	0.01	0.07	30.21
6E	Eighteenmile Ck., Burt Dam	56-74	6.74	1.52	0.000012	0.0213	0.01	0.07	8.06
6F	Eighteenmile Ck., Burt Dam	0-10	1.12	1.88	0.000015	0.0263	0.01	0.07	9.96
6F	Eighteenmile Ck., Burt Dam	10-28	3.03	6.57	0.000053	0.0920	0.01	0.07	34.82
6F	Eighteenmile Ck., Burt Dam	28-52	25.85	5.03	0.000040	0.0704	0.01	0.07	26.66
6F	Eighteenmile Ck., Burt Dam	52-70	0.03	2.78	0.000022	0.0389	0.01	0.07	14.73
6F	Eighteenmile Ck., Burt Dam	70-110	0.0001	7.09	0.000057	0.0993	0.01	0.07	37.58

Table 4-1. Sediment Results and Selected Guidance Values for Characterizing PCB Concentrations in Sediments, cont.

Eighteenmile Creek Sediment Study

All concentrations ppm dry weight basis, unless otherwise noted

					NYSDEC Technical Bioaccumulation Guidance (1)		Persaud's Provisional Sediment Guidlines (2)		
Station No.	Location	Sample Depth (cm)	Analytical Results (Sum of Congeners)	TOC(%)	Human (0.0008 µg/gOC)	Wildlife (1.4 µg/gOC)	NEL (0.01 ppm)	LEL (0.07 ppm)	SEL (530 µg/ gOC)
7ABC	Eighteenmile Ck., Newfane Dam	Surficial	0.12	7.09	0.000057	0.0993	0.01	0.07	37.58
7A	Eighteenmile Ck., Newfane Dam	0-20	0.25	4.52	0.000036	0.0633	0.01	0.07	23.96
7A	Eighteenmile Ck., Newfane Dam	20-50	0.24	2.62	0.000021	0.0367	0.01	0.07	13.89
7A	Eighteenmile Ck., Newfane Dam	50-90	0.002	2.12	0.000017	0.0297	0.01	0.07	11.24
7A	Eighteenmile Ck., Newfane Dam	90-104	ND	4.11	0.000033	0.0575	0.01	0.07	21.78
7B	Eighteenmile Ck., Newfane Dam	0-20	0.14	1.13	0.000009	0.0158	0.01	0.07	5.99
7B	Eighteenmile Ck., Newfane Dam	20-58	0.27	2.11	0.000017	0.0295	0.01	0.07	11.18
7B	Eighteenmile Ck., Newfane Dam	58-66	ND	1.06	0.000008	0.0148	0.01	0.07	5.62
7C	Eighteenmile Ck., Newfane Dam	0-20	0.42	2.09	0.000017	0.0293	0.01	0.07	11.08
7C	Eighteenmile Ck., Newfane Dam	20-70	0.001	2.8	0.000022	0.0392	0.01	0.07	14.84
7C	Eighteenmile Ck., Newfane Dam	70-83	0.004	2.14	0.000017	0.0300	0.01	0.07	11.34
8A	Erie Barge Canal, Lockport	0-10	0.12	3.22	0.000026	0.0451	0.01	0.07	17.07
8A	Erie Barge Canal, Lockport	10-20	0.37	2.33	0.000019	0.0326	0.01	0.07	12.35
8A	Erie Barge Canal, Lockport	20-30	5.33	3.96	0.000032	0.0554	0.01	0.07	20.99
8A	Erie Barge Canal, Lockport	30-40	3.15	2.81	0.000022	0.0393	0.01	0.07	14.89
8A	Erie Barge Canal, Lockport	40-50	0.56	6.83	0.000055	0.0956	0.01	0.07	36.20
8A	Erie Barge Canal, Lockport	50-60	0.56	6.87	0.000055	0.0962	0.01	0.07	36.41
8A	Erie Barge Canal, Lockport	60-70	0.24	4.42	0.000035	0.0619	0.01	0.07	23.43
8A	Erie Barge Canal, Lockport	70-80	0.32	9.31	0.000074	0.1303	0.01	0.07	49.34
8A	Erie Barge Canal, Lockport	80-90	1.10	5.62	0.000045	0.0787	0.01	0.07	29.79

Table 4-1. Sediment Results and Selected Guidance Values for Characterizing PCB Concentrations in Sediments, cont.

Eighteenmile Creek Sediment Study

All concentrations ppm dry weight basis, unless otherwise noted

Station No.	Location	Sample Depth (cm)	Analytical Results (Sum of Congeners)	TOC(%)	NYSDEC Technical Bioaccumulation Guidance (1) Human (0.0008 µg/gOC)	NYSDEC Technical Bioaccumulation Guidance (1) Wildlife (1.4 µg/gOC)	Persaud's Provisional Sediment Guidlines (2) NEL (0.01 ppm)	Persaud's Provisional Sediment Guidlines (2) LEL (0.07 ppm)	Persaud's Provisional Sediment Guidlines (2) SEL (530 µg/ gOC)
8A	Erie Barge Canal, Lockport	90-94	3.22	12.2	0.000098	0.1708	0.01	0.07	64.66
9	Eighteenmile Ck., Upstrm. of Canal	Surficial	0.02	1.59	0.000013	0.0223	0.01	0.07	8.43
10	Eighteenmile Ck., East Branch	Surficial	0.0001	1.04	0.000008	0.0146	0.01	0.07	5.51
11	The Gulf	Surficial	0.20	3.45	0.000028	0.0483	0.01	0.07	18.29
12	Eighteenmile Ck., Diversion Channel	0-18	24.93	1.31	0.000010	0.0183	0.01	0.07	6.94
12	Eighteenmile Ck., Diversion Channel	18-27	9.55	3.8	0.000030	0.0532	0.01	0.07	20.14

(1)- (NYSDEC 1999a) (2)- (Persaud 1993)

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

Chapter 5 - Dioxins/Furans

EPA method 1613B, dioxin/furan analysis, produces fifteen 2,3,7,8-substituted congener and ten tetra- through octa- homolog results. The results of these analyses are presented in Table 5-1.

Qualitative Evaluation

One process for evaluating dioxin and furan concentrations uses a qualitative approach. For this report, based on analytical results of well over 200 sediment samples collected by NYSDEC from throughout New York State, the tetra through octa dioxin homolog totals are considered to be low or background levels if less than 500 ppt. An average level would be greater than 500 and less than 2,500 ppt. Elevated levels would be greater than 2,500 ppt. For the furan tetra through octa homolog totals, less than 100 ppt would be low or background. From greater than 100 ppt to less than 750 ppt, the level would be average. Elevated levels would be greater than 750 ppt. These levels were determined using the NYSDEC Division of Water's existing database and dividing the database into thirds. The homolog totals representing the highest one-third of the database are designated as elevated, those totals representing the middle one-third are designated average, and the lowest one-third are designated as low or background.

Elevated levels of the dioxin homolog totals were observed in 34 of the 46 samples collected. For the remaining 12 samples, average concentrations were identified in five samples while seven samples had low levels of dioxins.

Elevated levels of the furan homolog totals were observed in 36 of the 46 samples submitted for chemical analysis. The remaining 10 samples were equally divided between average and low concentrations. See Table 5-1 for specific information.

Toxic Equivalency

Another process for assessing the toxicity of the measured concentration of dioxin and furan in a particular sample is the toxic equivalency. This methodology quantifies the toxicity of 2,3,7,8-substituted dioxin and furan congeners by proportioning their toxicities to 2,3,7,8-TCDD. These individual values can then be summed to represent the total Toxic Equivalency Quotient (TEQ) representing the overall toxicity of the various 2,3,7,8-congeners. The toxic equivalency factors used for comparing TEQs to the NYSDEC Water Quality Criteria are the International Toxicity Equivalency Factors [ITEFs (Ahlborg 1994)]. The ITEFs are used by the USEPA and the New York State Departments of Health and Environmental Conservation (Water Quality Regulations for Surface and Groundwater). For this report, all comparisons to criteria, standards, and TEQ percent abundance graphs use the 1994 ITEFs (Ahlborg).

Calculated TEQs were then compared (see Table 5-1) to human health and wildlife bioaccumulation sediment guidance values presented in the DEC publication Technical Guidance for Screening Contaminated Sediments (NYSDEC 1999a). These guidance values are based on equilibrium partitioning methodology and are a function of the organic carbon content of the sediment being evaluated.

Table 5-1. Dioxin/Furan Data

Eighteenmile Creek Sediment Study

All concentrations ppt, dry weight

Station / **Sample Depth(cm)**	**6BCEF** Surficial	**6C** 0-10	**6C** 10-20	**6C** 20-30	**6C** 30-40	**6C** 40-50	**6C** 50-60	**6C** 60-70	**6C** 70-80	**6C** 80-90	**6C** 90-99
Analyte											
2,3,7,8-TCDD	1.1	ND	1.1	1.1	1.7	3	3.9	ND	10	ND	ND
1,2,3,7,8-PeCDD	ND	ND	ND	ND	ND	ND	6.6	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND	ND	9	10	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	15	19	19	27	47	64	65	120	320	510	360
1,2,3,7,8,9-HxCDD	5.2	6.8	5.9	9.9	15	22	24	ND	94	100	63
1,2,3,4,6,7,8-HpCDD	340	450	410	610	820	1200	1300	2300	6300	8600	6900
2,3,7,8-TCDF	7.2 g	7.9 g	7.6 g	12 g	16 g	29 g	39 g	90 g	80 g	17 g	16 g
1,2,3,7,8-PeCDF	ND	ND	ND	7.2	10	24	44	62	ND	ND	ND
2,3,4,7,8-PeCDF	ND	ND	ND	6.8	10	22	43	73	ND	ND	ND
1,2,3,4,7,8-HxCDF	28	34	39	65	85	250	550	1100	610	120	170
1,2,3,6,7,8-HxCDF	11	14	15	26	41	99	200	320	170	99	110
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND	8.2	16	31	52	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	220	300	310	520	600	1500	3100 D	5300	3500	4300	4400
1,2,3,4,7,8,9-HpCDF	9.3	12	12	21	29	53	82	130	140	230	180
TCDDs (total)	23	20	24	24	32	71	110	150	110	50	38
PeCDDs (total)	15	14	13	5.4	8.2	34	58	ND	ND	ND	ND
HxCDDs (total)	120	140	130	200	300	420	440	650	1700	2700	1900
HpCDDs (total)	740	970	890	1400	1800	2500	2700	4400	13000	21000	16000
OCDD	4400 D	6900 D	6500 D	9800 D	12000 D	18000 D	20000 D	23000	83000 D	84000 D	79000 D
TCDFs (total)	100	100	100	140	190	290	410	640	860	140	180
PeCDFs (total)	35	35	38	74	140	290	570	770	460	350	370
HxCDFs (total)	170	230	210	310	480	960	1800	3000	2700	4600	3800
HpCDFs (total)	570	980	720	1100	1400	1600	4200	7500	9000	18000	15000
OCDF	450	610	590	1000	1500	2900	4000	5600	6200	8900	7900
Data Summary(1)											
Tetra thru Octa Homolog Totals											
Dioxin Homologs	5,298	8,044	7,557	11,429	14,140	21,025	23,308	28,200	97,810	107,750	96,938
Furan Homologs	1,325	1,955	1,658	2,624	3,710	6,040	10,980	17,510	19,220	31,990	27,250
Sum	6,623	9,999	9,215	14,053	17,850	27,065	34,288	45,710	117,030	139,740	124,188
2,3,7,8-TCDD Toxic Equivalence(2)	18.3	15.6	16.9	30.2	42.8	91.6	167.7	228.7	318.0	223.1	193.0
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)											
Human Bioaccumulation(sc=10,000 pg/gOC)	603	136	423	131	419	911	961	868	486	968	348
Wildlife Bioaccumulation(sc=200 pg/gOC)	12.1	2.7	8.5	2.6	8.4	18.2	19.2	17.4	9.7	19.4	7.0
Total Organic Carbon(%)	6.03	1.36	4.23	1.31	4.19	9.11	9.61	8.68	4.86	9.68	3.48

--- Low Concentration: Dioxins (<500 ppt), Furans (<100 ppt)
--- Average Concentration: Dioxins (500 to 2500 ppt), Furans (100 to 750 ppt)
--- Elevated Concentration: Dioxins (>2,500 ppt), Furans (>750 ppt)

--- Exceeds NYSDEC DFW Wildlife Bioaccumulation Criteria
--- Exceeds NYSDEC DFW Human Bioaccumulation Criteria

Notes:

(1) Only results greater than laboratory reporting limits used in data summary.

(2) WHO human intake TEFs as reported in Ahlborg, U.G, et al, Chemosphere 28: 1049-1067 (1994)

(3) NYSDEC Division of Fish and Wildlife

D- compound quantitated using a secondary dilution, g- 2,3,7,8-TCDF results confirmed on a DB-225 column

Table 5-1. Dioxin/Furan Data, cont.
Eighteenmile Creek Sediment Study

All concentrations ppt, dry weight

Analyte \ Station / Sample Depth(cm)	6E 0-26	6E 26-40	6E 40-56	6E 56-74	6F 0-10	6F 10-28	6F 28-52	6F 52-70	6F 70-110
2,3,7,8-TCDD	1	ND	10	ND	ND	1.6	ND	ND	ND
1,2,3,7,8-PeCDD	ND	ND	50	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	34	54	150	330	18	30	190	33	ND
1,2,3,7,8,9-HxCDD	9.1	ND	ND	87	ND	8.8	64	9.2	ND
1,2,3,4,6,7,8-HpCDD	710	1000	2700	6800	450	580	4300	660	9.5
2,3,7,8-TCDF	18 g	37 g	140 g	42 g	7.5 g	17 g	25 g	6.3 g	5 g
1,2,3,7,8-PeCDF	5.9	ND	78	ND	ND	7.8	ND	ND	ND
2,3,4,7,8-PeCDF	5.9	ND	100	ND	ND	9.2	ND	ND	ND
1,2,3,4,7,8-HxCDF	50	350	1500	230	27	77	50	10	ND
1,2,3,6,7,8-HxCDF	19	120	420	86	9.3	30	ND	9	ND
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	ND	70	ND	ND	6.6	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	420	1700	7100	3000	270	530	1100	310	ND
1,2,3,4,7,8,9-HpCDF	18	51	160	150	11	18	85	22	ND
TCDDs (total)	24	63	230	54	13	31	18	6.4	1.2
PeCDDs (total)	ND	ND	52	ND	ND	5.7	ND	21	ND
HxCDDs (total)	210	320	780	1700	110	180	1000	260	ND
HpCDDs (total)	1600	2100	5300	14000	990	1200	9200	1600	24
OCDD	11000 D	13000	27000	78000 D	6200 D	8400 D	55000 D	7300 D	300
TCDFs (total)	150	280	950	300	93	160	170	54	39
PeCDFs (total)	58	200	1300	290	28	110	83	52	5.8
HxCDFs (total)	290	1000	4200	2700	180	370	1100	360	ND
HpCDFs (total)	1100	2700	9600	11000	740	1100	4900	1300	ND
OCDF	1000	2400	7100	7300	640	860	3500 D	870	ND

Data Summary(1)

Tetra thru Octa Homolog Totals	6E 0-26	6E 26-40	6E 40-56	6E 56-74	6F 0-10	6F 10-28	6F 28-52	6F 52-70	6F 70-110
Dioxin Homologs	12,834	15,483	33,362	93,754	7,313	9,817	65,218	9,187	325
Furan Homologs	2,598	6,580	23,150	21,590	1,681	2,600	9,753	2,636	45
Sum	15,432	22,063	56,512	115,344	8,994	12,417	74,971	11,823	370
2,3,7,8-TCDD Toxic Equivalence(2)	40.7	82.3	436.6	258.1	13.4	34.0	88.8	16.0	0.1
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)									
Human Bioaccumulation(sc=10,000 pg/gOC)	1,460	666	570	152	188	657	503	278	709
Wildlife Bioaccumulation(sc=200 pg/gOC)	29.2	13.3	11.4	3.0	3.8	13.1	10.1	5.6	14.2
Total Organic Carbon(%)	14.6	6.66	5.7	1.52	1.88	6.57	5.03	2.78	7.09

--- Low Concentration: Dioxins (<500 ppt), Furans (<100 ppt)
--- Average Concentration: Dioxins (500 to 2500 ppt), Furans (100 to 750 ppt)
--- Elevated Concentration: Dioxins (>2,500 ppt), Furans (>750 ppt)

--- Exceeds NYSDEC DFW Wildlife Bioaccumulation Criteria
--- Exceeds NYSDEC DFW Human Bioaccumulation Criteria

Notes: (1) Only results greater than laboratory reporting limits used in data summary.

(2) WHO human intake TEFs as reported in Ahlborg, U.G, et al, Chemosphere 28: 1049-1067 (1994)

(3) NYSDEC Division of Fish and Wildlife

D- compound quantitated using a secondary dilution, g- 2,3,7,8-TCDF results confirmed on a DB-225 column

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

Eighteenmile Creek Sediment Study

All concentrations ppt, dry weight

Station	7ABC	7A	7A	7A	7A	7B	7B	7B	7C	7C	7C
Sample Depth(cm)	Surficial	0-20	20-50	50-90	90-104	0-20	20-58	58-66	0-20	20-70	70-83
Analyte											
2,3,7,8-TCDD	ND	2.2	7.2	ND	ND	1.2	ND	ND	3.6	ND	ND
1,2,3,7,8-PeCDD	ND	ND	7.5	ND	ND	ND	ND	ND	5.4	ND	ND
1,2,3,4,7,8-HxCDD	ND	5.9	35	ND	ND	ND	ND	ND	12	ND	ND
1,2,3,6,7,8-HxCDD	28	65	380	ND	11	30	15	ND	120	ND	ND
1,2,3,7,8,9-HxCDD	8.1	22	62	ND	ND	9.6	ND	ND	35	ND	ND
1,2,3,4,6,7,8-HpCDD	690	1300	8100 D	10	240	700	300	5.5	2500 D	6.8	7.2
2,3,7,8-TCDF	9.2 g	16 g	18 g	17 g	4.8 g	9.3 g	7.8 g	ND	19 g	8.1 g	18 g
1,2,3,7,8-PeCDF	5.3	10	9.8	6.9	ND	5.9	ND	ND	11	ND	6.3
2,3,4,7,8-PeCDF	6.5	11	11	6	ND	6.9	ND	ND	13	ND	ND
1,2,3,4,7,8-HxCDF	49	98	110	7.5	6.2	51	28	ND	98	ND	ND
1,2,3,6,7,8-HxCDF	17	31	64	ND	ND	17	8.9	ND	37	ND	ND
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	8.4	20	ND	ND	ND	ND	ND	9.3	ND	ND
1,2,3,4,6,7,8-HpCDF	460	720	3600 D	9.7	82	440	210	ND	1100	5.2	ND
1,2,3,4,7,8,9-HpCDF	16	32	230	ND	5.5	18	7.6	ND	44	ND	ND
TCDDs (total)	21	33	50	2.7	1.6	24	11	ND	39	ND	ND
PeCDDs (total)	ND	5.3	100	ND	ND	ND	80	ND	35	ND	ND
HxCDDs (total)	170	430	2100	8.4	74	180	80	ND	830	ND	ND
HpCDDs (total)	1600	2900	20000	25	560	1500	660	13	5400	16	17
OCDD	10000 D	21000 D	120000 D	450	3500	11000 D	5000 D	460	36000 D	170	290
TCDFs (total)	100	190	170	88	42	94	52	ND	160	33	49
PeCDFs (total)	76	180	440	31	16	82	32	ND	200	5.7	14
HxCDFs (total)	260	520	3700	13	71	280	140	ND	860	ND	ND
HpCDFs (total)	1200	1900	15000 D	9.7	320	1100	470	ND	3300	5.2	ND
OCDF	760	1700	15000 D	11	200	790	320	ND	2500 D	ND	ND
Data Summary(1)											
Tetra thru Octa Homolog Totals											
Dioxin Homologs	11,791	24,368	142,250	486	4,136	12,704	5,751	473	42,304	186	307
Furan Homologs	2,396	4,490	34,310	153	649	2,346	1,014	0	7,020	44	63
Sum	14,187	28,858	176,560	639	4,785	15,050	6,765	473	49,324	230	370
2,3,7,8-TCDD Toxic Equivalence(2)	37.1	53.5	218.3	4.1	8.7	39.1	10.7	0.1	121.3	0.1	0.7
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)											
Human Bioaccumulation(sc=10,000 pg/gOC)	709	452	262	212	411	113	211	106	209	280	214
Wildlife Bioaccumulation(sc=200 pg/gOC)	14.2	9.0	5.2	4.2	8.2	2.3	4.2	2.1	4.2	5.6	4.3
Total Organic Carbon(%)	7.09	4.52	2.62	2.12	4.11	1.13	2.11	1.06	2.09	2.8	2.14

Notes:

(1) Only results greater than laboratory reporting limits used in data summary.

(2) WHO human intake TEFs as reported in Ahlborg, U.G, et al, Chemosphere 28: 1049-1067 (1994)

(3) NYSDEC Division of Fish and Wildlife

D- compound quantitated using a secondary dilution, g- 2,3,7,8-TCDF results confirmed on a DB-225 column

--- Low Concentration: Dioxins (<500 ppt), Furans (<100 ppt)

--- Average Concentration: Dioxins (500 to 2500 ppt), Furans (100 to 750 ppt)

--- Elevated Concentration: Dioxins (>2,500 ppt), Furans (>750 ppt)

--- Exceeds NYSDEC DFW Wildlife Bioaccumulation Criteria

--- Exceeds NYSDEC DFW Human Bioaccumulation Criteria

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

Eighteenmile Creek Sediment Study

All concentrations ppt, dry weight

Analyte	Station: 8A Sample Depth(cm): 0-10	8A 10-20	8A 20-30	8A 30-40	8A 40-50	8A 50-60	8A 60-70	8A 70-80	8A 80-90	8A 90-94
2,3,7,8-TCDD	ND	1	4.6	9.2	2.3	ND	ND	1.2	5	6.6
1,2,3,7,8-PeCDD	ND	ND	ND	7.6	5	ND	ND	ND	5	5.4
1,2,3,4,7,8-HxCDD	ND	ND	ND	9.5	5	ND	ND	ND	8	7.7
1,2,3,6,7,8-HxCDD	ND	5.3	12	47	14	ND	6.1	9.2	59	61
1,2,3,7,8,9-HxCDD	ND	ND	8.1	25	9.1	ND	5	6	22	26
1,2,3,4,6,7,8-HpCDD	33	120	250	1100 D	310	70	140	200	1400 D	1500
2,3,7,8-TCDF	1.7 g	4.3 g	8.8 g	22 g	6.2 g	4.4 g	4 g	5 g	12 g	13 g
1,2,3,7,8-PeCDF	ND	25	14	37	12	ND	ND	5.4	22	16
2,3,4,7,8-PeCDF	ND	7.8	34	64	18	6.9	ND	7.8	29	25
1,2,3,4,7,8-HxCDF	6.8	62	130	550	240	72	50	81	410	220
1,2,3,6,7,8-HxCDF	ND	36	34	130	58	19	13	22	98	59
1,2,3,7,8,9-HxCDF	ND	26	ND	ND	5	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	ND	ND	ND	25	11	ND	ND	ND	17	13
1,2,3,4,6,7,8-HpCDF	24	170	440	2400 D	1100	290	240	410	2000 D	1200
1,2,3,4,7,8,9-HpCDF	ND	91	22	61 D	26	7.8	7	11	49 Dj	32
TCDDs (total)	12	20	37	110	40	16	16	25	74	61
PeCDDs (total)	ND	ND	ND	39	14	ND	6.6	ND	28	26
HxCDDs (total)	13	49	160	590	140	38	56	75	420	1400
HpCDDs (total)	76	260	630	2600	700	160	300	430	3200	3400
OCDD	330	1300	4500	19000 D	4400 D	660	1500	2300	26000 D	30000 D
TCDFs (total)	30	86	250	560	160	80	79	100	300	320
PeCDFs (total)	16	120	350	690	230	64	41	96	410	310
HxCDFs (total)	19	220	390	1500	600	170	140	220	1200	740
HpCDFs (total)	44	390	730	3100	1400	350	320	550	3100	2200
OCDF	27	210	420	2600 D	1100	300	250	450	2300 D	1500
Data Summary(1)										
Tetra thru Octa Homolog Totals										
Dioxin Homologs	431	1,629	5,327	22,339	5,294	874	1,879	2,830	29,722	34,887
Furan Homologs	136	1,026	2,140	8,450	3,490	964	830	1,416	7,310	5,070
Sum	567	2,655	7,467	30,789	8,784	1,838	2,709	4,246	37,032	39,957
2,3,7,8-TCDD Toxic Equivalence(2)	1.8	24.4	52.8	182.7	48.6	16.5	13.0	26.2	147.3	61.3
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)										
Human Bioaccumulation(sc=10,000 pg/gOC)	322	233	396	281	683	687	442	931	562	1,220
Wildlife Bioaccumulation(sc=200 pg/gOC)	6.4	4.7	7.9	5.6	13.7	13.7	8.8	18.6	11.2	24.4
Total Organic Carbon(%)	3.22	2.33	3.96	2.81	6.83	6.87	4.42	9.31	5.62	12.2

Notes:

(1) Only results greater than laboratory reporting limits used in data summary.

(2) WHO human intake TEFs as reported in Ahlborg, U.G, et al, Chemosphere 28: 1049-1067 (1994)

(3) NYSDEC Division of Fish and Wildlife

D- compound quantitated using a secondary dilution, g- 2,3,7,8-TCDF results confirmed on a DB-225 column

--- Low Concentration: Dioxins (<500 ppt), Furans (<100 ppt)

--- Average Concentration: Dioxins (500 to 2500 ppt), Furans (100 to 750 ppt)

--- Elevated Concentration: Dioxins (>2,500 ppt), Furans (>750 ppt)

--- Exceeds NYSDEC DFW Wildlife Bioaccumulation Criteria

--- Exceeds NYSDEC DFW Human Bioaccumulation Criteria

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

Eighteenmile Creek Sediment Study

All concentrations ppt, dry weight

Analyte	9 Surficial		10 Surficial		11 Surficial		12 0-18		12 18-27	
Station / Sample Depth(cm)	9 Surficial		10 Surficial		11 Surficial		12 0-18		12 18-27	
2,3,7,8-TCDD	ND		ND		ND		1.7		ND	
1,2,3,7,8-PeCDD	ND		ND		ND		ND		ND	
1,2,3,4,7,8-HxCDD	ND		ND		ND		11		6.6	
1,2,3,6,7,8-HxCDD	ND		ND		14		110		88	
1,2,3,7,8,9-HxCDD	ND		ND		7.3		36		22	
1,2,3,4,6,7,8-HpCDD	62		19		95		3800	D	2100	D
2,3,7,8-TCDF	3.5	g	ND	g	2.4	g	10	g	12	g
1,2,3,7,8-PeCDF	ND		ND		ND		9.8		18	
2,3,4,7,8-PeCDF	ND		ND		ND		46		63	
1,2,3,4,7,8-HxCDF	ND		ND		14		130		160	
1,2,3,6,7,8-HxCDF	ND		ND		6.5		53		55	
1,2,3,7,8,9-HxCDF	ND		ND		ND		ND		ND	
2,3,4,6,7,8-HxCDF	ND		ND		ND		14		11	
1,2,3,4,6,7,8-HpCDF	21		7.6		57		2400	D	1500	
1,2,3,4,7,8,9-HpCDF	ND		ND		ND		77	D	43	
TCDDs (total)	2.2		1.3		30		16		34	
PeCDDs (total)	ND		ND		ND		ND		ND	
HxCDDs (total)	18		ND		140		600		590	
HpCDDs (total)	120		43		220		7700		4400	
OCDD	430		420		990		33000	D	32000	D
TCDFs (total)	27		4.9		46		200		370	
PeCDFs (total)	17		ND		22		350		520	
HxCDFs (total)	20		ND		53		1400		980	
HpCDFs (total)	50		17		88		6100		3700	
OCDF	46		12		57		2700	D	2200	D
Data Summary(1)										
Tetra thru Octa Homolog Totals										
Dioxin Homologs	570		464		1,380		41,316		37,024	
Furan Homologs	160		34		266		10,750		7,770	
Sum	730		498		1,646		52,066		44,794	
2,3,7,8-TCDD Toxic Equivalence(2)	1.7		0.7		6.7		159.1		66.7	
DFW Site Specific Sediment Criteria for 2,3,7,8-TCDD(3)										
Human Bioaccumulation(sc=10,000 pg/gOC)	159		104		345		131		380	
Wildlife Bioaccumulation(sc=200 pg/gOC)	3.2		2.1		6.9		2.6		7.6	
Total Organic Carbon(%)	1.59		1.04		3.45		1.31		3.8	

--- Low Concentration: Dioxins (<500 ppt), Furans (<100 ppt)
--- Average Concentration: Dioxins (500 to 2500 ppt), Furans (100 to 750 ppt)
--- Elevated Concentration: Dioxins (>2,500 ppt), Furans (>750 ppt)

--- Exceeds NYSDEC DFW Wildlife Bioaccumulation Criteria
--- Exceeds NYSDEC DFW Human Bioaccumulation Criteria

Notes: (1) Only results greater than laboratory reporting limits used in data summary.

(2) WHO human intake TEFs as reported in Ahlborg, U.G, et al, Chemosphere 28: 1049-1067 (1994)

(3) NYSDEC Division of Fish and Wildlife

D- compound quantitated using a secondary dilution, g- 2,3,7,8-TCDF results confirmed on a DB-225 column

Those TEQs that exceed the wildlife bioaccumulation guidance values are highlighted (see Table 5-1). The TEQs in 37 of 46 sediment samples exceed the wildlife bioaccumulation sediment guidance values. Two samples (Station Nos. 6E: 56- 74 cm and 12: 0-18 cm) exceeded the sediment guidance values for human bioaccumulation.

Percent Abundance Patterns

A third process for evaluating the dioxin data are the percent abundance patterns of homolog totals and toxic equivalency quotients. 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 homolog total or TEQ value by a representative total. These percent abundance values can then be arranged in a fixed sequence that establishes a pattern. This pattern can be used to compare the similarity or divergence of the analytical results of multiple samples.

While the percent abundance patterns may provide insight to the complex realm of dioxin and furan characteristics, it must be remembered that there are 75 dioxin congeners (7 of which are 2,3,7,8-substituted and have a corresponding TEF) and 135 furan congeners (10 of which are 2,3,7,8-substituted and have a corresponding TEF). Only the tetra- through octa- homolog totals are used in the homolog percent abundance calculations. The analytical results used to characterize the dioxins and furans represents only a portion of the total dioxin or furan mass.

Dioxin/Furan Homolog Percent Abundance Patterns

Graphs of the dioxin and furan homolog percent abundance patterns were created for discrete sampling areas within the overall study area. See Figure's 5-1A through 5-1E.

The graphs indicate that the dioxin homolog percent abundance patterns are consistent throughout the 11 sampling sites presented. Octa-chlorodioxin dominates these graphs and is thought to be produced by multi-combustion processes and the production of pentachlorophenol. The furan homolog percent abundance patterns (as can be seen in the lower half of each figure) demonstrate more variability.

A characteristic of Eighteenmile Creek sediments is a greater percentage of hepta-furan homolog relative to the percentage of octa-furan homolog. This ratio is thought to be a characteristic of contamination caused by sintering plants within the iron/steel industry.

TEQ Percent Abundance Patterns

Graphs of toxic equivalency percent abundance patterns were created using the analytical results (Figure Nos. 5-2A through 5-2E).

Generally, the TEQs provided by the octa-dioxin and 1,2,3,4,7,8-HxCDF congeners dominate the overall toxicity. The octa-dioxin congener is thought to be produced by pentachlorophenol production and/or multiple combustion processes. The 1,2,3,4,7,8-HxCDF congener is characteristic of contamination in the Pettit Flume on the Niagara River, which received discharges from the Occidental Chemical Company.

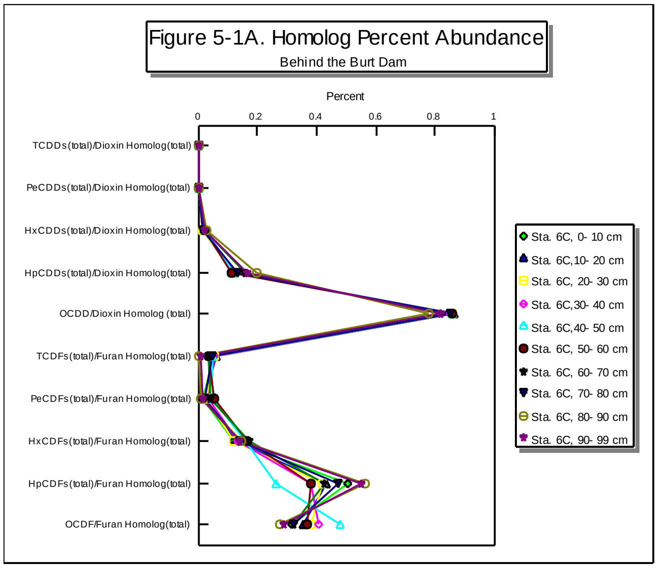


Figure 5-1A. Homolog Percent Abundance
Behind the Burt Dam

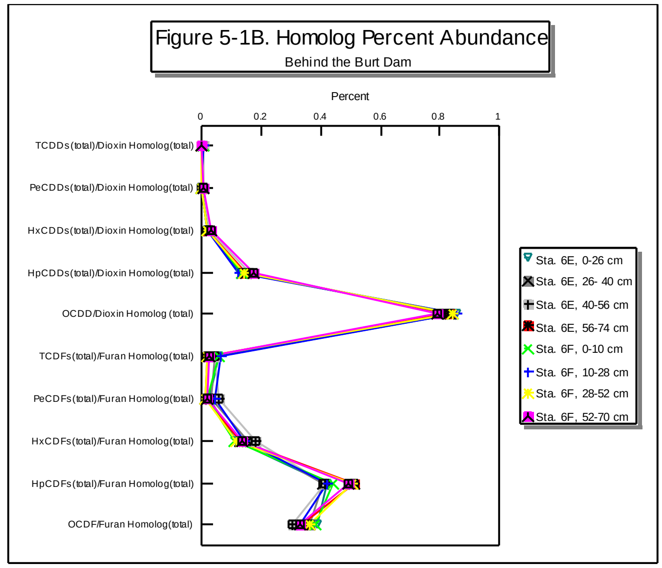


Figure 5-1B. Homolog Percent Abundance
Behind the Burt Dam

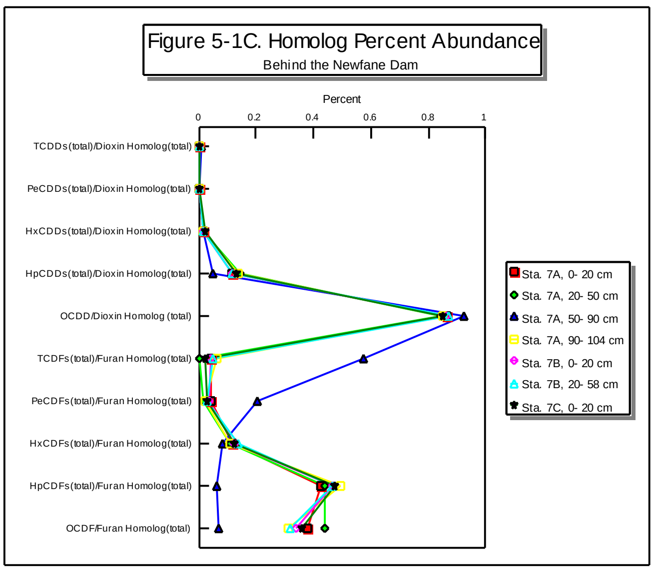


Figure 5-1C. Homolog Percent Abundance
Behind the Newfane Dam

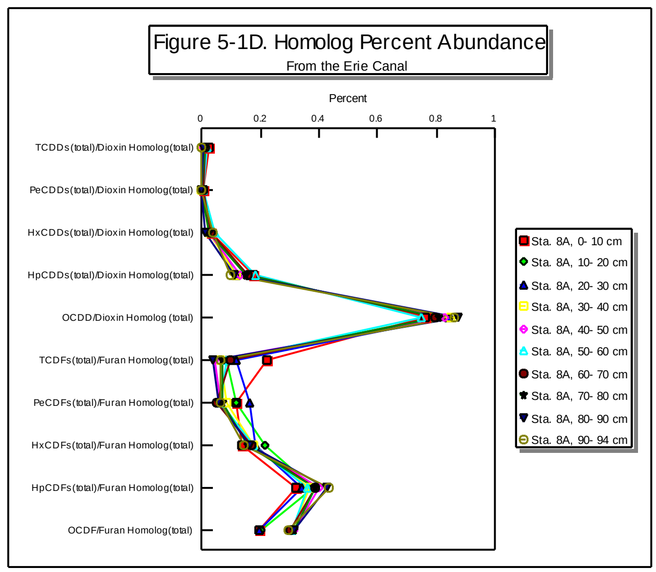


Figure 5-1D. Homolog Percent Abundance
From the Erie Canal

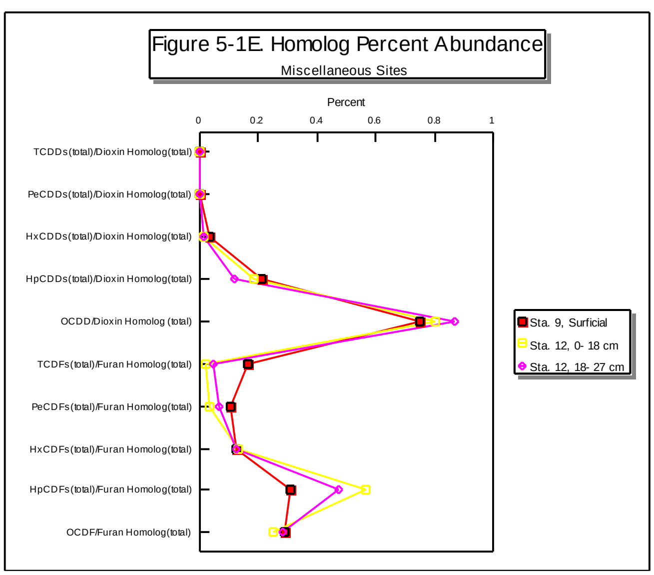


Figure 5-1E. Homolog Percent Abundance
Miscellaneous Sites

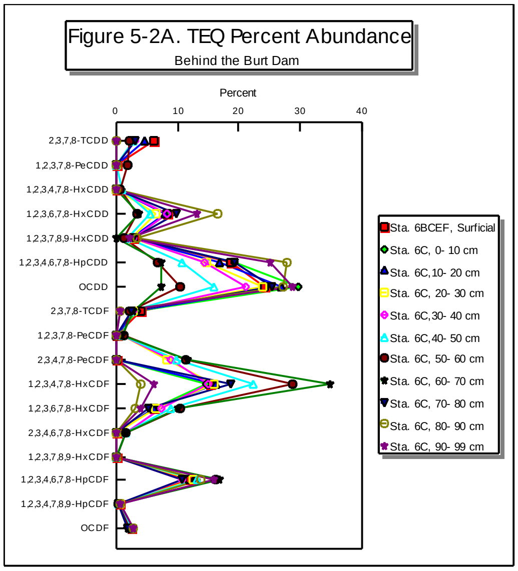


Figure 5-2A. TEQ Percent Abundance
Behind the Burt Dam
Percent
0
10
20
30
40
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
OCDF
Sta. 6BCEF, Surficial
Sta. 6C, 0- 10 cm
Sta. 6C,10- 20 cm
Sta. 6C, 20- 30 cm
Sta. 6C,30- 40 cm
Sta. 6C,40- 50 cm
Sta. 6C, 50- 60 cm
Sta. 6C, 60- 70 cm
Sta. 6C, 70- 80 cm
Sta. 6C, 80- 90 cm
Sta. 6C, 90- 99 cm

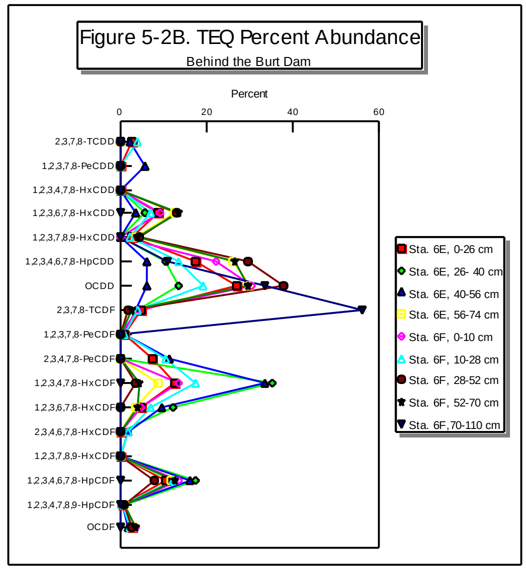


Figure 5-2B. TEQ Percent Abundance
Behind the Burt Dam
Percent
0
20
40
60
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
OCDF
Sta. 6E, 0-26 cm
Sta. 6E, 26- 40 cm
Sta. 6E, 40-56 cm
Sta. 6E, 56-74 cm
Sta. 6F, 0-10 cm
Sta. 6F, 10-28 cm
Sta. 6F, 28-52 cm
Sta. 6F, 52-70 cm
Sta. 6F,70-110 cm

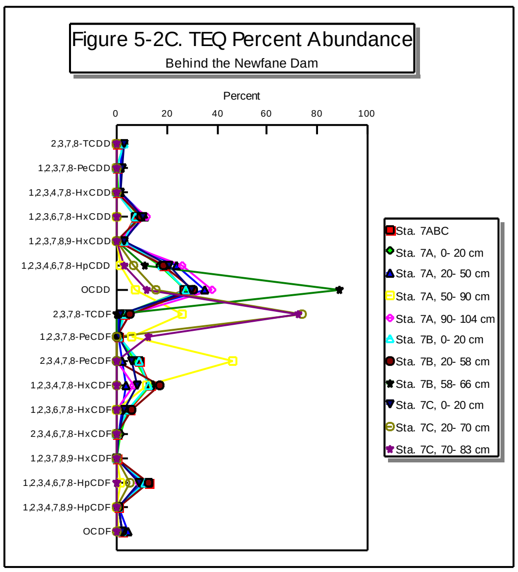


Figure 5-2C. TEQ Percent Abundance
Behind the Newfane Dam
Percent
0
20
40
60
80
100
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
OCDF
Sta. 7ABC
Sta. 7A, 0- 20 cm
Sta. 7A, 20- 50 cm
Sta. 7A, 50- 90 cm
Sta. 7A, 90- 104 cm
Sta. 7B, 0- 20 cm
Sta. 7B, 20- 58 cm
Sta. 7B, 58- 66 cm
Sta. 7C, 0- 20 cm
Sta. 7C, 20- 70 cm
Sta. 7C, 70- 83 cm

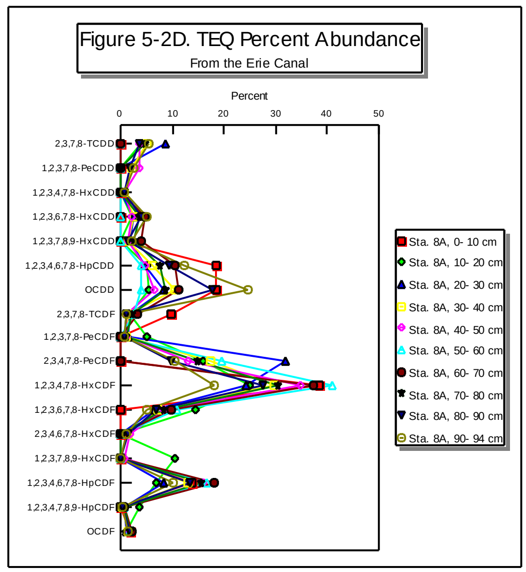


Figure 5-2D. TEQ Percent Abundance
From the Erie Canal
Percent
0
10
20
30
40
50
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
OCDF
Sta. 8A, 0- 10 cm
Sta. 8A, 10- 20 cm
Sta. 8A, 20- 30 cm
Sta. 8A, 30- 40 cm
Sta. 8A, 40- 50 cm
Sta. 8A, 50- 60 cm
Sta. 8A, 60- 70 cm
Sta. 8A, 70- 80 cm
Sta. 8A, 80- 90 cm
Sta. 8A, 90- 94 cm

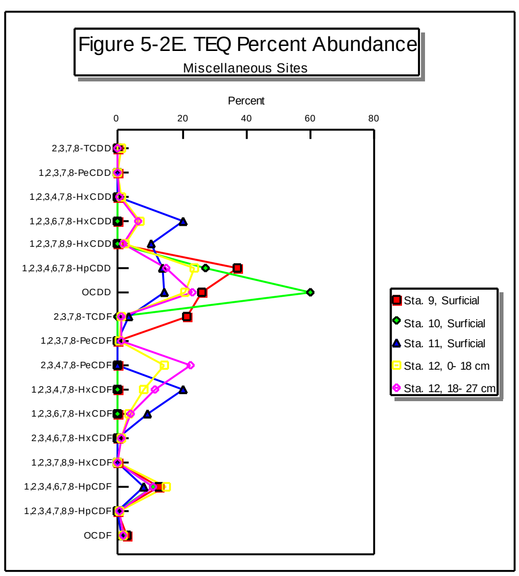


Figure 5-2E. TEQ Percent Abundance
Miscellaneous Sites
Percent
0
20
40
60
80
2,3,7,8-TCDD
1,2,3,7,8-PeCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,4,6,7,8-HpCDD
OCDD
2,3,7,8-TCDF
1,2,3,7,8-PeCDF
2,3,4,7,8-PeCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
OCDF
Sta. 9, Surficial
Sta. 10, Surficial
Sta. 11, Surficial
Sta. 12, 0- 18 cm
Sta. 12, 18- 27 cm

Chapter 6 - Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs comprise a large family of hydrocarbons and are ubiquitous in our natural environment. PAHs are generally produced as a result of incomplete combustion, some from natural emissions such as forest fires and volcanic eruptions and others from anthropogenic sources including coal and oil-fired electric power plants, incinerators and automobile exhausts. High PAH concentrations in sediments may also be indicative of diesel or higher molecular weight petroleum contamination (Schwerko, 1993).

High PAH concentrations can adversely affect aquatic organisms in the environment. Sediment quality values found in the *Ontario Ministry of the Environment and Energy* (Persaud et al., 1993) were used to evaluate the potential impact of the PAHs observed during this study on aquatic organisms.

PAH concentrations greater than analytical detection limits were encountered at many sites at various depths.

Total PAH concentrations were calculated to summarize the relative magnitude of the PAHs encountered and to evaluate their environmental significance. The Persaud et al. guidelines for Total PAHs are based upon the sum of 16 PAH compounds, however, results for Total PAHs presented here are based upon the sum of the 19 PAH compounds reported by the analytical laboratory used for this study. PAH compounds included in the Total PAH results presented here but not included in the Persaud et al. guidelines for Total PAHs include benzo(b)fluoranthene, benzo(e)pyrene, 2-methylnaphthalene and perylene. Additionally, benzo(b)fluorene is included in the Persaud et al. Total PAH guideline but was not evaluated for this study. These results, along with the sediment guidelines previously discussed are presented in Figure 6-1A. Corresponding data are summarized in Table 6-1. Complete analytical results of all PAH compounds analyzed are included in Appendix E.

The Persaud guidelines are useful for evaluating sediment contaminant levels and their expected long term, or chronic, impact on sediment-dwelling organisms. Guidelines for the Lowest Effect Level (LEL) and Severe Effect Level (SEL) are included in Figure 6-1A. Contaminant concentrations greater than the LEL guidance value are considered marginally to significantly polluted and will affect sediment use by some sensitive benthic organisms. Sediments exceeding the SEL guidance are considered heavily polluted and likely to adversely affect the health of the majority of sediment-dwelling organisms. Total PAH concentrations observed during this study did not exceed the SEL guidance values at any locations.

Total PAHs exceeding Persaud's LEL guideline were encountered at most of the sites sampled. The highest concentrations were generally found in the deeper sediment core samples. The highest total PAH concentration measured during the study was 29.8 ppm (Station No. 8A, 80-90 cm).

Total PAHs at most of the surficial samples were generally below the LEL concentration of 4 ppm. This indicates there is not severe (total) PAH contamination in the biologically active surficial sediments. Exceptions to these findings were in the surficial sediments at Station Nos. 9 (25.6 ppm), 11 (22.9 ppm) and 12 (13.3 ppm). Total PAH concentrations in the surficial sediments at these sites were considerably higher than the 4 ppm LEL guidance value.

Station No. 9 was located on Eighteenmile Creek, upstream of the Erie Barge Canal and was intended to be a background site. The highest Mirex concentration (380 ppb) measured during the study was also encountered at this location. Station No. 11 was located on the Gulf and the potential source(s) of PAH contamination there are unknown. Finally, Station No. 12 was located near the abandoned Flintkote building (downstream of the Erie Barge Canal's confluence with Eighteenmile Creek). Very high total PAH concentrations (119 ppm) were previously measured (NYSDEC 1998a) upstream of this location.

Benzo(a)anthracene and benzo(a)pyrene are PAH compounds of significant environmental concern (Connell, 1997). Concentrations of benzo(a)anthracene and benzo(a)pyrene greater than analytical detection limits along with Persaud's corresponding LEL and SEL values are presented in Figures 6-1B and 6-1C, respectively.

Figure 6-1A. Total PAH Concentrations

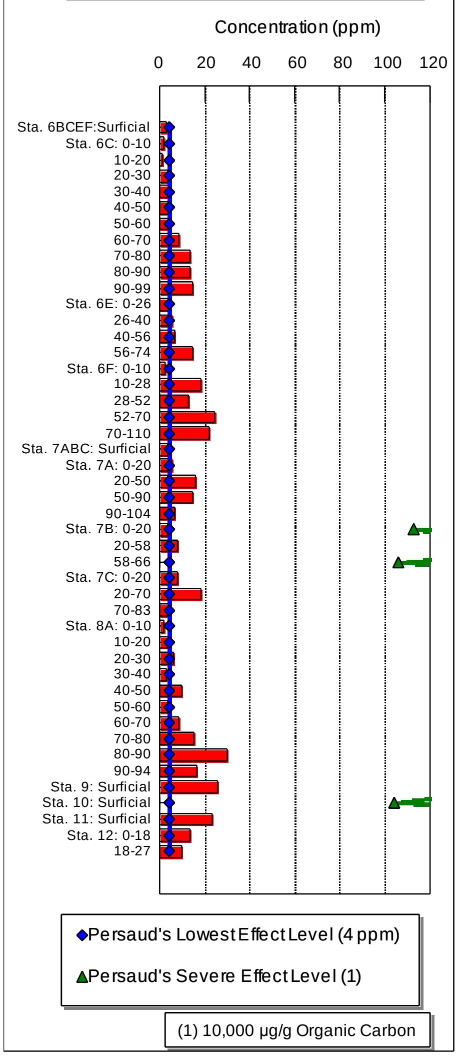


Figure 6-1B. Benzo(a)anthracene Concentrations

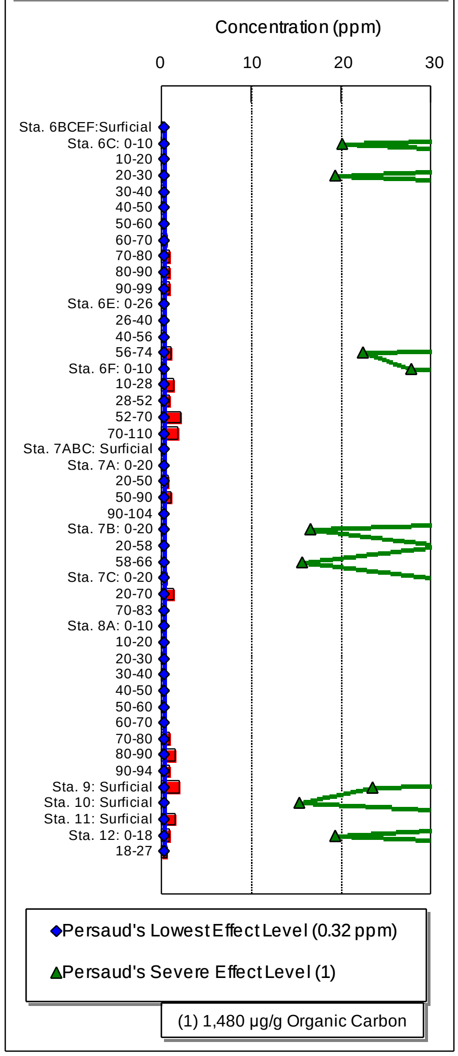
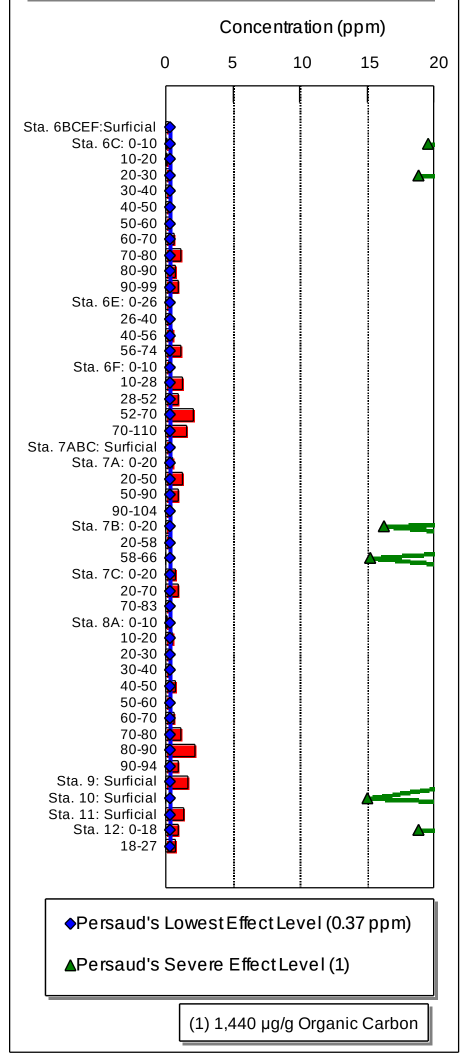


Figure 6-1C. Benzo(a)pyrene Concentrations



Elevated levels of benzo(a)anthracene and benzo(a)pyrene were observed at the same locations and depths as the elevated total PAHs (see Figure 6-1A). This is not surprising as samples with high calculated total PAH concentrations were comprised of elevated levels of these compounds. Benzo(a)anthracene and benzo(a)pyrene concentrations did not exceed Persaud's SEL guidance values in any samples.

Table 6-1. Eighteenmile Creek PAH Summary

(all concentrations ppm unless otherwise noted, dry weight corrected)

Station			Total PAHs	Persaud Guidance (1993)		Benzo(a)anthracene	Persaud Guidance (1993)		Benzo(a)pyrene	Persaud Guidance (1993)	
No.	**Depth (cm)**	**TOC (%)**	**Result**	**LEL**	**SEL (1)**	**Result**	**LEL**	**SEL (2)**	**Result**	**LEL**	**SEL (3)**
6BCEF	Surficial	6.03	2.75	4	603	0.16	0.32	89.24	0.23	0.37	86.83
6C	0-10	1.36	1.405	4	136	0.082	0.32	20.13	0.12	0.37	19.58
6C	10-20	4.23	1.019	4	423	0	0.32	62.60	0.077	0.37	60.91
6C	20-30	1.31	3.27	4	131	0.22	0.32	19.39	0.28	0.37	18.86
6C	30-40	4.19	4.166	4	419	0.26	0.32	62.01	0.33	0.37	60.34
6C	40-50	9.11	4.297	4	911	0.28	0.32	134.83	0.37	0.37	131.18
6C	50-60	9.61	4.331	4	961	0.29	0.32	142.23	0.35	0.37	138.38
6C	60-70	8.68	8.251	4	868	0.6	0.32	128.46	0.64	0.37	124.99
6C	70-80	4.86	13.268	4	486	1	0.32	71.93	1.1	0.37	69.98
6C	80-90	9.68	13.19	4	968	0.87	0.32	143.26	0.76	0.37	139.39
6C	90-99	3.48	14.54	4	348	0.96	0.32	51.50	0.98	0.37	50.11
6E	0-26	14.6	4.283	4	1460	0.29	0.32	216.08	0.34	0.37	210.24
6E	26-40	6.66	5.517	4	666	0.41	0.32	98.57	0.47	0.37	95.90
6E	40-56	5.7	6.696	4	570	0.45	0.32	84.36	0.52	0.37	82.08
6E	56-74	1.52	14.39	4	152	1.1	0.32	22.50	1.1	0.37	21.89
6F	0-10	1.88	2.475	4	188	0.15	0.32	27.82	0.19	0.37	27.07
6F	10-28	6.57	17.921	4	657	1.4	0.32	97.24	1.2	0.37	94.61
6F	28-52	5.03	12.844	4	503	0.96	0.32	74.44	0.94	0.37	72.43
6F	52-70	2.78	24.11	4	278	2.1	0.32	41.14	2.1	0.37	40.03
6F	70-110	7.09	21.73	4	709	1.8	0.32	104.93	1.6	0.37	102.10
7ABC	Surficial	7.09	3.25	4	709	0.19	0.32	104.93	0.28	0.37	102.10
7A	0-20	4.52	5.038	4	452	0.29	0.32	66.90	0.48	0.37	65.09
7A	20-50	2.62	15.543	4	262	0.84	0.32	38.78	1.2	0.37	37.73
7A	50-90	2.12	14.54	4	212	1.1	0.32	31.38	0.94	0.37	30.53
7A	90-104	4.11	6.268	4	411	0.47	0.32	60.83	0.37	0.37	59.18
7B	0-20	1.13	3.718	4	113	0.24	0.32	16.72	0.32	0.37	16.27
7B	20-58	2.11	7.84	4	211	0.24	0.32	31.23	0.26	0.37	30.38
7B	58-66	1.06	0	4	106	0	0.32	15.69	0	0.37	15.26
7C	0-20	2.09	7.606	4	209	0.59	0.32	30.93	0.69	0.37	30.10
7C	20-70	2.8	18.18	4	280	1.4	0.32	41.44	0.95	0.37	40.32
7C	70-83	2.14	4.171	4	214	0.35	0.32	31.67	0.22	0.37	30.82
8A	0-10	3.22	1.87	4	322	0.12	0.32	47.66	0.11	0.37	46.37
8A	10-20	2.33	4.43	4	233	0.24	0.32	34.48	0.51	0.37	33.55
8A	20-30	3.96	6.068	4	396	0.22	0.32	58.61	0.32	0.37	57.02
8A	30-40	2.81	2.768	4	281	0.16	0.32	41.59	0.26	0.37	40.46
8A	40-50	6.83	9.497	4	683	0.55	0.32	101.08	0.78	0.37	98.35
8A	50-60	6.87	3.716	4	687	0.23	0.32	101.68	0.3	0.37	98.93
8A	60-70	4.42	8.518	4	442	0.49	0.32	65.42	0.65	0.37	63.65
8A	70-80	9.31	14.959	4	931	0.88	0.32	137.79	1.1	0.37	134.06
8A	80-90	5.62	29.804	4	562	1.5	0.32	83.18	2.2	0.37	80.93
8A	90-94	12.2	16.23	4	1220	0.86	0.32	180.56	0.95	0.37	175.68
9	Surficial	1.59	25.62	4	159	2	0.32	23.53	1.7	0.37	22.90
10	Surficial	1.04	0	4	104	0	0.32	15.39	0	0.37	14.98
11	Surficial	3.45	22.926	4	345	1.5	0.32	51.06	1.4	0.37	49.68
12	0-18	1.31	13.272	4	131	0.95	0.32	19.39	0.98	0.37	18.86
12	18-27	3.8	9.878	4	380	0.63	0.32	56.24	0.76	0.37	54.72

Notes: Total PAHs is the sum of the following19 PAH compounds: Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(e)pyrene, Benzo[g,h,i]perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, 2-Methylnapthalene, Perylene, Phenanthrene and Pyrene.

(1) 10,000 µg/g Organic Carbon
(2) 1,480 µg/g Organic Carbon
(3) 1,440 µg/g Organic Carbon

Chapter 7 –Total Organic Carbon and Solids

Total organic carbon (TOC), percent solids, and percent volatile solids were evaluated for each sample collected. These results are presented in Table 7-1.

Visual descriptions and grain size analyses were performed on a limited number of samples and are summarized in Appendix F.

Sediment TOC concentrations were evaluated as many trace elements and non-polar organic compounds sorb more readily to the fine-grained organic sediments. The NYSDEC Division of Fish and Wildlife (DFW) sediment guidance (1999a) used to evaluate trace elements and non-polar organic compounds is based upon equilibrium partitioning methodology. Sediment TOC concentrations are needed to calculate sample specific guidance values. The Persaud sediment guidelines for identifying SELs in sediments (1993) are also based upon sample specific TOC concentrations.

Table 7-1. Total Organic Carbon and Solids Results

Station No.	Sample Depth (cm)	Total Organic Carbon (%)	Solids (%)	Total Volatile Solids (%)
6BCEF	Surficial	6.03	28.5	10.9
6C	0-10	1.36	26.4	11.2
6C	10-20	4.23	31.7	11.2
6C	20-30	1.31	32.6	11.3
6C	30-40	4.19	35.2	11.9
6C	40-50	9.11	37.4	11.7
6C	50-60	9.61	41.7	11
6C	60-70	8.68	30.1	16.5
6C	70-80	4.86	35.8	18.9
6C	80-90	9.68	39	17
6C	90-99	3.48	39.2	15.9
6E	0-26	14.6	33.1	11.4
6E	26-40	6.66	39.9	11
6E	40-56	5.7	32.8	19.4
6E	56-74	1.52	32.4	21.9
6F	0-10	1.88	30.6	13.2
6F	10-28	6.57	41.7	14.1
6F	28-52	5.03	36.2	19.5
6F	52-70	2.78	45.5	11.9
6F	70-110	7.09	46	10.9
7ABC	Surficial	7.09	25.7	12.4
7A	0-20	4.52	26.4	16
7A	20-50	2.62	41.9	13.9
7A	50-90	2.12	48	13.9
7A	90-104	4.11	50.1	18.7
7B	0-20	1.13	29.7	12
7B	20-58	2.11	55.6	8.6
7B	58-66	1.06	61.7	7
7C	0-20	2.09	32.4	12.2
7C	20-70	2.8	45.3	9.6
7C	70-83	2.14	45.7	10.9
8A	0-10	3.22	52.8	5
8A	10-20	2.33	64.7	5.5
8A	20-30	3.96	66.2	5
8A	30-40	2.81	68.1	5.2
8A	40-50	6.83	62	5
8A	50-60	6.87	64.8	34.9
8A	60-70	4.42	60.6	4.9
8A	70-80	9.31	62.3	4.5
8A	80-90	5.62	64.8	6.3
8A	90-94	12.2	68.9	4.9
9	Surficial	1.59	75.7	5.2
10	Surficial	1.04	36.3	8.6
11	Surficial	3.45	49.8	8.7
12	0-18	1.31	49.7	9
12	18-27	3.8	57.4	14
13 (1)	Surficial	1.22	26.3	13.4

Note: (1)- Blind field duplicate of sample form Station No. 7ABC

Chapter 8 -Sediment Toxicity

Toxicity was measured using 10-day solid phase tests for survival and growth (*Chironomus tentans* and *Hyalella azteca)* following EPA methods (Table 1-3).

Approximately 5 liters of surficial sediments were collected at each site by Standard ponar, homogenized, and cooled to 4° C before shipment to the lab for testing. Subsamples were submitted to the contract labs for chemical analysis. Toxicity samples were shipped within 48 hours of collection in polyethylene containers.

The toxicity tests were set up in the lab within 48 hours after the samples were received. Eight replicates were run on each sample. One control sample was supplied by the lab and run with each test. Both growth and survival were measured as endpoints for each species.

Statistical analyses of the results were conducted using TOXSTAT software (WEST 1994) to compare test endpoints with the control samples. Dunnett's ANOVA test was used to determine differences between each group and control means after data sets had passed normality and homogeneity. Shapiro-Wilk's and Chi-square were used to test for normality while Bartlett's and Hartley's tests were used to test for homogeneity of variance. Transformation of the data was used to overcome normality and homogeneity of variance problems when possible.

Surficial samples were collected to evaluate three regions within the study area. These regions included the depositional pools created upstream of the Burt (Station No. 6BCEF) and Newfane (Station No. 7ABC) Dams. Additionally, a surficial sediment sample was collected from the Erie Barge Canal (Station No. 8A) in the City of Lockport. Sample No. 6BCEF is a composite of surficial samples collected at Station Nos. 6B, 6C, 6E and 6F. The Station No. 7ABC sample was composed of surficial sediment from Station No. 7A, 7B and 7C.

It had been planned that a control sample for the toxicity tests be collected from Eighteenmile Creek (Station No. 9) upstream of the Erie Barge Canal's overflow to Eighteenmile Creek. A sediment control sample was not collected, as there was no flow in Eighteenmile Creek at Station No. 9.

Chironomus tentans showed reduced growth (statistically significant) in sediment samples from the region behind the Newfane Dam (Station No. 7ABC). No differences in survival were observed in any samples. Complete study results of the tests are found in Appendix G

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Chapter 9 – Water Samples

Water sampling was performed to evaluate contaminant concentrations in sediments transported from the Erie Barge Canal into Eighteenmile Creek and through Eighteenmile Creek into the Olcott Harbor AOC. This was accomplished by measuring total and filtered concentrations of contaminants in water samples. Water sample results, including trace metals, mercury, PCBs and dioxins/furans are presented in Table Nos. 9-1 through 9-4, respectively.

It had been planned that all water sampling be conducted during high flow scour conditions, as might occur during a rainstorm. A significant volume of bed load sediment can be resuspended into the water column during such conditions. Considerable sediment scour and resuspension can also occur as a result of annual spring runoff. Unfortunately, a high flow event was not encountered during the sampling period.

All water column sampling for this project was conducted by field staff from the NYSDEC Region 9 Office (Buffalo, NY) on November 3, 1998. Flow into Eighteenmile Creek was, however, elevated during this sampling as the Erie Barge Canal was being drained for the winter. Winter drainage is accomplished by opening a submerged waste gate at the location where Eighteenmile Creek passes under the Erie Barge Canal.

Approximately 50 cubic feet per second is diverted from the barge canal into the main stem of Eighteenmile Creek during dry weather, low flow conditions (NYSDEC, 1997). Flow in Eighteenmile Creek can be composed primarily of Barge Canal overflow during these low flow periods. The East Branch of Eighteenmile Creek flow is also augmented by overflow from the barge canal. Additional unregulated flows are also spilled into Eighteenmile Creek from the Barge Canal overflow weirs on the Main and East Branch's during high flow conditions.

The first water column sample (Station No. 8B) was taken from the Erie Barge Canal overflow structure (Lockport, NY) located on the main channel of Eighteenmile Creek. Eighteenmile Creek passes through a culvert under the Erie Barge Canal at this location. This sample was collected to evaluate the potential contaminant flux from the Erie Barge Canal into Eighteenmile Creek.

A second water column sample was collected to evaluate the suspended sediment transport and associated contaminant flux passing over the Burt Dam and through the hydroelectric generating facility (Station No. 6A). It is suspected that a considerable volume of suspended sediment is transported over and through this facility during high flows. The Olcott Harbor AOC is located downstream of the Burt Dam.

Sediment data resulting from previous NYSDEC sampling (1998a) showed higher contaminant concentrations in the surficial samples downstream of the Burt Dam. The highest contaminant concentrations upstream of the Burt Dam were found in the deeper core samples and not in the surficial sediments.

No estimate of overflow from the Erie Canal into Eighteenmile Creek was available for the day of the sampling (November 3, 1998). Flow through the Burt Hydroelectric on the day of sampling was approximately 94 cubic feet per second (CFS). This estimate, provided by a representative from the Algonquin Power Corporation, Inc, was based upon the average daily production at the station.

The total and soluble trace metals results (Table 9-1) are at concentrations less then detection and reporting limits. As such, they were not used to estimate sediment transport or contaminant flux and no comparison with NYS water quality standards was performed. It is expected that much higher sediment loads and associated contaminant concentrations would be observed during high flow conditions.

Total and methylmercury results were also not evaluated against NYS water quality standards. This assessment was not performed, as the dissolved fraction, which is the basis of the NYS standards, was not evaluated by the laboratory as requested.

The PCB water sampling data (Table No. 9-3) show the majority of the Total PCBs measured at Station Nos. 6A and 8A is in the filtered or dissolved phase of the water samples (96% and 90%, respectively). Total PCB concentrations were evaluated using the NYS water quality regulations (NYSDEC, 1999b). The NYS water quality standards for PCBs are 1×10^{-6} μg/l (0.000,001 ppb) for the protection of human health from fish consumption [H(FC)] and 1.2×10^{-4} μg/l (0.000,12 ppb) for the protection of wildlife (W). Concentrations of Total PCBs in both water samples collected exceeded these standards (Station No. 6A: 0.084,13 ppb, Station No. 8B: 0.001,05 ppb).

Again, greater sediment resuspension and associated contaminant loading would be expected during a high-energy storm event. It is unknown if the high ratio of dissolved to total PCBs observed during this study would also be observed during such an event as a greater mass of sediment would be resuspended.

Table 9-1. Trace Metals in Eighteenmile Creek and Erie Barge Canal Water Samples

all concentrations, μg/l (ppb)

	Station No. 6A Total Conc.		Station No. 6A Soluble Conc.		Station No. 8B Total Conc.		Station No. 8B Soluble Conc.	
Analyte	**Result**	**Data Flag**	**Result**	**Data Flag**	**Result**	**Data Flag**	**Result**	**Data Flag**
Arsenic	2.8	U	2.8	U	2.8	U	2.8	U
Cadmium	0.4	U	0.4	U	0.4	U	0.4	U
Chromium	0.6	U	0.6	U	0.6	U	0.6	U
Copper	5.7	B	5.8	B	5	B	4.7	B
Lead	1.7	U	1.7	U	1.7	U	1.7	U
Zinc	0.6	U	0.6	U	0.6	U	0.6	U

Notes:
B- Parameter was between instrument detection limit and contract required detection limit.
U- Parameter not detected at or above reporting limit

Table 9-2. Total Mercury and Methylmercury in Eighteenmile Creek and Erie Barge Canal Water Samples

all concentrations, ng/L (ppt)

	Station No. 6A		Station No. 8B	
Analyte	**Result**	**Detection Limit**	**Result**	**Detection Limit**
Total Mercury	3.16	0.2	1.6	0.2
Methylmercury	0.05	0.05	0.05	0.05

Table 9-3. PCBs in Eighteenmile Creek and Erie Barge Canal Water Samples
all concentrations, pg/L (ppqd, 1668 modified)

	Station No. 6A Total Conc.		Station No. 6A Filtered Conc.		Station No. 8B Total Conc.		Station No. 8B Filtered Conc.	
Congener	**Result**	**Det. Limit**	**Result**	**Det. Limit**	**Result**	**Det. Limit**	**Result**	**Det. Limit**
PCB-4; PCB-10	7,800	1,000	6,100	1,000	ND	1,000	ND	1,000
PCB-6	ND	1,000	ND	1,000	ND	1,000	ND	1,000
PCB-7	ND	1,000	ND	1,000	ND	1,000	ND	1,000
PCB-8; PCB-5	ND	1,000	ND	1,000	ND	1,000	ND	1,000
PCB-15	2,100	1,000	2,100	1,000	ND	1,000	ND	1,000
PCB-16; PCB-32	6,200	1,000	6,400	1,000	ND	1,000	ND	1,000
PCB-17	6,100	1,000	6,100	1,000	ND	1,000	ND	1,000
PCB-18	6,200	1,000	6,500	1,000	ND	1,000	ND	1,000
PCB-19	6,400	1,000	5,700	1,000	ND	1,000	ND	1,000
PCB-22	1,000	1,000	1,100	1,000	ND	1,000	ND	1,000
PCB-25	1,600	1,000	1,900	1,000	ND	1,000	ND	1,000
PCB-26	5,800	1,000	6,100	1,000	ND	1,000	ND	1,000
PCB-27; PCB-24	2,500	1,000	2,500	1,000	ND	1,000	ND	1,000
PCB-31; PCB-28	7,400	1,000	7,600	1,000	ND	1,000	ND	1,000
PCB-33	ND	1,000	ND	1,000	ND	1,000	ND	1,000
PCB-37	ND	1,000	1,100	1,000	ND	1,000	ND	1,000
PCB-40	960	200	860	200	ND	200	ND	200
PCB-42	1,200	400	940	400	ND	400	ND	400
PCB-44	2,700	400	2,200	400	ND	400	ND	400
PCB-45	810	400	650	400	ND	400	ND	400
PCB-46	510	200	390	200	ND	200	ND	200
PCB-47; PCB-48	670	200	620	200	ND	200	ND	200
PCB-49	1,000	200	970	200	ND	200	ND	200
PCB-52	1,900	200	1,800	200	ND	200	ND	200
PCB-53	860	200	740	200	ND	200	ND	200
PCB-56; PCB-60	900	200	700	200	ND	200	ND	200
PCB-64; PCB-41	2,600	200	2,200	200	ND	200	ND	200
PCB-66	660	200	550	200	ND	200	ND	200
PCB-70	640	200	590	200	ND	200	ND	200
PCB-74	240	200	240	200	ND	200	ND	200
PCB-77	ND	200	ND	200	ND	200	ND	200
PCB-81	ND	200	ND	200	ND	200	ND	200
PCB-82	540	200	350	200	ND	200	ND	200
PCB-83	330	200	300	200	ND	200	ND	200
PCB-84; PCB-90; PCB-101	3,400	200	3,000	200	450	200	320	200
PCB-85	440	200	410	200	ND	200	ND	200
PCB-87	830	200	790	200	ND	200	ND	200
PCB-91	550	200	470	200	ND	200	ND	200
PCB-95	2,400	200	2,000	200	ND	400	210	200
PCB-97	790	200	780	200	ND	200	ND	200
PCB-99	470	200	460	200	ND	200	ND	200
PCB-105	950	200	820	200	ND	400	ND	200
PCB-107	ND	200	ND	200	ND	200	ND	200
PCB-110	3,800	200	3,400	200	600	200	410	200
PCB-114	ND	200	ND	200	ND	200	ND	200
PCB-118	880	200	880	200	ND	400	ND	200
PCB-119	ND	200	ND	200	ND	200	ND	200
PCB-123	ND	200	ND	200	ND	200	ND	200
PCB-126	ND	200	ND	200	ND	200	ND	200
PCB-128; PCB-167	ND	200	ND	200	ND	200	ND	200
PCB-129	ND	200	ND	200	ND	200	ND	200
PCB-130	ND	200	ND	200	ND	200	ND	200
PCB-131	ND	200	ND	200	ND	200	ND	200
PCB-134	ND	200	ND	200	ND	200	ND	200
PCB-135	ND	200	ND	200	ND	200	ND	200
PCB-136	ND	200	ND	200	ND	200	ND	200
PCB-137	ND	200	ND	200	ND	200	ND	200
PCB-138	ND	200	ND	200	ND	200	ND	200
PCB-141	ND	200	ND	200	ND	200	ND	200
PCB-146	ND	200	ND	200	ND	200	ND	200
PCB-149	ND	200	ND	200	ND	200	ND	200
PCB-151	ND	200	ND	200	ND	200	ND	200
PCB-153	ND	200	ND	200	ND	200	ND	200
PCB-156	ND	200	ND	200	ND	200	ND	200
PCB-157	ND	200	ND	200	ND	200	ND	200
PCB-158	ND	200	ND	200	ND	200	ND	200
PCB-168; PCB-132	ND	200	ND	200	ND	200	ND	200
PCB-169	ND	200	ND	200	ND	200	ND	200
PCB-171	ND	200	ND	200	ND	200	ND	200
PCB-172	ND	200	ND	200	ND	200	ND	200
PCB-174	ND	400	ND	400	ND	400	ND	400
PCB-175	ND	200	ND	200	ND	200	ND	200
PCB-176	ND	200	ND	200	ND	200	ND	200
PCB-177	ND	400	ND	400	ND	400	ND	400
PCB-178	ND	200	ND	200	ND	200	ND	200
PCB-179	ND	200	ND	200	ND	200	ND	200
PCB-180	ND	200	ND	200	ND	200	ND	200
PCB-183	ND	400	ND	400	ND	400	ND	400
PCB-184	ND	400	ND	400	ND	400	ND	400
PCB-185	ND	400	ND	400	ND	400	ND	400
PCB-187	ND	200	ND	200	ND	200	ND	200
PCB-189	ND	200	ND	200	ND	200	ND	200
PCB-190; PCB-170	ND	200	ND	200	ND	200	ND	200
PCB-191	ND	200	ND	200	ND	200	ND	200
PCB-193	ND	200	ND	200	ND	200	ND	200
PCB-194	ND	200	ND	200	ND	200	ND	200
PCB-195	ND	200	ND	200	ND	200	ND	200
PCB-197	ND	400	ND	400	ND	400	ND	400
PCB-198	ND	400	ND	400	ND	400	ND	400
PCB-199	ND	200	ND	200	ND	200	ND	200
PCB-200	ND	200	ND	200	ND	200	ND	200
PCB-201	ND	400	ND	400	ND	400	ND	400
PCB-202	ND	200	ND	200	ND	200	ND	200
PCB-203; PCB-196	ND	200	ND	200	ND	200	ND	200
PCB-205	ND	200	ND	200	ND	200	ND	200
PCB-206	ND	200	ND	200	ND	200	ND	200
PCB-207	ND	200	ND	200	ND	200	ND	200
PCB-208	ND	200	ND	200	ND	200	ND	200
PCB-209	ND	200	270	200	ND	200	ND	200
Total Concentration	**84,130**		**80,580**		**1,050**		**940**	

Only the octachlorodibenzo-p-dioxin (OCDD) congener was reported (Station No. 6A-Burt Dam) at a concentration greater than the analytical detection limit (Table 9-4). The calculated toxic equivalency (1.5×10^{-9} ppb) of the OCDD result (total water sample) exceeded the NYSDEC (1999b) water quality standard of 6×10^{-10} ppb (2,3,7,8-TCDD toxic equivalency) for the protection of human health from fish consumption [H(FC)]. Wildlife protection standards were not evaluated as reported 2,3,7,8, TCDD concentrations, for which they apply, were less than analytical detection limits.

Table 9-4. Dioxins and Furans in Eighteenmile Creek and Erie Barge Canal Water Samples
all concentrations, pg/L (ppqd, 1613B)

	Station No. 6A Total Conc.		Station No. 6A Filtered Conc.		Station No. 8B Total Conc.		Station No. 8B Filtered Conc.	
Analyte	**Result**	**Det. Limit**	**Result**	**Det. Limit**	**Result**	**Det. Limit**	**Result**	**Det. Limit**
1,2,3,4,6,7,8-HpCDD	ND	50	ND	50	ND	100	ND	50
1,2,3,4,6,7,8-HpCDF	ND	50	ND	50	ND	100	ND	50
1,2,3,4,7,8-HxCDD	ND	50	ND	50	ND	100	ND	50
1,2,3,4,7,8-HxCDF	ND	50	ND	50	ND	100	ND	50
1,2,3,4,7,8,9-HpCDF	ND	50	ND	50	ND	100	ND	50
1,2,3,6,7,8-HxCDD	ND	50	ND	50	ND	100	ND	50
1,2,3,6,7,8-HxCDF	ND	50	ND	50	ND	100	ND	50
1,2,3,7,8-PeCDD	ND	50	ND	50	ND	100	ND	50
1,2,3,7,8-PeCDF	ND	50	ND	50	ND	100	ND	50
1,2,3,7,8,9-HxCDD	ND	50	ND	50	ND	100	ND	50
1,2,3,7,8,9-HxCDF	ND	50	ND	50	ND	100	ND	50
2,3,4,6,7,8-HxCDF	ND	50	ND	50	ND	100	ND	50
2,3,4,7,8-PeCDF	ND	50	ND	50	ND	100	ND	50
2,3,7,8-TCDD	ND	10	ND	10	ND	20	ND	10
2,3,7,8-TCDF	ND	10	ND	10	ND	20	ND	10
HpCDDs (total)	ND	50	ND	50	ND	100	ND	50
HpCDFs (total)	ND	50	ND	50	ND	100	ND	50
HxCDDs (total)	ND	50	ND	50	ND	100	ND	50
HxCDFs (total)	ND	50	ND	50	ND	100	ND	50
OCDD	150	--	170	--	ND	200	ND	100
OCDF	ND	100	ND	100	ND	200	ND	100
PeCDDs (total)	ND	50	ND	50	ND	100	ND	50
PeCDFs (total)	ND	50	ND	50	ND	100	ND	50
TCDDs (total)	ND	10	ND	10	ND	20	ND	10
TCDFs (total)	ND	10	ND	10	ND	20	ND	10

Note: ND- Parameter not detected at or above reporting limit

Note: OCDD TEQ (ppb) = OCDD concentration (ppb) X TEF (0.001) X Bioaccumulation Factor (0.01)

Total organic carbon (TOC), total suspended solids (TSS) and turbidity in the water samples were evaluated and are presented in Table 9-5. The TSS and turbidity data indicate low levels of sediment resuspension.

Table 9-5. Total Organic Carbon and Solids in Eighteenmile Creek and Erie Barge Canal Water Samples

	Station No. 6A		Station No. 8B	
Analyte	**Result**	**Detection Limit**	**Result**	**Detection Limit**
Total Organic Carbon (ppb)	3,400	500	3,300	500
Total Suspended Solids (ppb)	7,700	5,000	22,000	5,000
Turbidity (NTU)	1.3	0.04	2	0.04

Chapter 10 Summary/Conclusions

Metals

All trace metals evaluated exceeded their LEL screening values at several sampling stations. Sediment contaminant concentrations greater than the LEL but less than the SEL are considered marginally to significantly polluted (Persaud et al. 1993).

The highest trace metals observed during this study were generally found in the deeper sediment samples from the depositional pool created upstream of the Burt Dam. Trace metals exceeding their SEL values in this section of Eighteenmile Creek include cadmium (20.1 ppm, 56-74 cm), chromium (1,490 ppm, 56- 74 cm), copper (2,450 ppm, 70-80 cm), lead (4,490 ppm, 70-80 cm), nickel (997 ppm, 28- 52 cm), silver (8 ppm, 80- 90 cm) and zinc (15,100 ppm, 28- 52 cm). The SEL indicates the concentration at which pronounced disturbance of the sediment-dwelling community can be expected (Persaud et al. 1993). Trace metal concentrations in many surface and near surface samples exceeded the LEL guidance values. Concentrations of trace metals in surface sediments are, however, considerably lower than the buried, peak concentrations.

It is unknown why the maximum concentrations observed at Station No. 6F were found closer to the surface (28-52 cm subsample). One hypothesis is that the net depositional rate at this site is lower, due to its location in the shallower, faster moving waters at the upstream end of the Burt Dam depositional pool.

Radiodating results show the maximum copper (2,450 ppm) and lead (4,490 ppm) concentrations in the Burt Dam depositional pool (Station No. 6C) occur in sediments deposited sometime between the middle 1950's and early 1960's (70- 80 cm subsample).

High concentrations of several metals were also found within the depositional pool created upstream of the Newfane Dam (Station Nos. 7ABC, 7A, 7B and 7C). Trace metals of particular concern in this section of Eighteenmile Creek include cadmium (9.5 ppm), chromium (798 ppm), copper (1,330 ppm), lead (2,840 ppm), mercury (10.1 ppm), nickel (178 ppm), silver (4.6 ppm) and zinc (8,640 ppm). With the exception of mercury (Station No. 7A, 90-104 cm) all of the above noted concentrations were observed in the 0-20 cm section of the core from the Newfane Dam (Station No. 7A). Additionally, all of these metals exceeded their respective SEL concentrations.

Radiodating results from the core collected at Station No. 7C indicate the 20-24 cm depth corresponds to the period 1963-1964 (complete results presented in Appendix H). Due to the coarse sectioning of the core for metals analysis (0- 20 cm section) it can be definitively said only that peak trace metals occurred sometime between the 1963-1964 period and the date of sample collection (August 19, 1998). Concentrations of trace metals in the Station No. 7ABC surficial sample (composite of surficial samples from Station Nos. 7A, 7B and 7C) are, however, lower than in the 0-20 cm sample. It is believed, based upon these results, that trace metals concentrations in the lower portion of the 0-20 cm sample would be higher than in the upper portion of the sample.

Trace metals concentrations were generally lower at sampling sites located upstream of the Burt and Newfane Dam depositional pools. Although lower in concentration, trace metals exceeding their respective SEL concentrations include copper (Station No. 12), lead (Station Nos. 8A, 11 and 12), silver (Station No. 12) and zinc (Station Nos. 8A, 11 and 12).

Pesticides

Of the chlorinated pesticides evaluated DDT and its metabolites exceeded their LEL guidance value (Persaud et al. 1993) most often.

The highest concentrations of total DDT (sum of DDT + DDD + DDE) occur in the depositional pool created by the Burt Dam (Station Nos. 6C, E and F). Additionally, the highest total DDT concentrations at these sites are found in the deeper sediments. This suggests the total DDT at these sites is reflective of historic contamination. Radiodating results from the sediment core collected at Station No. 6C (see figure 2-2) show sediments at the 70- 80 cm depth there were deposited in the early 1960's or earlier. The high ratio of DDD (36 ppm) and DDE (33.7 ppm) to total DDT (72.4 ppm) at Station No. 6c (70- 80 cm depth) also suggests this sample may be reflective of a metabolized or old DDT application.

An elevated level of total DDT (61.55 ppm) was also measured in the upper core section (0-18 cm) at Station No. 12. Additional track-down sampling in this area appears warranted.

Mirex was encountered at an elevated concentration in the surficial sediments at Station No. 9 (380 ppb). Although this concentration exceeds Persaud's (1993) LEL guidance value (7 ppb), it is below the SEL guidance value (2,067 ppb). Mirex, a chlorinated pesticide used in the control of fire ants and as a flame retardant, was banned by the USEPA in 1976. It is recommended that additional, limited sampling be performed at this location to further define the spatial and temporal extent of the mirex contamination there.

Chlordane and dieldrin were also found at concentrations exceeding their LEL guidance values but only at a small number of locations.

With the exceptions of the DDT, chlordane and mirex, in the surface and near-surface sediments at Station Nos. 9 and 12, most of the pesticides exceeding their LEL guidance values (Table 3-1) were encountered in the deeper sediments sampled. Contaminants found in deeper sediments are less biologically available and therefore, less likely to bioaccumulate.

PCBs

PCB congeners were analyzed for most sediment samples collected for this study.

Forty-four of the forty-six congener sums exceed NYSDEC's (1999a) human bioaccumulation guidance values. The majority of these results (37) also exceed NYSDEC's (1999a) wildlife bioaccumulation guidance values and Persaud's No- (39) and Low- (37) Effects Levels. This is not surprising since these guidance values are low enough that most measurable quantities of PCBs are likely to exceed one or several of these guidance values. Additionally, the upper sub-sample (0-18 cm) collected at Station No. 12 (Eighteenmile Creek below the Williams St. Dump) had a PCB concentration (24.93 ppm) that exceeded Persaud's Severe-Effect Level (6.94 ppm) for that site.

Dioxins/Furans

Qualitative Evaluation

When compared to analytical results of well over 200 sediment samples collected by NYSDEC from throughout New York State, elevated levels of tetra- through octa- dioxin homolog totals (>2,500 ppt) were observed in 34 of the 46 samples collected. Average concentrations (500 to 2,500 ppt) were identified in five samples while the remaining seven samples had low levels (<500 ppt) of dioxins.

Elevated levels of the furan homolog totals (>750 ppt) were observed in 36 of the 46 samples submitted for chemical analysis. The remaining 10 samples were equally divided between average (100 to 750 ppt) and low (<100 ppt) concentrations.

Toxic Equivalency

Another process for assessing the toxicity of the measured concentration of dioxin and furan in a particular sample is the toxic equivalency. This methodology quantifies the toxicity of 2,3,7,8-substituted dioxin and furan congeners by proportioning their toxicities to 2,3,7,8-TCDD.

The TEQs in 37 of 46 sediment samples exceed the wildlife bioaccumulation sediment guidance values. Two samples (Station Nos. 6E: 56- 74 cm and 12: 0-18 cm) exceeded the sediment guidance values for human bioaccumulation.

Percent Abundance Patterns

A third process for evaluating the dioxin data are the percent abundance patterns of homolog totals and toxic equivalency quotients. Percent abundance patterns are useful in characterizing the composition of complex compounds such as dioxins, furans, and PCB's. Only the tetra- through octa- homolog totals are used in the homolog percent abundance calculations. Therefore, analytical results used to characterize the dioxins and furans represent only a portion of the total dioxin and furan mass.

Dioxin/Furan Homolog Percent Abundance Patterns

The dioxin homolog percent abundance patterns (Figure 5-1A through 5-1E) are consistent throughout the 11 sampling sites presented. Octa-chlorodioxin dominates and is thought to be produced by multi-combustion processes and the production of pentachlorophenol. The furan homolog percent abundance patterns demonstrate more variability.

A characteristic of Eighteenmile Creek sediments is a greater percentage of hepta-furan homolog relative to the percentage of octa-furan homolog. This ratio is thought to be a characteristic of contamination caused by sintering plants within the iron and steel industry.

TEQ Percent Abundance Patterns

Toxic equivalency percent abundance patterns were created using the analytical results (Figure's 5-2A through 5-2E).

The TEQs provided by the octa-dioxin and 1,2,3,4,7,8-HxCDF congeners dominate the overall toxicity. The octa-dioxin congener is thought to be produced by pentachlorophenol production and/or multiple combustion processes. The 1,2,3,4,7,8-HxCDF congener is characteristic of contamination in the Pettit Flume on the Niagara River, which received discharges from the Occidental Chemical Company.

PAHs

Total PAHs exceeding Persaud's LEL guideline were encountered at most of the sites sampled. Concentrations above the LEL are considered marginally to significantly polluted. The highest concentrations were generally found in the deeper sediment core samples. The highest total PAH concentration measured during the study was 29.8 ppm (Station No. 8A, 80-90 cm).

Total PAHs in most of the surficial samples were generally below the LEL concentration of 4 ppm. This indicates there is not severe (total) PAH contamination in the biologically active surficial sediments. Exceptions to these findings were in the surficial sediments at Station Nos. 9 (25.6 ppm), 11 (22.9 ppm) and 12 (13.3 ppm). Although concentrations of benzo(a)anthracene and benzo(a)pyrene were observed above Persaud's LEL guidance values, none exceeded Persaud's SEL guidance.

Toxicity Tests

Toxicity was measured using 10-day solid phase tests for survival and growth, on *Chironomus tentans* and *Hyalella azteca* following EPA and ASTM methods.

Surficial samples were collected to evaluate three regions within the study area. These regions included the depositional pools created upstream of the Burt (Station No. 6BCEF) and Newfane (Station No. 7ABC) Dams. Additionally, a surficial sediment sample was collected from the Erie Barge Canal (Station No. 8A) in the City of Lockport. Sample No. 6BCEF is a composite of surficial samples collected at Station Nos. 6B, 6C, 6E and 6F. The Station No. 7ABC sample was composed of sediments from Station Nos. 7A, 7B and 7C.

Chironomus tentans showed reduced growth (statistically significant) in sediment samples from the region behind the Newfane Dam (Station No. 7ABC). No differences in survival were observed in any samples

Water Sampling

Total and filtered water samples were taken from the Erie Barge Canal overflow structure in Lockport, NY (Station No. 8B) and immediately downstream of the Burt Hydroelectric Dam (Station No. 6A).

Sampling was performed to evaluate contaminated sediment transport from the Erie Barge Canal into Eighteenmile Creek and through Eighteenmile Creek into the Olcott Harbor AOC.

Unfortunately, no high flow storm events were encountered during the study. It was planned that water column sampling be performed during a period of high sediment resuspension. As total and filtered water sampling was not performed during such conditions, no sediment transport calculations were made.

Flow into Eighteenmile Creek was, however, elevated during this sampling (November 3, 1998) as the Erie Barge Canal was being drained for the winter. Winter drainage is accomplished by opening a submerged waste gate at the location where Eighteenmile Creek passes under the Erie Barge Canal.

Estimates of the sediment loading into and through Eighteenmile Creek were not calculated as low suspended solids and turbidity concentrations encountered during the water sampling.

Total and soluble trace metals sampling results (see Table 9-1) were at concentrations less than detection and reporting limits. As such, they were not used to estimate contaminant flux associated with sediment transport and no comparisons with NYS water quality standards were performed. It is expected that greater sediment loads and associated contaminant transport would be observed during high flow conditions.

Total and methylmercury results were also not evaluated against NYS water quality standards, as their dissolved fraction, which is the basis of the NYS standards, was not reported.

The PCB water sampling data (Table No. 9-3) show the majority of the Total PCBs measured at Station Nos. 6A and 8A is in the filtered or dissolved phase of the sample (96% and 90%, respectively). Total PCB concentrations were evaluated using the NYS water quality regulations (NYSDEC, 1999b). The water quality standard of 0.001 μg/l (1 ppt) for Total PCBs was exceeded in both samples collected (Station No. 6A = 84.13 ppt, Station No. 8B = 1.05 ppt).

Again, greater sediment resuspension and associated contaminant loading would be expected during a high-energy storm event. It is unknown if the high ratio of dissolved to total PCBs observed during this study would also be observed during such an event as a greater mass of sediment would be resuspended.

Only the octachlorodibenzo-p-dioxin (OCDD) congener was reported (Station No. 6A) at a concentration greater than the analytical detection limit (Table 9-4). The calculated toxic equivalency of the Total OCDD (1.5×10^{-9} ppb) was greater than the NYSDEC (1999b) water quality standard of 6×10^{-10} ppb (2,3,7,8-TCDD toxic equivalency) for human fish consumption.

Priority Waterbodies List (PWL)

The NYSDEC maintains a listing of waterbody segments whose best-intended usage is affected (NYSDEC, 2000). Both the New York State Erie Barge Canal and Eighteenmile Creek are included on the PWL as waterbodies whose primary usage is affected, or suspected to be affected, due to contaminated sediments. These waterbodies, including their impacted usage and source confirmation, are summarized in Table 10-1.

Table 10-1. Confirmation of Contaminated Sediments as Responsible for Priority Waterbodies Listing

Segment Name / Number	Primary Use Impacted	Severity	Type of Pollutant	PWL Listed Primary Source	Confirmation of Contaminated Sediments as Primary Source of Contamination	
Erie Barge Canal (#0102-022, Niagara River to Lockport)	Fish Consumption advisory (Carp- 1 meal / month) due to elevated PCBs	Impaired	Priority Organics	Contaminated Sediments	Confirmed	PCBs up to 5.3 ppm were measured during this study. Higher concentrations (93 ppm) have been reported by the New York State Canal Corporation (NYSCC, 2000).
Eighteenmile Creek (#0301-0002)	Fish Consumption advisory (all species- eat none) due to PCBs	Precluded	Priority Organics	Contaminated Sediments	Confirmed	High levels of metals (cadmium- 20.1 ppm, lead- 4,490 ppm, zinc- 15, 100 ppm, etc.), PCBs (24.9 ppm) and dioxins/furans (176,000 ppt) measured.

Chapter 11 - QA/QC

In evaluating the Quality Control results for the PAH, pesticides, PCB congener, and dioxin/furan analyses, although some individual parameters fell outside the control limits, the analytical quality control results generally met their criteria and represent a data set of good quality.

Data Quality Requirements and Assessments

Field sampling and laboratory analyses were performed in accordance with approved EPA standard procedures (Table 1-3) unless otherwise noted. 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 is based upon historical laboratory results and not field results.

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, a blind field duplicate of a surficial sample was submitted for laboratory analysis. This sample was taken from a homogenized ponar sample and submitted under a fictitious station identifier. 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. In addition, a blind field duplicate was also submitted for analysis. 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 1613B 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 contract labs (NYSDEC, 1991, See ASP Exhibit E in Vol. 8).
- Representativeness: It is expected, based upon professional judgment of sampling locations that the sediment samples collected were representative of

sediments from the study area. Sediment cores were collected from depositional areas that are not dredged. Radiodating of three cores was performed to evaluate the depositional patterns and rates. Radiodating results can be useful for quantifying historical deposition and determining if dredging occurred at the site. Surficial sediment samples were also evaluated as they 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 85 percent of the sediment cores and surficial samples will define completeness for this aspect of the study. Also, any data not meeting minimum QA criteria will be identified.

Sampling Procedures

Most of the sediment cores were two and one half-inch diameter hand, push-cores collected from small skiffs. Four-inch diameter cores were also taken from onboard the NYSDEC's twenty-four foot pontoon boat using an electric vibrocorer (PVL Technologies, Model VT-1). Surficial sediment samples were collected using either Standard Ponar® or Petite Ponar® grab samplers.

Complete descriptions of the sediment coring and surficial sampling procedures, including sample custody procedures is presented, in detail, in the USEPA-approved Quality Assurance Plan (NYSDEC, 1998b).

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 on a dry weight basis in ppm, ppb and ppt. All field and laboratory QA/QC results have been reported including any 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 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 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 as well as 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 is conducted to evaluate inorganic and conventional parameters. These QC samples were analyzed at a frequency of one 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 difference

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 *i*th 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:

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

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:

$$\% \text{ Completeness} = \frac{v}{n} x100\%$$

where: v = number of valid samples

n = number of valid samples necessary to achieve project objectives

Blind Field Duplicates

A blind field duplicate was collected at one site and submitted for laboratory analysis. The laboratories utilized were not informed they were analyzing a field prepared split sample. This sample was submitted to evaluate the overall variability in sample results due to field sampling techniques and laboratory precision. The blind field duplicate was composed of sample material collected at Station No. 7ABC (Newfane Dam, composite of surficial samples collected at Station Nos. 7A, 7B and 7C). The blind field duplicate sample was identified as Station No. 13. Results of these samples are presented with the sample variation (represented by RPD) in Tables 11-1 (trace metals) and 11-2 (inorganics). No RPD calculations for organic parameters were performed as, due to a sampling error, an organic blind field duplicate sample was not submitted for analysis.

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 were randomly spot checked.

Inorganics

All sample holding times as required by the methods were met. The method blanks were within the method criteria. The Laboratory Control Samples (LCS) for Total Organic Carbon (TOC) were within the laboratory control limits. The matrix spike recoveries for TOC were within the 75-125% control limits. The matrix spike duplicates were within the 20% RPD control limits. Replicate analyses were within the 20% RPD with the exception of TVS (22.3 %) for Station No. 6E (40-60 cm). TOC samples were dried prior to analysis. The RPD for TOC for the Station Nos. 7ABC and 13 blind field duplicate was 141.28 %.

Table 11-1. Field Duplicate Results- Trace Metals
all concentrations ppm, dry weight basis unless otherwise noted

Station	Depth(cm)	Aluminum, Total	Arsenic, Total	Cadmium, Total		Chromium, Total	Copper, Total	Iron, Total
7ABC	Surficial	13,900	7.5	2.1	B	105	241	2.38
13	Surficial	16,100	7.6	2.4	B	122	280	2.8
% RPD		14.67	1.32	13.33		14.98	14.97	14.79

Station	Depth(cm)	Lead, Total	Mercury Total	Monomethyl Mercury (ppb)	Nickel, Total	Silver, Total		Zinc, Total
7ABC	Surficial	329	1.1	5.49	56.2	1	B	816
13	Surficial	378	1.26	3.26	64.3	1.10	B	934
% RPD		13.86	13.56	50.97	13.44	9.52		13.49

Data Qualifiers: B- Compound detected above reporting levels in method blank

Table 11-2. Field Duplicate Results- Inorganics

Station No.	Sample Depth (cm)	Total Organic Carbon (%)	Solids (%)	Total Volatile Solids (%)
7ABC	Surficial	7.09	25.7	12.4
13	Surficial	1.22	26.3	13.4
% RPD		141.28	2.31	7.75

Metals

All analyses were performed within the required holding times. All Initial and Continuing Calibration Blanks (ICB/CCBs) were within control limits. Preparation and method blanks were below reporting limits. All Interference Check Samples (ICSA and ICSAB) were within control limits as were Laboratory Control Samples (80-120% control limits).

All Serial Dilution percent differences were within the Contract Lab Protocol (CLP) control limits. All Matrix Spike recoveries were within the 75-125% control limits (exception allowed when sample concentration exceeds the spike added concentration by a factor of four or more). MS analyses are not required for calcium, magnesium, sodium, potassium in waters and soils. Also, not required for aluminum and iron in soils. All duplicate analyses were within the method criteria.

High Resolution Mercury/Monomethyl Mercury Analysis

All analyses were performed within the required holding times. All Initial and Continuing Calibration Blanks (ICB/CCBs) were within control limits. Quality control samples met acceptance criteria as did calibration and method blanks. With the exception of water sample 6A the method duplicate acceptance criteria was met for all other samples. The sample 6a method duplicate acceptance criterion is RPD≤41% or ± the PQL if the native sample concentration ≤5 times the PQL. Duplicate analysis was performed on water sample 6A. The native sample concentration was <5x the PQL and the results yielded met the acceptance criterion. On this basis, qualification of the data was not required.

All matrix spike analyses met the acceptance criterion and the overall data quality was deemed acceptable. The RPD for the monomethyl mercury for Station Nos. 7ABC and 13 blind field duplicates was 50.97%.

Pesticides

The following narrative is provided in reference to Quanterra Lot Number: H9C290134

Twenty three (23) sediment samples were received in November 1998 and were transferred to the Knoxville Laboratory in March 1999 for the analysis of selected organochlorine pesticides. The method referenced for the analysis was gas chromatography / high-resolution mass spectrometry. The quantitation method specified was isotope dilution for analytes for which a stable isotopically labeled analog was available. Isotopically labeled internal standards were used far other analytes. Two samples were lost to breakage in the laboratory (Station Nos. 6F 10-28 and 6F 52-70). The remaining samples, control samples and blanks were extracted, purified and analyzed using Quanterra Knoxville Standard Operating Procedure ID00014. Extracts were analyzed by GUMS operating in the selected ion monitoring mode for enhanced sensitivity. The results reported are applicable to the samples submitted for analysis only.

Summary of PCB Congeners Analysis

Sediment Samples

All samples including the Method Blank and Laboratory Control Sample had low recovery of 13C-DecaCB-209. The signal to noise ratio exceeds 10:1 in all samples and because the quantitation of this analyte is corrected by isotope dilution, the data quality is not affected.

In several samples (6C: 60-70 cm, 6C: 70-80 cm, 6E: 40-56 cm, 6E: 56-74 cm, 6F: 28-52 cm, 7C: 0-20 cm, 8A: 20-30 cm, 12: 0-18 cm) the ion abundance ratio for the 13C-TCB-81 surrogate exceeds the theoretical value by more than 15% due most likely to matrix interference. Depending on the extent of the contribution of the interfering peak, recovery of the surrogate may be biased high. There were no other anomalies associated with this report.

Water Samples

Many analytes in the Laboratory Control Sample associated with PCB analyses show very low or very high recovery. Those compounds which are quantitated by isotope dilution are least affected, while those for which internal standard quantitation is used have much higher variability. The anomalous recoveries are most likely due to the selective loss of particular congeners during extract cleanup. No backup sample was available to perform reextraction. Quantitation of compounds which show very low or very high recovery in the LCS should be considered estimated.

There were no other anomalies associated with this report.

Summary of Dioxins/Furans (Sediment and Water Samples)

Detection limits for dioxins and furans are reported on a sample specific basis and all results are recovery corrected per the isotope dilution technique.

PAHs

Several samples had PAH internal standard recoveries outside the recovery goals. These results were flagged with an "m" qualifier and data was reviewed for impact on quality. In all cases, there was no negative impact on native quantitation and results were reported.

There were no other anomalies associated with this report.

Toxicity Tests

A standard reference toxicant (SRT) test was conducted for *Chironomus tentans*, and *Hyalella azteca*; the resulting LC50 values fell within control chart limits and were viewed as being acceptable.

Field Audit

A field audit for the project was not performed.

Chapter 12 References

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Appendix A. Trace Metals
All Concentrations ppm (dry weight) unless otherwise noted

Station No.	Depth (cm)	Aluminum, Total	Arsenic, Total	Cadmium, Total	Chromium, Total	Copper, Total
6BCEF	Surficial	13,500	6.5	2.3 B	103	197
6C	0-10	14,400	5.9 B	2.4 B	121	258
6C	10-20	13,900	6.2	3 B	152	298
6C	20-30	16,500	7.8	4.4	175	352
6C	30-40	15,200	6.9	7.2	251	532
6C	40-50	13,900	6.9	8.9	344	653
6C	50-60	14,700	7	7.3	365	563
6C	60-70	15,200	10.8	16.2	1240	1260
6C	70-80	17,400	12.3	11.6	848	2450
6C	80-90	16,400	12.1	8.3	424	2200
6C	90-99	16,500	10.6	10.4	450	1880
6E	0-26	13,100	4.4 B	3	158	328
6E	26-40	11,700	4.3 B	7.7	284	562
6E	40-56	8,450	4.8 B	11.6	753	851
6E	56-74	15,100	12.5	20.1	1490	2310
6F	0-10	11,100	6.5	2.5 B	107	351
6F	10-28	7,730	4.9	2.4	124	191
6F	28-52	6,280	11.7	9.4	616	1270
6F	52-70	14,400	9.6	2.6	113	449
6F	70-110	11,400	10.5	2.2	75	299
7ABC	Surficial	13,900	7.5	2.1 B	105	241
7A	0-20	17,200	10.6	9.5	798	1330
7A	20-50	12,600	12.1	4.5	251	795
7A	50-90	13,400	12.5	0.96 B	89.9	193
7A	90-104	12,800	11.2	1 B	176	215
7B	0-20	13,000	6.2	2.2 B	112	246
7B	20-58	10,500	4.3	0.23 B	15.7	19.9
7B	58-66	9,250	4.3	0.24 B	14.4	15.9
7C	0-20	14,700	7.5	5.5	380	639
7C	20-70	13,800	11	2.6	195	468
7C	70-83	18,000	12.3	1.2 B	89.2	172
8A	0-10	13,700	5.7	0.24 B	29.4	40
8A	10-20	13,200	5.5	0.51 B	33.2	45.4
8A	20-30	11,700	15.1	5.4	90.8	97.8
8A	30-40	11,100	4.2	1.6	47.3	58.1
8A	40-50	11,100	10	2.6	64.6	79.3
8A	50-60	11,900	4.9	0.48 B	31.8	43.7
8A	60-70	12,300	4.9	0.72 B	36.3	50.2
8A	70-80	12,500	5.1	0.97 B	39.6	51.8
8A	80-90	11,700	5.5	2.1	65.7	75.4
8A	90-94	10,700	7.5	5.6	90.5	106
9	Surficial	10,200	7.7	0.86 B	17.9	20.2
10	Surficial	15,600	6.5	0.45 B	22.5	24.2
11	Surficial	9,070	4.2	0.67 B	82.1	80.2
12	0-18	6,720	6.2	1.3 B	42.6	252
12	18-27	7,790	9.9	1.4 B	64.2	291
13 (1)	Surficial	16,100	7.6	2.4 B	122	280

Notes:
U- Parameter not detected at or above reporting limit
B- Parameter was between instrument detection limit and contract required detection limit.
(1)- Blind Field Duplicate of Sample From Station No. 7ABC

Appendix A. Trace Metals, Cont.

All Concentrations ppm (dry weight) unless otherwise noted

Station No.	Depth (cm)	Iron, Total	Lead, Total	Nickel, Total	Silver, Total	Zinc, Total
6BCEF	Surficial	2.46	278	45.2	1.3 B	813
6C	0-10	2.56	357	56.4	1.4 B	1010
6C	10-20	2.47	413	63.8	1.5 B	1260
6C	20-30	3.07	488	76	2 B	1550
6C	30-40	2.92	870	122	3.7 B	2880
6C	40-50	2.59	909	300	3.9 B	3520
6C	50-60	2.88	872	281	2.2 B	3340
6C	60-70	3.29	1990	478	5.2	6560
6C	70-80	3	4490	360	5.8	10800
6C	80-90	3.07	3120	200	8	2540
6C	90-99	2.98	2190	195	6.2	2850
6E	0-26	2.41	454	72.8	1.6 B	1400
6E	26-40	2.15	787	312	2.8 B	3290
6E	40-56	1.87	1190	312	3 B	3070
6E	56-74	2.57	4150	270	5.8 B	11600
6F	0-10	2.39	318	60.3	2.4 B	950
6F	10-28	1.83	320	120	0.8 B	1210
6F	28-52	2.32	2740	997	2.2 B	15100
6F	52-70	3.21	673	94.8	1.8 B	1160
6F	70-110	2.42	315	40.3	1.6 B	1140
7ABC	Surficial	2.38	329	56.2	1 B	816
7A	0-20	3.25	2840	178	4.6 B	8640
7A	20-50	2.29	900	74.3	2.9 B	2040
7A	50-90	2.69	346	26.1	1.3 B	485
7A	90-104	2.56	545	24.2	1.7 B	424
7B	0-20	2.38	321	58.1	0.97 B	829
7B	20-58	2.01	21.3	19.4	U	71.8
7B	58-66	1.97	15.9	18.5	U	60.4
7C	0-20	2.84	1240	117	2.4 B	3620
7C	20-70	2.76	825	61.1	1.7 B	1820
7C	70-83	3.32	353	31.9	1.3 B	443
8A	0-10	2.93	33.6	32.1	0.33 B	212
8A	10-20	2.77	40.3	33.8	0.6 B	254
8A	20-30	2.35	80.1	37.6	1.5 B	669
8A	30-40	2.33	115	31.8	0.69 B	341
8A	40-50	2.46	75.2	43.1	0.92 B	603
8A	50-60	2.56	101	33.1	0.56 B	233
8A	60-70	2.58	55.4	36	0.42 B	263
8A	70-80	2.53	54.2	38.4	0.34 B	277
8A	80-90	2.49	84	48.1	0.69 B	450
8A	90-94	2.19	99.7	40	1.2 B	899
9	Surficial	2.49	103	22.9	U	170
10	Surficial	2.81	26.4	26.8	U	130
11	Surficial	1.18	236	20.2	U	558
12	0-18	1.66	354	25.5	1.5 B	640
12	18-27	2.04	493	34.6	3.5	774
13 (1)	Surficial	2.76	378	64.3	1.1 B	934
		0				

Notes:

U- Parameter not detected at or above reporting limit

B- Parameter was between instrument detection limit and contract required detection limit.

(1)- Blind Field Duplicate of Sample From Station No. 7ABC

Appendix B. Low Level Mercury Results

All Concentrations ppb (dry weight)

Station No.	Depth (cm)	Mercury, Total	Methylmercury	Qualifiers
6BCEF	Surficial	640	2.36	
6C	0-10	757	2.99	
6C	10-20	717	1.78	
6C	20-30	596	0.484	M,J
6C	30-40	914	1.06	
6C	40-50	988	0.956	
6C	50-60	870	0.904	
6C	60-70	1,270	5.46	J
6C	70-80	2,380	3.81	J
6C	80-90	3,310	7.21	
6C	90-99	3,130	7.33	J
6E	0-26	1,030	1.58	
6E	26-40	949	0.963	J
6E	40-56	1,420	2.99	
6E	56-74	2,620	10.1	
6F	0-10	590	5.23	J
6F	10-28	536	0.726	
6F	28-52	2,060	3.15	
6F	52-70	2,370	1.918	J
6F	70-110	2,970	2.71	J
7ABC	Surficial	1,100	5.49	
7A	0-20	1,330	2.98	
7A	20-50	4,730	4.81	
7A	50-90	4,360	2.51	
7A	90-104	10,100	1.9	J
7B	0-20	757	1.7	
7B	20-58	101	0.111	
7C	0-20	966	2.17	J
7C	20-70	3,340	4.44	
7C	70-83	4,340	2.57	
8A	0-10	118	0.211	
8A	10-20	526	0.628	J
8A	20-30	673	0.924	
8A	30-40	197	0.091	
8A	40-50	270	0.233	
8A	50-60	142	0.271	
8A	60-70	180	0.12	
8A	70-80	195	0.291	
8A	80-90	210	0.009	B,J
8A	90-94	455	0.452	J
10	Surficial	58	2.51	
11	Surficial	83	1.05	
13 (1)	Surficial	1,260	3.26	

Notes:
B- Result is above method detection limit but less than practical quantitation limit.
J- Estmated value.
M- Duplicate precision (RPD) was not within acceptable criteria.
1- Blind Field Duplicate of Sample from Station No. 7ABC

Appendix C. Pesticide Results

ppb, dry weight

Station	Depth (cm)	2,4'-DDD			2,4'-DDE			2,4'-DDT			4,4'-DDD		
6BCEF	Surficial	0.96			0.099		J Q	0.19		J Q	2.7		
6C	0-10	0.69		J	0.065		J Q	0.26		J	1.9		
6C	10-20	0.56		J	0.075		J Q	0.1		J	1.4		
6C	20-30	0.36		J	0.05		J Q	0.08		J Q	1		
6C	30-40	0.73			0.19		J	0.48		J Q	1.5		
6C	40-50	0.59			0.19		J Q	0.11		J	1.1		
6C	50-60	0.6			0.21		J Q	0.15		J	1.2		
6C	60-70	3.2			0.73			0.6		J	7.3		
6C	70-80	11			1.7		J Q	ND	9.2	U	25		
6C	80-90	3.4			2.9		Q	1.7		J	10		
6C	90-99	1.3		J	2.2		Q	ND	1.8	U	4.1		
6E	0-26	0.75			0.1		J Q	0.16		J	2		
6E	26-40	0.65			0.2		J Q	0.21		J	1.5		
6E	40-56	2.5			0.47		J Q	0.59			5.9		
6E	56-74	18			2.7		J	ND	12	U	54		
6F	0-10	1.2			0.11		J Q	0.62			3.4		
6F	28-52	9.7			2.3		J	ND	1.7	U	25		
6F	70-110	0.01		J Q	ND	0.026	U	ND	0.022	U	0.03		J Q
7ABC	Surficial	0.88			0.078		J,Q	0.21		J	2.9		
7A	0-20	2.3			0.68		J	0.24		J	5.4		
7A	20-50	0.54		J	0.62		J	ND	0.21	U	1.7		
7A	50-90	ND	0.1	U	ND	0.016	U	ND	0.04	U	ND	0.044	U
7A	90-104	ND	0.0	U	ND	0.019	U	ND	0.019	U	ND	0.021	U
7B	0-20	1.8			0.16		J	0.27		J	4.5		
7B	20-58	2.2			0.18		J Q	0.22		J	5		
7B	58-66	ND	0.0	U	ND	0.015	U	ND	0.015	U	ND	0.014	U
7C	0-20	1.3			0.19		J Q	0.2		J	3		
7C	20-70	0.56			0.092		J Q	0.08		J	1.3		
7C	70-83	ND	0.0	U	ND	0.028	U	ND	0.02	U	ND	0.023	U
8A	0-10	0.017		J	ND	0.021	U	ND	0.012	U	0.057		J
8A	10-20	0.082		J	0.02		J Q	0.014		J Q	0.25		J
8A	20-30	0.61			0.15		J Q	0.35		Q	2.6		
8A	30-40	1.3			0.4			0.11		J Q	3.6		
8A	40-50	0.36			0.072		J Q	0.057		J Q	1.1		
8A	50-60	0.15			0.033		J Q	0.066		J Q	0.57		
8A	60-70	0.12		J	0.029		J Q	0.047		J Q	0.48		
8A	70-80	0.081		J	0.035		J Q	0.019		J Q	0.28		J
8A	80-90	0.23		J	0.22		J	0.039		J Q	0.96		
8A	90-94	0.55			0.63			0.15		J	1.8		
9	Surficial	0.47			0.12		J	0.51			1.8		
10	Surficial	0.29		J	0.029		J Q	0.056		J Q	0.68		
11	Surficial	0.13		J	ND	0.068	U	ND	0.044	U	0.3		J
12	0-18	7.9			0.45			8.3			20		
12	18-27	4.3			0.34		J	1.3			12		

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	4,4'-DDE			4,4'-DDT			Aldrin			alpha-BHC		
6BCEF	Surficial	5.4			0.87			ND	0.048	U	ND	0.039	U
6C	0-10	4.4			1.3			ND	0.036	U	ND	0.044	U
6C	10-20	3.4			0.47		J	ND	0.023	U	ND	0.034	U
6C	20-30	2.8			0.38		J	ND	0.025	U	ND	0.033	U
6C	30-40	6			2.1			ND	0.026	U	0.02		J
6C	40-50	6.2			0.42		J	ND	0.031	U	0.017		J Q
6C	50-60	7.3			0.63			ND	0.033	U	0.028		J
6C	60-70	19			2.2			ND	0.082	U	0.18		J
6C	70-80	32			2.7			ND	0.25	U	0.26		J
6C	80-90	36			5			ND	0.15	U	0.12		J Q
6C	90-99	21			1.2		J	ND	0.15	U	0.12		J Q
6E	0-26	4.4			0.58			ND	0.023	U	ND	0.033	U
6E	26-40	6.3			0.77			ND	0.036	U	0.031		J
6E	40-56	12			1.1		J	ND	0.056	U	0.044		J
6E	56-74	39		Q	2.5		J	ND	0.56	U	0.2		J
6F	0-10	5.6			3.7			ND	0.037	U	0.023		J
6F	28-52	35			1.9		J	0.17		J	0.083		J Q
6F	70-110	0.035		J Q	0.037		J Q	ND	0.039	U	0.019		J
7ABC	Surficial	4.1			0.75			ND	0.12	U	0.025		J
7A	0-20	14			0.97			ND	0.079	U	0.047		J,Q
7A	20-50	7.1			0.39		J	ND	0.14		ND	0.1	U
7A	50-90	0.053		J Q	ND	0.076	U	ND	0.025	U	ND	0.021	U
7A	90-104	ND	0.059	U	ND	0.02	U	ND	0.042	U	ND	0.024	U
7B	0-20	7.4			0.71			ND	0.035	U	0.022		J
7B	20-58	8			0.58			ND	0.037	U	0.017		J
7B	58-66	ND	0.032	U	ND	0.021	U	ND	0.011	U	ND	0.01	U
7C	0-20	5.4			0.69			0.048		J	0.033		J Q
7C	20-70	1.4			0.24		J	ND	0.032	U	0.016		J
7C	70-83	ND	0.032	U	ND	0.057	U	ND	0.028	U	ND	0.034	U
8A	0-10	0.1		J Q	0.027		J Q	ND	0.014	U	ND	0.02	U
8A	10-20	0.47		Q	0.068		J Q	ND	0.0076	U	0.013		J Q
8A	20-30	2.8		Q	8.1			0.021		J	0.014		J
8A	30-40	6.4			0.21		J	0.021		J	0.024		J Q
8A	40-50	1.6			0.18		J	ND	0.02	U	ND	0.021	U
8A	50-60	0.87			0.22		J	ND	0.033	U	ND	0.027	U
8A	60-70	0.87			0.16		J	ND	0.023	U	ND	0.027	U
8A	70-80	0.53		Q	0.098		J	ND	0.016	U	ND	0.032	U
8A	80-90	3.4			0.13		J	ND	0.022	U	0.02		J
8A	90-94	12			0.41			0.032		J	0.046		J
9	Surficial	3			2.9			0.14		J	0.03		J
10	Surficial	2.1			0.21		J	ND	0.019	U	ND	0.019	U
11	Surficial	0.42		Q	0.17		J	ND	0.022	U	0.05		J Q
12	0-18	8.9			16			0.07		J	0.042		J
12	18-27	5			2.2			ND	0.05	U	0.055		J

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	alpha-Chlordane			alpha-Endosulfan			beta-BHC			beta-Endosulfan		
6BCEF	Surficial	0.33		J	ND	3	U	0.057		J Q			NR
6C	0-10	0.21		J Q	ND	1.9	U	0.058		J Q			NR
6C	10-20	0.23		J	ND	2.5	U	0.037		J Q			NR
6C	20-30	0.14		J	ND	2.2	U	0.036		J			NR
6C	30-40	0.88			ND	1.9	U	0.033		J Q			NR
6C	40-50	0.51		J	ND	1.6	U	ND	0.053	U			NR
6C	50-60	0.55			ND	1.1	U	0.02		J Q			NR
6C	60-70	3.2		Q	ND	6	U	0.044		J Q			NR
6C	70-80	8			ND	14	U	ND	0.26	U			NR
6C	80-90	1.9		Q J	ND	11	U	0.17		J Q			NR
6C	90-99	0.75		J Q	ND	5.4	U	ND	0.24	U			NR
6E	0-26	0.36		J	ND	1.1	U	0.031		J Q			NR
6E	26-40	0.58			ND	1.3	U	0.022		J Q			NR
6E	40-56	2.1			ND	1.6	U	0.056		J Q			NR
6E	56-74	7			ND	8.8	U	0.27		J Q			NR
6F	0-10	0.45		J	ND	0.85	U	0.056		J			NR
6F	28-52	4.2			ND	6.6	U	0.14		J Q			NR
6F	70-110	ND	0.08	U	ND	2.6	U	ND	0.05	U			NR
7ABC	Surficial	0.33		J	ND	1.4	U	0.071		J			NR
7A	0-20	1.5			ND	1.7	U	0.057		J			NR
7A	20-50	0.36		J,Q	ND	2.4	U	ND	0.14				NR
7A	50-90	ND	0.047	U	ND	1.1	U	ND	0.02	U			NR
7A	90-104	ND	0.04	U	ND	3.3	U	ND	0.051	U			NR
7B	0-20	1.4			ND	3.5	U	0.045		J Q			NR
7B	20-58	0.73			0.26		J	0.039		J Q			NR
7B	58-66	ND	0.022	U	ND	0.6	U	ND	0.017	U			NR
7C	0-20	0.66			ND	0.78	U	ND	0.057	U			NR
7C	20-70	0.24		J	ND	1.4	U	ND	0.032	U			NR
7C	70-83	ND	0.055	U	ND	0.32	U	ND	0.03	U			NR
8A	0-10	ND	0.11	U	ND	1.7	U	ND	0.03	U			NR
8A	10-20	0.15		J	ND	0.62	U	0.011		J Q			NR
8A	20-30	0.54			ND	0.6	U	0.017		J Q			NR
8A	30-40	0.99		Q	ND	1	U	0.018		J			NR
8A	40-50	0.31		J	ND	0.84	U	0.02		J			NR
8A	50-60	0.17		J	ND	0.93	U	ND	0.027	U			NR
8A	60-70	0.18		J	ND	0.24	U	ND	0.035	U			NR
8A	70-80	0.12		J	ND	0.3	U	ND	0.026	U			NR
8A	80-90	0.23		J	ND	0.43	U	ND	0.026	U			NR
8A	90-94	0.5			ND	0.91	U	ND	0.058	U			NR
9	Surficial	9.9		Q	2.7			0.016		J Q			NR
10	Surficial	ND	0.07	U	ND	2.9	U	0.039		J			NR
11	Surficial	0.16		J Q	ND	4	U	0.38		J	ND	1.5	U
12	0-18	2.3			ND	4.9	U	0.11		J			NR
12	18-27	1.3			ND	2.3	U	0.15		J			NR

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	cis-Nonachlor			delta-BHC			Dieldrin			Endosulfan-sulfate		
6BCEF	Surficial	ND	0.39	U	ND	0.045	U	0.18		J Q			NR
6C	0-10	ND	0.4	U	ND	0.051	U	ND	0.19	U			NR
6C	10-20	ND	0.25	U	ND	0.017	U	ND	0.1	U			NR
6C	20-30	ND	0.36	U	ND	0.041	U	ND	0.092	U			NR
6C	30-40	0.33		J	ND	0.017	U	0.12		J			NR
6C	40-50	0.17		J Q	ND	0.042	U	0.098		J			NR
6C	50-60	0.25		J	ND	0.04	U	0.22		J			NR
6C	60-70	0.95			ND	0.089	U	7.6					NR
6C	70-80	1.7		J	ND	0.24	U	36					NR
6C	80-90	0.89		J	ND	0.21	U	1.5		J			NR
6C	90-99	ND	2	U	ND	0.16	U	ND	0.97	U			NR
6E	0-26	0.14		J	ND	0.036	U	0.25		J Q			NR
6E	26-40	0.24		J	ND	0.024	U	0.51					NR
6E	40-56	0.62			ND	0.068	U	14					NR
6E	56-74	1.8		J	ND	0.44	U	68					NR
6F	0-10	0.13		J Q	ND	0.02	U	0.31		J Q			NR
6F	28-52	1.2		J	ND	0.25	U	8.6					NR
6F	70-110	ND	0.17	U	ND	0.037	U	ND	0.15	U			NR
7ABC	Surficial	ND	0.78		ND	0.058	U			NR			NR
7A	0-20	0.61		J	ND	0.082	U			NR			NR
7A	20-50	ND	0.9	U	ND	0.12				NR			NR
7A	50-90	ND	0.17	U	ND	0.032	U			NR			NR
7A	90-104	ND	0.15	U	ND	0.029	U			NR			NR
7B	0-20	0.3		J	ND	0.042	U			NR			NR
7B	20-58	0.16		J Q	ND	0.019	U			NR			NR
7B	58-66	ND	0.049	U	ND	0.022	U			NR			NR
7C	0-20	0.15		J Q	ND	0.051	U			NR			NR
7C	20-70	ND	0.28	U	ND	0.026	U			NR			NR
7C	70-83	ND	0.13	U	ND	0.023	U			NR			NR
8A	0-10	ND	0.14	U	ND	0.014	U			NR			NR
8A	10-20	ND	0.26	U	ND	0.014	U			NR			NR
8A	20-30	0.13		J Q	ND	0.028	U			NR			NR
8A	30-40	0.26		J	ND	0.043	U			NR			NR
8A	40-50	0.12		J	ND	0.023	U			NR			NR
8A	50-60	ND	0.27	U	ND	0.027	U			NR			NR
8A	60-70	ND	0.37	U	ND	0.029	U			NR			NR
8A	70-80	ND	0.28	U	ND	0.028	U			NR			NR
8A	80-90	0.15		J	ND	0.022	U			NR			NR
8A	90-94	0.32			ND	0.031	U			NR			NR
9	Surficial	3.8			ND	0.016	U			NR			NR
10	Surficial	ND	1.1	U	ND	0.041	U	ND	0.092	U			NR
11	Surficial	ND	0.24	U	0.046		J	0.38		J	ND	0.042	U
12	0-18	0.49			ND	0.034	U			NR			NR
12	18-27	0.3		J	0.041		J Q			NR			NR

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	Endrin			Endrin-aldehyde			Endrin-ketone			gamma-BHC (Lindane)		
6BCEF	Surficial	ND	0.69	U			NR	ND	0.66	U	ND	0.045	U
6C	0-10	ND	0.98	U			NR	ND	1.2	U	ND	0.047	U
6C	10-20	ND	1.4	U			NR	ND	2.5	U	0.065		J
6C	20-30	ND	0.89	U			NR	ND	1.4	U	ND	0.074	U
6C	30-40	ND	1.3	U			NR	ND	1.2	U	0.15		J
6C	40-50	ND	1.2	U			NR	ND	1.5	U	0.019		J
6C	50-60	ND	0.53	U			NR	ND	0.73	U	0.019		J Q
6C	60-70	ND	2	U			NR	ND	2.2	U	0.063		J
6C	70-80	ND	4.6	U			NR	ND	5.8	U	0.16		J
6C	80-90	ND	4.4	U			NR	ND	6.3	U	0.17		J
6C	90-99	ND	2.1	U			NR	ND	2.1	U	ND	0.16	U
6E	0-26	ND	0.5	U			NR	ND	0.5	U	ND	0.028	U
6E	26-40	ND	0.46	U			NR	ND	0.63	U	0.036		J
6E	40-56	ND	0.74	U			NR	ND	0.95	U	0.047		J Q
6E	56-74	ND	2.9	U			NR	ND	4.4	U	0.32		J Q
6F	0-10	ND	0.96	U			NR	ND	1.2	U	0.04		J Q
6F	28-52	ND	4.2	U			NR	ND	3.6	U	0.08		J Q
6F	70-110	ND	1.4	U			NR	ND	1.5	U	0.028		J
7ABC	Surficial	ND	2.2				NR			NR	0.054		J
7A	0-20	ND	1.1	U			NR			NR	0.047		J Q
7A	20-50	ND	1.5	U			NR			NR	ND	0.11	
7A	50-90	ND	0.72	U			NR			NR	ND	0.021	U
7A	90-104	ND	0.59	U			NR			NR	0.021		J Q
7B	0-20	ND	1.4	U			NR			NR	0.031		J Q
7B	20-58	ND	0.69	U			NR			NR	ND	0.024	U
7B	58-66	ND	0.57	U			NR			NR	ND	0.019	U
7C	0-20	ND	0.57	U			NR			NR	ND	0.057	U
7C	20-70	ND	0.62	U			NR			NR	ND	0.026	U
7C	70-83	ND	0.36	U			NR			NR	ND	0.032	U
8A	0-10	ND	0.53	U			NR			NR	ND	0.032	U
8A	10-20	ND	0.37	U			NR			NR	ND	0.014	U
8A	20-30	ND	1.1	U			NR			NR	ND	0.032	U
8A	30-40	0.49		Q			NR			NR	0.015		J
8A	40-50	ND	0.64	U			NR			NR	ND	0.018	U
8A	50-60	ND	0.41	U			NR			NR	ND	0.027	U
8A	60-70	ND	0.18	U			NR			NR	0.019		J Q
8A	70-80	ND	0.096	U			NR			NR	ND	0.028	U
8A	80-90	ND	0.11	U			NR			NR	0.014		J Q
8A	90-94	ND	0.83	U			NR			NR	0.024		J
9	Surficial	ND	0.53	U			NR			NR	0.022		J Q
10	Surficial	ND	0.83	U			NR	ND	1.3	U	ND	0.024	U
11	Surficial	ND	0.74	U	ND	0.72	U	ND	1.6	U	ND	0.07	U
12	0-18	ND	1.4	U			NR			NR	0.053		J
12	18-27	ND	1	U			NR			NR	0.066		J

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	gamma-Chlordane			Heptachlor			Heptachlor-epoxide			Hexachloro-benzene	
6BCEF	Surficial	0.3		J	ND	0.026	U	ND	0.042	U	0.72	B
6C	0-10	0.26		J	ND	0.023	U	ND	0.047	U	0.91	B
6C	10-20	0.19		J	ND	0.02	U	ND	0.03	U	0.78	B
6C	20-30	0.11		J	ND	0.015	U	ND	0.03	U	0.53	J B
6C	30-40	0.45		J	0.018		J Q	ND	0.085	U	2.2	J
6C	40-50	0.31		J	ND	0.012	U	ND	0.042	U	2.6	B
6C	50-60	0.35		J	ND	0.021	U	ND	0.048	U	2.5	B
6C	60-70	2.8			ND	0.06	U	ND	0.1	U	3.5	B
6C	70-80	7.3			ND	0.22	U	ND	0.31	U	5.5	B
6C	80-90	2.9			ND	0.14	U	ND	0.23	U	4.4	B
6C	90-99	1.5		J	ND	0.092	U	ND	0.27	U	1.1	J B
6E	0-26	0.36		J	ND	0.022	U	ND	0.053	U	2	B
6E	26-40	0.41		J	0.018		J	ND	0.058	U	2.9	B
6E	40-56	1.6			ND	0.056	U	ND	0.092	U	4.4	B
6E	56-74	8.2			ND	0.25	U	ND	0.61	U	22	B
6F	0-10	0.4		J	ND	0.013	U	ND	0.045	U	1.5	B
6F	28-52	4.2			ND	0.16	U	ND	0.23	U	6.6	B
6F	70-110	ND	0.085	U	ND	0.024	U	ND	0.05	U	0.069	J B
7ABC	Surficial	0.41		J	ND	0.041	U	0.028		J	0.92	B
7A	0-20	1.1			ND	0.05	U	ND	0.033	U	7.2	B
7A	20-50	0.49		J	ND	0.11	U	ND	0.097	U	3.4	B
7A	50-90	ND	0.078	U	ND	0.016	U	ND	0.023	U	0.034	J B
7A	90-104	ND	0.059	U	ND	0.021	U	ND	0.019	U	0.026	J B
7B	0-20	1.4			0.017		J Q	0.045		J Q	1.5	B
7B	20-58	0.67			ND	0.019	U	ND	0.026	U	1.7	B
7B	58-66	ND	0.24	U	ND	0.0068	U	ND	0.012	U	0.0082	J Q B
7C	0-20	0.6			ND	0.022	U	ND	0.033	U	1.3	B
7C	20-70	0.26		J	ND	0.017	U	ND	0.032	U	0.62	B
7C	70-83	ND	0.064	U	ND	0.014	U	ND	0.026	U	0.012	J B
8A	0-10	0.044		J	ND	0.01	U	ND	0.02	U	0.027	J B
8A	10-20	0.22		J	ND	0.015	U	ND	0.012	U	0.064	J B
8A	20-30	0.63			ND	0.021	U	ND	0.032	U	0.15	J B
8A	30-40	1.1			ND	0.018	U	ND	0.033	U	0.61	B
8A	40-50	0.31		J	ND	0.014	U	ND	0.028	U	0.16	J B
8A	50-60	0.16		J	ND	0.016	U	ND	0.027	U	0.061	J B
8A	60-70	0.12		J Q	ND	0.016	U	ND	0.021	U	0.056	J B
8A	70-80	0.081		J Q	ND	0.012	U	ND	0.011	U	0.054	J B
8A	80-90	0.26		J	ND	0.012	U	ND	0.017	U	0.23	J B
8A	90-94	0.66			ND	0.029	U	ND	0.04	U	0.37	B
9	Surficial	7.8		Q	0.04		J	0.64		Q	0.55	B
10	Surficial	ND	0.087	U	ND	0.013	U	ND	0.029	U	0.032	J B
11	Surficial	0.2		J	ND	0.036	U	0.022		J Q	0.34	J B
12	0-18	2.5			0.092		J	0.21		J	0.94	B
12	18-27	1.1			ND	0.03	U	ND	0.0089	U	0.32	J B

Appendix C. Pesticide Results, cont.

ppb, dry weight

Station	Depth (cm)	Methoxychlor			Mirex			oxy-Chlordane			trans-Nonachlor		
6BCEF	Surficial	0.051		J Q B	0.075		J Q	ND	0.17	U	0.2		J
6C	0-10	0.034		J Q B	0.098		J	ND	0.11	U	0.16		J Q
6C	10-20	0.022		J Q B	0.084		J Q	ND	0.056	U	0.1		J Q
6C	20-30	0.017		J Q B	0.041		J	ND	0.041	U	0.08		J
6C	30-40	0.66		Q B	0.21		J	ND	0.11	U	0.28		J
6C	40-50	0.056		J Q B	0.073		J Q	ND	0.065	U	0.17		J
6C	50-60	0.075		J Q B	0.1		J	ND	0.058	U	0.2		J
6C	60-70	0.38		J Q B	0.41		J	ND	0.19	U	1.3		
6C	70-80	0.55		J Q B	0.86		J	ND	0.61	U	3.4		
6C	80-90	0.29		J Q B	0.063		J	ND	0.39	U	0.89		J
6C	90-99	1.9		J Q B	ND	0.54	U	ND	0.44	U	0.46		J Q
6E	0-26	0.056		J B Q	0.15		J	ND	0.042	U	0.25		J
6E	26-40	0.053		J Q B	0.2		J	ND	0.056	U	0.21		J
6E	40-56	0.19		J B Q	0.28		J	ND	0.13	U	0.77		
6E	56-74	0.67		J B Q	1.5		J	ND	1.1	U	2.7		J
6F	0-10	0.048		J B Q	0.17		J	ND	0.071	U	0.28		J
6F	28-52	0.58		J B Q	0.72		J	ND	0.55	U	1		J Q
6F	70-110	0.08		J B Q	ND	0.033	U	ND	0.063	U	ND	0.13	U
7ABC	Surficial	0.075		J,Q,B	0.12		J	ND	0.18	U	0.18		J
7A	0-20	0.18		J,Q,B	0.24		J	ND	0.12		0.43		J,Q
7A	20-50	0.13		J,Q,B	ND	0.19	U	ND	0.26	U	ND	0.49	U
7A	50-90	0.027		J Q	0.04			ND	0.063	U	ND	0.16	U
7A	90-104	ND	0.022	U	ND	0.029	U	ND	0.051	U	ND	0.066	U
7B	0-20	0.051		J Q	0.18		J Q	ND	0.15	U	1.4		
7B	20-58	0.037		J Q	0.15		J	ND	0.058	U	0.39		
7B	58-66	ND	0.0065	U	ND	0.0096	U	ND	0.027	U	ND	0.036	U
7C	0-20	0.054		J Q	0.2		J Q	ND	0.072	U	0.36		J
7C	20-70	0.028		J Q	0.03		J	ND	0.06	U	0.076		J Q
7C	70-83	ND	0.021	U	ND	0.03	U	ND	0.055	U	ND	0.1	U
8A	0-10	0.013		J Q	0.043		J Q	ND	0.05	U	ND	0.21	U
8A	10-20	0.033		J Q	0.016		J Q	ND	0.039	U	0.11		J
8A	20-30	0.14		J Q	0.17		J Q	ND	0.037	U	0.31		J
8A	30-40	0.076		J Q	0.085		J	ND	0.065	U	0.4		
8A	40-50	0.085		J Q	0.41		Q	ND	0.054	U	0.13		J Q
8A	50-60	0.058		J Q	0.01		J Q	ND	0.094	U	0.11		
8A	60-70	0.044		J Q	0.011		J	ND	0.068	U	0.074		J
8A	70-80	0.046		J Q	0.0088		J Q	ND	0.032	U	0.035		J Q
8A	80-90	0.032		J Q	0.049		J Q	ND	0.036	U	0.074		J
8A	90-94	0.18		J Q	0.071		J Q	ND	0.058	U	0.19		J
9	Surficial	0.64		B	380		X	0.64		Q	12		
10	Surficial	0.032		J Q B	ND	0.041	U	ND	0.056	U	ND	0.1	U
11	Surficial	0.052		J Q B	0.42		Q	ND	0.11	U	0.13		J Q
12	0-18	0.64		Q	0.074		J Q	0.11		J	1.8		
12	18-27	0.23		J Q	0.059		J Q	ND	0.13	U	0.62		

Notes: Results noted as ND or U were not detected at or above the stated limit, J- estimated result,
Q- estimated maximum possible concentration, B- method blank contamination,
X- recovered amount of spike is less than the project reporting limit, NR- not reported.

Appexdix D.- PCB Results
Eighteenmile Creek Sediment Study
All concentrations reported in pg/g (dry weight corrected)
Quanterra Environmental Services

Congener / Station / Date	06BCEF 08/18/98	6C0010 08/18/98	6C1020 08/18/98	6C2030 08/18/98	6C3040 08/18/98	6C4050 08/18/98	6C5060 08/18/98	6C6070 08/18/98	6C7080 08/18/98	6C8090 08/18/98	6C9099 08/18/98	6E0026 08/18/98	6E2640 08/18/98	6E4056 08/18/98	6E5674 08/18/98
PCB-4; PCB-10	6,700	3,700	3,300	6,000	7,700	8,700	11,000	52,000	62,000	3,200	1,600	8,600	13,000	52,000	64,000
PCB-6	3,000	1,400	1,200	2,700	4,800	4,500	6,400	38,000	49,000	2,200	350	4,100	3,600	65,000	37,000
PCB-7	640	320	250	550	1,000	1,200	1,700	15,000	23,000	950	170	910	1,000	15,000	18,000
PCB-8; PCB-5	3,800	1,900	1,500	3,700	7,700	9,900	13,000	150,000	230,000	12,000	2,400	5,900	8,200	140,000	190,000
PCB-15	11,000	7,000	5,000	12,000	16,000	21,000	17,000	83,000	110,000	6,900	3,200	15,000	21,000	82,000	59,000
PCB-16; PCB-32	18,000	10,000	7,400	20,000	34,000	53,000	56,000	230,000	280,000	29,000	8,500	26,000	53,000	220,000	270,000
PCB-17	19,000	10,000	7,200	20,000	26,000	40,000	43,000	170,000	210,000	18,000	5,100	25,000	40,000	160,000	160,000
PCB-18	23,000	12,000	9,800	27,000	54,000	84,000	88,000	380,000	460,000	48,000	13,000	35,000	83,000	370,000	390,000
PCB-19	6,000	3,900	2,700	5,500	7,200	9,200	10,000	33,000	ND	3,500	1,300	8,400	9,700	31,000	41,000
PCB-22	5,800	2,800	2,500	9,000	17,000	27,000	27,000	200,000	180,000	15,000	4,400	9,600	24,000	190,000	120,000
PCB-25	18,000	8,700	6,100	19,000	26,000	29,000	30,000	69,000	46,000	4,900	1,500	24,000	26,000	89,000	340,000
PCB-26	56,000	31,000	21,000	62,000	80,000	100,000	110,000	260,000	190,000	23,000	5,700	79,000	110,000	340,000	170,000
PCB-27; PCB-24	6,500	3,900	2,600	6,300	7,400	9,100	9,700	27,000	30,000	2,900	1,000	8,700	9,000	25,000	30,000
PCB-31; PCB-28	59,000	32,000	24,000	80,000	130,000	200,000	200,000	1,100,000	980,000	110,000	32,000	91,000	190,000	920,000	460,000
PCB-33	7,300	3,400	2,900	11,000	24,000	41,000	39,000	330,000	310,000	27,000	6,800	12,000	33,000	280,000	220,000
PCB-37	680	3,100	2,400	8,900	15,000	24,000	22,000	150,000	120,000	860	4,300	9,000	24,000	130,000	5,100
PCB-40	7,000	4,400	3,000	9,900	14,000	22,000	22,000	120,000	150,000	8,500	2,600	12,000	22,000	120,000	59,000
PCB-42	19,000	8,900	6,900	20,000	30,000	44,000	39,000	250,000	320,000	17,000	9,100	20,000	40,000	240,000	120,000
PCB-44	ND	16,000	13,000	39,000	56,000	86,000	78,000	520,000	650,000	39,000	24,000	39,000	82,000	510,000	250,000
PCB-45	3,800	3,000	2,400	6,300	10,000	17,000	15,000	110,000	130,000	6,500	1,700	6,800	15,000	110,000	63,000
PCB-46	1,800	1,400	1,100	3,000	4,600	7,200	6,600	47,000	62,000	2,800	740	3,100	6,800	45,000	26,000
PCB-47; PCB-48	15,000	13,000	9,900	27,000	36,000	53,000	47,000	320,000	400,000	25,000	16,000	26,000	47,000	300,000	150,000
PCB-49	22,000	18,000	14,000	39,000	51,000	75,000	66,000	420,000	500,000	41,000	34,000	39,000	68,000	420,000	210,000
PCB-52	28,000	24,000	18,000	48,000	67,000	99,000	85,000	540,000	620,000	61,000	50,000	49,000	87,000	570,000	290,000
PCB-53	6,300	4,600	3,300	8,800	12,000	19,000	18,000	100,000	120,000	7,400	2,400	10,000	18,000	100,000	64,000
PCB-56; PCB-60	14,000	7,800	5,100	18,000	28,000	47,000	45,000	350,000	440,000	27,000	8,700	22,000	45,000	320,000	220,000
PCB-64; PCB-41	30,000	22,000	16,000	47,000	69,000	110,000	98,000	590,000	760,000	44,000	19,000	53,000	100,000	600,000	320,000
PCB-66	22,000	14,000	9,500	30,000	42,000	74,000	67,000	500,000	650,000	47,000	27,000	32,000	65,000	470,000	230,000
PCB-70	24,000	14,000	9,200	31,000	48,000	87,000	76,000	560,000	690,000	68,000	40,000	37,000	76,000	530,000	290,000
PCB-74	13,000	6,800	4,700	17,000	26,000	47,000	42,000	310,000	370,000	35,000	15,000	19,000	44,000	320,000	200,000
PCB-77	2,900	1,600	1,100	3,900	5,400	9,000	8,800	52,000	64,000	4,500	1,700	4,500	8,700	48,000	27,000
PCB-81	200	130	71	200	300	510	480	3,700	4,300	320	260	290	480	3,100	1,900
PCB-82	4,400	2,200	1,600	5,400	7,300	11,000	12,000	61,000	71,000	7,100	4,400	6,400	11,000	57,000	15,000
PCB-83	3,600	1,800	1,200	4,400	5,300	7,900	9,400	33,000	45,000	8,300	8,000	5,000	7,500	31,000	23,000
PCB-84; PCB-90; PCB-101	31,000	18,000	12,000	39,000	50,000	78,000	80,000	320,000	470,000	110,000	110,000	45,000	71,000	310,000	270,000
PCB-85	6,100	3,200	2,200	7,100	9,400	15,000	16,000	69,000	94,000	12,000	8,800	8,200	13,000	64,000	52,000
PCB-87	10,000	5,800	3,800	11,000	16,000	25,000	26,000	120,000	190,000	22,000	17,000	14,000	23,000	110,000	96,000
PCB-91	7,100	3,800	2,500	8,600	11,000	15,000	15,000	57,000	80,000	14,000	12,000	10,000	14,000	56,000	45,000
PCB-95	20,000	11,000	7,700	25,000	30,000	45,000	45,000	180,000	280,000	46,000	48,000	28,000	41,000	180,000	130,000
PCB-97	10,000	5,500	4,000	13,000	17,000	27,000	29,000	120,000	180,000	34,000	31,000	15,000	25,000	120,000	99,000
PCB-99	14,000	7,600	5,200	17,000	21,000	33,000	33,000	130,000	200,000	50,000	53,000	19,000	29,000	130,000	110,000
PCB-105	7,800	4,000	3,300	8,700	11,000	15,000	17,000	130,000	120,000	15,000	9,800	11,000	16,000	110,000	50,000
PCB-107	2,100	1,100	760	2,700	3,000	4,900	5,600	30,000	36,000	8,700	9,000	3,100	4,900	29,000	17,000
PCB-110	36,000	19,000	14,000	45,000	56,000	80,000	84,000	290,000	460,000	110,000	100,000	51,000	74,000	270,000	230,000
PCB-114	380	340	240	700	970	1,500	1,600	11,000	12,000	1,200	780	920	1,100	11,000	4,500
PCB-118	16,000	9,200	6,800	21,000	26,000	42,000	41,000	230,000	240,000	63,000	63,000	22,000	34,000	230,000	110,000
PCB-119	1,200	640	410	1,500	1,700	2,500	2,400	7,500	11,000	3,600	4,000	1,700	2,100	7,700	6,000
PCB-123	460	160	110	430	670	710	830	3,600	4,900	920	890	390	850	3,600	2,700
PCB-126	58	33	24	70	91	160	150	960	960	120	97	85	140	990	330
PCB-128; PCB-167	1,600	880	1,200	1,900	2,400	3,900	3,800	22,000	26,000	8,700	9,100	2,400	3,600	21,000	6,600
PCB-129	390	230	250	450	590	1,000	960	6,200	7,900	1,900	1,800	570	930	6,100	1,900
PCB-130	680	330	320	810	900	1,400	1,600	8,500	11,000	3,100	4,000	910	1,500	8,500	2,700
PCB-131	97	45	33	100	170	200	210	1,600	1,500	450	510	110	220	1,500	470
PCB-134	840	450	320	960	1,100	1,700	1,700	8,300	11,000	4,000	4,100	1,200	1,700	8,200	3,700
PCB-135	1,700	760	480	2,000	2,000	3,600	3,500	13,000	19,000	10,000	9,600	2,200	3,100	14,000	15,000
PCB-136	890	570	340	1,100	1,300	2,400	2,100	8,300	13,000	5,800	6,000	1,400	2,100	9,200	9,100
PCB-137	360	240	230	390	590	1,000	780	5,700	6,700	2,400	2,100	640	840	5,700	2,000
PCB-138	8,600	4,900	5,500	9,600	12,000	20,000	19,000	100,000	120,000	47,000	49,000	12,000	19,000	100,000	40,000
PCB-141	900	550	550	1,000	1,400	2,700	2,300	14,000	18,000	5,400	4,700	1,300	2,400	15,000	5,100
PCB-146	940	580	420	1,100	1,400	2,400	2,100	9,900	16,000	5,700	5,900	1,400	2,000	11,000	4,400
PCB-149	5,300	3,200	2,100	6,100	7,600	13,000	11,000	54,000	78,000	30,000	29,000	7,900	11,000	57,000	34,000
PCB-151	1,400	830	540	1,700	2,100	3,600	3,100	15,000	17,000	6,600	5,500	2,000	3,000	16,000	1,400
PCB-153	3,700	2,300	2,000	4,500	5,800	10,000	8,500	47,000	62,000	28,000	28,000	5,600	8,600	50,000	24,000
PCB-156	640	370	670	740	960	1,600	1,500	10,000	12,000	3,500	3,500	880	1,400	11,000	2,700
PCB-157	160	95	150	190	240	410	380	2,500	3,100	890	900	250	380	2,500	640
PCB-158	560	390	430	660	1,000	1,700	1,400	9,500	10,000	3,900	3,500	940	1,400	10,000	2,600
PCB-168; PCB-132	3,000	1,700	1,300	3,500	4,400	7,000	6,700	32,000	42,000	15,000	16,000	4,300	6,500	32,000	14,000
PCB-169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-171	580	290	550	730	930	1,300	1,500	7,700	9,300	2,700	2,300	820	1,300	7,800	2,200
PCB-172	280	140	280	340	460	670	780	4,200	4,600	1,400	1,300	400	680	4,300	1,600
PCB-174	2,100	1,100	1,800	2,700	3,700	5,600	6,300	34,000	37,000	11,000	9,500	3,100	5,600	34,000	8,800
PCB-175	64	54	36	77	130	130	160	670	690	230	220	60	120	1,100	200
PCB-176	180	100	98	240	310	480	530	2,700	3,100	930	890	270	470	2,800	900
PCB-177	1,900	830	1,500	2,300	2,800	5,600	4,900	24,000	25,000	8,000	6,600	2,800	4,200	22,000	5,900
PCB-178	550	300	290	690	800	1,100	1,300	5,900	6,500	2,000	2,100	770	1,100	5,800	1,700
PCB-179	940	510	430	1,200	1,500	2,200	2,500	12,000	13,000	4,100	3,900	1,300	2,100	13,000	3,100
PCB-180	3,400	1,700	3,700	4,400	5,700	8,900	9,900	58,000	59,000	19,000	17,000	4,900	9,100	60,000	32,000
PCB-183	740	400	570	950	1,200	1,900	2,100	12,000	13,000	3,900	3,600	1,000	1,900	12,000	3,300
PCB-184	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-185	180	97	140	230	330	520	570	3,200	3,400	940	800	280	510	3,300	730
PCB-187	2,300	1,200	1,400	2,800	3,500	5,100	5,700	29,000	36,000	12,000	11,000	3,700	5,700	29,000	9,600
PCB-189	79	42	110	99	140	210	260	1,600	1,200	410	350	120	220	1,700	650
PCB-190; PCB-170	2,300	1,100	2,800	2,800	3,700	5,400	6,600	33,000	37,000	11,000	9,200	3,200	5,500	33,000	18,000
PCB-191	65	35	81	82	110	170	190	1,000	1,200	330	280	93	170	1,100	600
PCB-193	180	120	230	240	390	520	550	3,600	3,300	1,100	740	330	490	2,500	1,500
PCB-194	880	450	980	1,100	1,600	2,400	2,600	16,000	15,000	5,200	5,600	1,300	2,400	16,000	7,400
PCB-195	410	190	500	530	740	1,100	1,300	7,900	7,700	2,200	2,200	640	1,200	7,900	3,500
PCB-197	ND	ND	ND	ND	ND	ND	44	ND	ND	85	110	ND	ND	ND	140
PCB-198	ND	ND	ND	48	79	120	97	660	740	260	450	64	81	620	260
PCB-199	96	52	84	130	170	270	300	1,600	1,600	620	720	150	250	1,600	1,100
PCB-200	67	39	50	99	120	180	200	1,000	1,100	530	670	100	150	1,000	300
PCB-201	1,300	690	1,100	1,700	2,300	3,300	3,600	20,000	20,000	11,000	12,000	2,000	3,300	20,000	11,000
PCB-202	190	100	99	250	310	410	490	2,100	2,400	1,700	2,200	270	400	2,100	830
PCB-203; PCB-196	910	490	900	1,200	1,700	2,500	2,900	22,000	7,700	3,800	3,700	1,400	2,400	22,000	3,600
PCB-205	50	26	60	65	100	140	160	870	910	300	300	81	160	930	450
PCB-206	1,700	910	690	2,400	2,800	3,800	4,400	17,000	17,000	30,000	34,000	2,700	3,800	16,000	22,000
PCB-207	38	25	20	62	71	87	100	400	390	680	930	64	82	420	510
PCB-208	320	190	130	500	540	710	830	3,100	3,100	6,300	8,000	540	690	3,000	3,900
PCB-209	4,700	2,400	1,400	6,900	16,000	13,000	13,000	44,000	47,000	99,000	100,000	7,300	13,000	40,000	66,000
Totals	**681,874**	**420,123**	**319,826**	**924,012**	**1,321,711**	**2,007,407**	**1,960,151**	**10,609,460**	**12,557,290**	**1,670,425**	**1,247,157**	**1,061,447**	**1,877,813**	**10,279,060**	**6,737,610**

Appexdix D.- PCB Results, cont.
Eighteenmile Creek Sediment Study
All concentrations reported in pg/g (dry weight corrected)
Quanterra Environmental Services

Congener / Station Date	6F0010 08/18/98	6F1028 08/18/98	6F2852 08/18/98	6F5270 08/18/98	6F7010 08/18/98	07ABC 08/19/98	7A0020 08/19/98	7A2050 08/19/98	7A5090 08/19/98	7A9010 08/19/98	7B0020 08/19/98	7B2058 08/19/98	7B5866 08/19/98	7C0020 08/19/98	7C2070 08/19/98
PCB-4; PCB-10	14,000	83,000	60,000	ND	ND	1,200	1,800	440	ND	ND	2,200	8,500	ND	3,800	100
PCB-6	4,600	19,000	110,000	110	ND	660	1,600	560	ND	ND	600	5,300	ND	2,400	ND
PCB-7	1,000	6,300	23,000	ND	ND	160	350	170	ND	ND	170	1,900	ND	1,300	ND
PCB-8; PCB-5	5,400	25,000	180,000	240	ND	770	2,300	2,000	ND	ND	690	9,900	ND	8,900	200
PCB-15	16,000	26,000	96,000	130	ND	1,800	3,000	960	ND	ND	2,000	5,400	ND	5,800	ND
PCB-16; PCB-32	32,000	68,000	200,000	510	ND	2,400	6,100	4,300	ND	ND	2,700	9,800	ND	13,000	ND
PCB-17	32,000	55,000	140,000	260	ND	2,500	4,600	2,700	ND	ND	2,700	8,300	ND	9,300	ND
PCB-18	37,000	97,000	320,000	880	ND	2,700	11,000	8,100	ND	ND	3,600	15,000	ND	21,000	100
PCB-19	13,000	30,000	ND	ND	ND	810	1,300	510	ND	ND	1,100	3,700	ND	2,200	ND
PCB-22	8,100	24,000	130,000	280	ND	810	3,500	2,800	ND	ND	950	4,700	ND	7,500	ND
PCB-25	26,000	37,000	220,000	410	ND	3,200	5,000	1,100	ND	ND	3,100	6,600	ND	4,900	ND
PCB-26	91,000	170,000	620,000	1,500	ND	8,000	17,000	4,000	ND	ND	10,000	23,000	ND	17,000	ND
PCB-27; PCB-24	12,000	20,000	18,000	ND	ND	860	1,200	420	ND	ND	990	2,700	ND	1,900	ND
PCB-31; PCB-28	83,000	200,000	740,000	2,100	ND	9,700	28,000	19,000	230	ND	11,000	34,000	ND	45,000	110
PCB-33	11,000	36,000	220,000	470	ND	920	5,000	5,200	ND	ND	1,100	7,300	ND	12,000	ND
PCB-37	7,400	19,000	69,000	220	ND	680	2,300	1,900	ND	ND	850	210	ND	5,100	ND
PCB-40	13,000	29,000	410,000	190	ND	120	2,600	1,600	ND	ND	1,500	2,600	ND	4,200	ND
PCB-42	24,000	40,000	760,000	380	ND	2,400	5,300	3,500	ND	ND	3,000	4,000	ND	7,600	ND
PCB-44	47,000	91,000	1,700,000	930	ND	4,900	11,000	7,700	88	ND	6,200	8,400	ND	16,000	ND
PCB-45	8,600	17,000	ND	120	ND	820	2,100	1,300	ND	ND	1,000	1,800	ND	3,400	ND
PCB-46	4,300	7,300	120,000	54	ND	380	880	560	ND	ND	470	740	ND	1,400	ND
PCB-47; PCB-48	34,000	51,000	820,000	450	ND	4,000	7,200	5,600	57	ND	4,800	5,800	ND	11,000	ND
PCB-49	50,000	96,000	1,400,000	1,100	ND	5,800	10,000	7,900	83	ND	6,600	7,800	ND	15,000	ND
PCB-52	65,000	160,000	1,700,000	1,500	25	7,100	13,000	10,000	120	ND	8,800	11,000	ND	18,000	24
PCB-53	14,000	21,000	260,000	140	ND	1,400	2,700	1,500	ND	ND	1,700	2,700	ND	4,100	ND
PCB-56; PCB-60	20,000	40,000	700,000	450	ND	2,100	5,400	4,400	49	ND	2,700	5,400	ND	11,000	ND
PCB-64; PCB-41	62,000	96,000	1,800,000	940	21	6,500	14,000	8,600	100	ND	7,800	12,000	ND	21,000	20
PCB-66	31,000	40,000	980,000	850	ND	3,400	9,000	9,000	96	ND	4,500	7,500	ND	16,000	ND
PCB-70	34,000	65,000	1,100,000	1,200	21	4,100	12,000	12,000	130	ND	5,200	9,900	ND	22,000	ND
PCB-74	17,000	34,000	620,000	490	ND	2,100	600	5,800	61	ND	2,600	4,500	ND	12,000	ND
PCB-77	3,900	6,600	110,000	71	ND	400	920	660	ND	ND	530	790	ND	1,800	ND
PCB-81	310	380	13,000	ND	ND	29	46	31	ND	ND	36	44	ND	94	ND
PCB-82	5,900	9,400	240,000	62	ND	500	930	580	ND	ND	590	730	ND	1,600	ND
PCB-83	4,400	30,000	190,000	110	ND	440	730	860	ND	ND	490	590	ND	1,100	ND
PCB-84; PCB-90; PCB-101	42,000	130,000	1,500,000	1,400	23	4,600	8,600	13,000	130	ND	5,100	6,300	ND	14,000	ND
PCB-85	7,500	11,000	290,000	98	ND	700	1,200	1,000	ND	ND	790	920	ND	2,200	ND
PCB-87	14,000	22,000	590,000	190	ND	1,400	2,200	1,900	25	ND	1,600	1,800	ND	4,200	ND
PCB-91	9,600	19,000	340,000	190	ND	1,000	1,600	1,500	ND	ND	1,100	1,300	ND	2,300	ND
PCB-95	29,000	59,000	1,100,000	830	ND	4,000	5,200	6,000	66	ND	3,300	4,400	ND	7,200	ND
PCB-97	13,000	21,000	530,000	350	ND	1,300	2,500	3,400	36	ND	1,500	1,800	ND	4,200	ND
PCB-99	17,000	45,000	590,000	580	ND	1,900	3,700	6,100	59	ND	2,200	2,400	ND	5,700	ND
PCB-105	9,900	13,000	400,000	110	ND	940	1,400	1,300	ND	ND	1,100	1,300	ND	3,100	ND
PCB-107	2,500	4,300	100,000	85	ND	240	460	860	ND	ND	290	330	ND	780	ND
PCB-110	46,000	81,000	1,900,000	1,300	21	4,600	7,900	9,800	110	ND	5,100	6,400	ND	11,000	ND
PCB-114	870	960	39,000	ND	ND	57	93	81	ND	ND	71	79	ND	230	ND
PCB-118	19,000	25,000	620,000	510	ND	1,800	3,500	5,900	63	ND	2,200	2,500	ND	6,000	ND
PCB-119	1,500	14,000	47,000	60	ND	180	290	450	ND	ND	180	220	ND	380	ND
PCB-123	400	1,300	18,000	23	ND	76	99	210	ND	ND	110	77	ND	270	ND
PCB-126	71	130	34,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	28	ND
PCB-128; PCB-167	2,200	3,000	63,000	74	ND	260	450	880	ND	ND	300	300	ND	740	ND
PCB-129	560	1,500	21,000	ND	ND	68	110	200	ND	ND	77	76	ND	200	ND
PCB-130	820	5,000	26,000	32	ND	96	160	380	ND	ND	120	110	ND	280	ND
PCB-131	130	2,500	3,600	ND	ND	ND	20	49	ND	ND	ND	20	ND	56	ND
PCB-134	1,300	27,000	36,000	46	ND	160	230	460	ND	ND	180	180	ND	340	ND
PCB-135	1,500	91,000	56,000	170	ND	440	740	2,100	ND	ND	430	410	ND	1,500	ND
PCB-136	1,600	18,000	44,000	76	ND	210	340	760	ND	ND	220	250	ND	480	ND
PCB-137	670	780	21,000	ND	ND	85	150	270	ND	ND	90	93	ND	260	ND
PCB-138	12,000	67,000	260,000	450	ND	1,500	2,400	5,100	53	ND	1,700	1,700	ND	3,900	ND
PCB-141	1,400	2,600	38,000	55	ND	210	360	740	ND	ND	240	240	ND	630	ND
PCB-146	1,400	47,000	40,000	95	ND	240	410	970	ND	ND	260	260	ND	590	ND
PCB-149	8,300	98,000	210,000	410	ND	1,200	1,900	4,000	42	ND	1,300	1,400	ND	2,700	ND
PCB-151	2,100	44,000	46,000	110	ND	320	520	1,100	ND	ND	340	350	ND	720	ND
PCB-153	5,500	21,000	120,000	430	ND	1,100	1,900	4,900	53	ND	1,200	1,200	ND	3,000	ND
PCB-156	830	1,000	28,000	31	ND	110	190	410	ND	ND	130	120	ND	340	ND
PCB-157	230	290	7,700	ND	ND	27	44	86	ND	ND	30	30	ND	78	ND
PCB-158	940	1,200	27,000	32	ND	130	250	440	ND	ND	140	140	ND	330	ND
PCB-168; PCB-132	4,400	32,000	140,000	170	ND	510	810	1,700	ND	ND	570	610	ND	1,200	ND
PCB-169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-171	640	5,000	15,000	ND	ND	62	96	200	ND	ND	63	61	ND	140	ND
PCB-172	320	3,000	6,700	ND	ND	33	54	130	ND	ND	34	33	ND	89	ND
PCB-174	2,500	18,000	47,000	82	ND	240	400	910	ND	ND	240	240	ND	620	ND
PCB-175	55	740	1,400	ND	ND	ND	ND	31	ND	ND	ND	ND	ND	27	ND
PCB-176	220	6,700	5,100	ND	ND	32	52	120	ND	ND	32	32	ND	78	ND
PCB-177	3,000	62,000	42,000	51	ND	170	260	560	ND	ND	160	170	ND	390	ND
PCB-178	680	29,000	12,000	22	ND	80	110	220	ND	ND	77	77	ND	150	ND
PCB-179	1,100	34,000	21,000	43	ND	140	220	460	ND	ND	140	130	ND	300	ND
PCB-180	4,100	22,000	78,000	160	ND	470	790	1,900	23	ND	470	460	ND	1,200	ND
PCB-183	870	6,400	17,000	46	ND	140	230	540	ND	ND	140	140	ND	350	ND
PCB-184	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-185	230	1,300	4,100	ND	ND	ND	49	110	ND	ND	ND	ND	ND	75	ND
PCB-187	3,200	84,000	52,000	120	ND	370	550	1,200	ND	ND	360	350	ND	780	ND
PCB-189	87	410	1,800	ND	ND	ND	ND	33	ND	ND	ND	ND	ND	22	ND
PCB-190; PCB-170	2,400	12,000	54,000	67	ND	210	350	800	ND	ND	210	210	ND	560	ND
PCB-191	71	390	1,700	ND	ND	ND	ND	32	ND	ND	ND	ND	ND	23	ND
PCB-193	250	3,200	3,500	ND	ND	27	34	99	ND	ND	26	22	ND	56	ND
PCB-194	990	5,900	17,000	49	ND	140	210	560	ND	ND	130	110	ND	310	ND
PCB-195	470	4,100	8,700	ND	ND	51	82	220	ND	ND	50	45	ND	120	ND
PCB-197	ND	300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-198	ND	350	ND	ND	ND	ND	ND	72	ND	ND	ND	ND	ND	ND	ND
PCB-199	120	1,200	1,700	ND	ND	ND	33	84	ND	ND	ND	ND	ND	46	ND
PCB-200	92	1,500	1,400	ND	ND	22	37	120	ND	ND	ND	21	ND	53	ND
PCB-201	1,700	13,000	23,000	120	ND	190	320	1,200	ND	ND	190	180	ND	450	ND
PCB-202	240	2,800	2,700	32	ND	45	69	330	ND	ND	43	38	ND	100	ND
PCB-203; PCB-196	1,100	8,200	13,000	100	ND	200	340	710	ND	ND	200	180	ND	310	ND
PCB-205	62	360	1,100	ND	ND	ND	ND	32	ND	ND	ND	ND	ND	ND	ND
PCB-206	2,100	12,000	20,000	480	ND	280	480	5,400	96	ND	310	330	ND	1,000	ND
PCB-207	45	260	600	22	ND	ND	30	240	ND	ND	21	ND	ND	54	ND
PCB-208	410	2,600	4,300	170	ND	96	170	2,000	35	ND	120	100	ND	380	ND
PCB-209	4,600	26,000	43,000	980	ND	510	1,300	10,000	140	ND	730	670	ND	2,200	ND
Totals	**1,121,783**	**3,025,250**	**25,853,100**	**26,598**	**111**	**116,626**	**248,448**	**240,110**	**1,945**	**0**	**137,980**	**273,518**	**0**	**417,209**	**554**

Appexdix D.- PCB Results, cont.
Eighteenmile Creek Sediment Study
All concentrations reported in pg/g (dry weight corrected)
Quanterra Environmental Services

Congener / Station Date	7C7083 08/19/98	8A0010 08/20/98	8A1020 08/20/98	8A2030 08/20/98	8A3040 08/20/98	8A4050 08/20/98	8A5060 08/20/98	8A6070 08/20/98	8A7080 08/20/98	8A8090 08/20/98	8A9094 08/20/98	09SURF 08/17/98	10SURF 08/18/98	11SURF 08/17/98	12TOP 08/19/98	12BOT 08/19/98
PCB-4; PCB-10	120	1,500	2,900	100,000	120,000	65,000	55,000	3,100	3,800	67,000	28,000	ND	ND	790	130,000 D	920,000 D
PCB-6	ND	590	1,700	84,000	27,000	13,000	16,000	1,400	1,800	20,000	37,000	ND	ND	240	60,000 D	280,000 D
PCB-7	ND	210	750	53,000	14,000	12,000	13,000	450	540	11,000	12,000	ND	ND	ND	11,000 D	52,000 D
PCB-8; PCB-5	ND	940	3,000	160,000	42,000	19,000	21,000	2,400	2,900	30,000	50,000	ND	ND	360	71,000 D	510,000 D
PCB-15	ND	3,100	12,000	270,000	58,000	12,000	20,000	4,700	5,900	11,000	24,000	140	ND	1,500	200,000 D	550,000 D
PCB-16; PCB-32	160	2,200	6,600	190,000	140,000	27,000	23,000	5,400	7,000	35,000	110,000	ND	ND	6,000	320,000 D	480,000 D
PCB-17	130	2,200	4,900	160,000	110,000	30,000	33,000	4,700	5,500	24,000	110,000	ND	ND	2,100	260,000 D	690,000 D
PCB-18	260	2,400	6,800	210,000	150,000	26,000	30,000	6,100	7,800	58,000	200,000	ND	ND	8,000	280,000 D	420,000 D
PCB-19	ND	1,100	5,900	77,000	84,000	16,000	12,000	2,000	2,800	14,000	16,000	ND	ND	1,200	190,000	350,000
PCB-22	ND	610	1,900	34,000	21,000	3,300	4,900	1,500	2,000	11,000	49,000	ND	ND	1,100	120,000 D	60,000 D
PCB-25	ND	2,200	5,100	120,000	41,000	11,000	12,000	4,200	5,200	15,000	78,000	ND	ND	2,300	150,000 D	180,000 D
PCB-26	200	6,900	19,000	490,000	210,000	43,000	53,000	14,000	17,000	58,000	260,000	ND	ND	8,500	520,000 D	740,000 D
PCB-27; PCB-24	ND	760	3,200	59,000	41,000	8,200	9,100	1,600	2,100	7,300	20,000	ND	ND	720	88,000 D	210,000 D
PCB-31; PCB-28	330	8,600	22,000	420,000	210,000	46,000	56,000	20,000	24,000	100,000	110,000	260	ND	15,000	1,000,000 D	720,000 D
PCB-33	ND	740	2,700	56,000	31,000	4,300	6,700	2,000	2,600	18,000	81,000	ND	ND	1,900	78,000 D	38,000 D
PCB-37	ND	670	2,700	30,000	27,000	2,600	3,200	1,700	2,400	9,000	33,000	190	ND	280	98,000 D	38,000 D
PCB-40	36	1,100	4,300	46,000	32,000	2,400	3,000	1,900	3,100	8,200	32,000	27	ND	2,500	220,000 D	52,000 D
PCB-42	42	1,500	8,600	96,000	64,000	5,300	5,600	3,400	5,800	16,000	65,000	68	ND	3,700	490,000 D	120,000 D
PCB-44	120	3,900	19,000	200,000	120,000	10,000	12,000	7,500	12,000	33,000	130,000	120	ND	8,500	1,200,000 D	200,000 D
PCB-45	ND	700	4,400	42,000	25,000	2,500	2,100	1,400	2,500	7,300	28,000	ND	ND	2,000	220,000 D	52,000 D
PCB-46	ND	330	1,900	18,000	12,000	1,300	940	610	1,100	3,100	12,000	ND	ND	910	110,000 D	30,000 D
PCB-47; PCB-48	68	3,400	14,000	160,000	64,000	12,000	8,500	6,100	8,500	21,000	89,000	85	ND	3,700	850,000 D	250,000 D
PCB-49	98	5,000	21,000	220,000	95,000	15,000	12,000	8,500	14,000	33,000	150,000	110	ND	6,000	1,100,000 D	340,000 D
PCB-52	150	7,000	29,000	300,000	150,000	20,000	16,000	11,000	19,000	45,000	180,000	260	ND	9,200	1,600,000 D	420,000 D
PCB-53	36	1,200	7,400	83,000	44,000	5,300	6,000	2,200	3,700	9,700	42,000	37	ND	2,100	330,000 D	130,000 D
PCB-56; PCB-60	99	1,900	6,800	60,000	44,000	4,200	5,300	4,400	6,200	22,000	80,000	240	ND	4,800	930,000 D	53,000 D
PCB-64; PCB-41	170	5,200	20,000	250,000	130,000	15,000	17,000	11,000	16,000	44,000	180,000	220	ND	10,000	1,600,000 D	320,000 D
PCB-66	120	3,200	13,000	100,000	92,000	7,200	9,100	6,100	6,300	15,000	110,000	210	ND	4,700	1,100,000 D	100,000 D
PCB-70	150	3,100	11,000	120,000	95,000	7,800	10,000	7,100	10,000	38,000	130,000	300	ND	8,200	1,300,000 D	110,000 D
PCB-74	78	1,800	5,500	63,000	33,000	4,600	5,800	4,100	5,300	21,000	80,000	130	ND	3,000	840,000 D	71,000 D
PCB-77	ND	420	1,600	14,000	13,000	1,300	1,200	950	1,300	3,500	11,000	130	ND	1,100	120,000 D	12,000 D
PCB-81	ND	58	130	800	920	70	65	96	130	310	920	ND	ND	96	21,000 D	870 D
PCB-82	34	470	1,600	14,000	17,000	1,500	1,200	1,300	1,800	3,900	12,000	120	ND	2,000	210,000 D	11,000 D
PCB-83	ND	530	1,000	10,000	9,000	1,100	850	850	1,200	2,600	8,100	78	ND	960	110,000 D	13,000 D
PCB-84; PCB-90; PCB-101	210	4,100	12,000	120,000	120,000	13,000	10,000	9,200	14,000	32,000	97,000	920	23	9,600	1,400,000 D	140,000 D
PCB-85	31	560	1,900	18,000	22,000	1,800	1,500	1,600	2,200	5,300	15,000	210	ND	2,700	290,000 D	16,000 D
PCB-87	69	1,400	4,000	34,000	41,000	4,100	3,200	3,300	4,500	11,000	31,000	360	ND	4,200	640,000 D	37,000 D
PCB-91	33	740	2,400	25,000	20,000	2,400	1,900	1,700	2,500	5,500	17,000	170	ND	1,900	230,000 D	37,000 D
PCB-95	130	2,900	8,400	81,000	67,000	7,000	6,400	5,300	6,900	9,400	59,000	410	ND	3,400	820,000 D	120,000 D
PCB-97	60	960	3,500	31,000	36,000	3,600	3,000	2,700	3,800	9,100	27,000	280	ND	3,700	450,000 D	33,000 D
PCB-99	67	1,500	4,700	40,000	46,000	4,800	4,100	3,700	5,100	12,000	36,000	360	ND	3,700	580,000 D	55,000 D
PCB-105	49	1,400	3,300	24,000	25,000	3,700	2,800	3,100	3,600	7,700	23,000	530	ND	2,900	460,000 D	19,000 D
PCB-107	ND	360	760	5,700	4,600	930	510	680	890	1,800	5,700	94	ND	560	90,000 D	7,500 D
PCB-110	180	4,700	12,000	120,000	100,000	13,000	9,900	9,500	13,000	29,000	78,000	1,600	21	11,000	1,100,000 D	160,000 D
PCB-114	ND	80	190	1,400	2,300	310	220	260	310	720	2,200	35	ND	240	35,000 D	1,200 D
PCB-118	69	2,500	7,000	47,000	45,000	6,900	4,800	6,200	7,700	16,000	46,000	840	ND	4,800	630,000 D	52,000 D
PCB-119	ND	150	360	3,700	2,600	400	280	280	400	820	2,300	21	ND	180	28,000 D	5,900 D
PCB-123	ND	82	230	2,200	1,800	300	120	190	160	430	1,000	29	ND	130	58,000 D	3,500 D
PCB-126	ND	ND	40	200	290	35	25	34	44	94	220	ND	ND	35	4,100 D	200 D
PCB-128; PCB-167	ND	770	1,000	7,300	6,500	940	630	1,000	1,100	2,700	5,600	270	ND	790	65,000 D	7,000 D
PCB-129	ND	190	270	2,100	1,900	200	160	270	300	800	1,600	57	ND	210	24,000 D	1,900 D
PCB-130	ND	370	440	2,700	2,500	380	250	430	440	1,200	2,100	98	ND	260	26,000 D	3,100 D
PCB-131	ND	47	59	760	380	60	30	67	59	260	410	ND	ND	34	4,000 D	350 D
PCB-134	ND	470	460	5,600	2,700	500	280	440	510	1,300	2,600	79	ND	240	29,000 D	5,100 D
PCB-135	22	610	780	32,000	7,200	2,100	510	1,100	1,200	3,900	7,000	150	ND	500	57,000 D	10,000 D
PCB-136	ND	520	640	9,400	4,100	670	370	590	700	2,200	4,200	86	ND	290	49,000 D	8,000 D
PCB-137	ND	180	250	2,200	1,800	300	150	260	330	790	1,900	56	ND	200	25,000 D	2,100 D
PCB-138	51	3,900	6,200	50,000	34,000	4,500	3,400	6,000	6,800	18,000	33,000	1,300	23	3,500	290,000 D	40,000 D
PCB-141	ND	580	970	10,000	6,600	990	540	940	1,100	3,200	5,900	150	ND	490	58,000 D	5,400 D
PCB-146	ND	570	750	10,000	5,100	930	540	730	860	2,200	4,300	120	ND	320	44,000 D	8,200 D
PCB-149	52	3,200	4,000	57,000	24,000	4,300	2,400	3,900	4,600	12,000	23,000	620	ND	1,800	230,000 D	42,000 D
PCB-151	ND	760	1,100	17,000	6,200	1,100	680	1,100	1,300	3,800	7,600	170	ND	460	54,000 D	9,700 D
PCB-153	53	2,400	3,900	55,000	26,000	4,500	2,600	3,800	4,600	12,000	22,000	540	ND	1,400	190,000 D	30,000 D
PCB-156	ND	350	460	3,700	2,900	400	280	470	490	1,000	2,700	87	ND	210	33,000 D	3,100 D
PCB-157	ND	73	110	600	680	110	61	97	110	270	580	27	ND	87	8,000 D	740 D
PCB-158	ND	490	480	4,200	3,400	390	320	460	600	1,400	2,900	110	ND	310	37,000 D	2,800 D
PCB-168; PCB-132	21	1,700	1,800	20,000	11,000	1,800	1,100	1,700	1,900	5,100	10,000	310	ND	1,100	110,000 D	16,000 D
PCB-169	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-171	ND	260	300	4,200	2,100	260	210	260	330	710	1,500	120	ND	260	11,000 D	1,600 D
PCB-172	ND	110	170	1,900	1,200	180	120	160	220	490	920	75	ND	170	6,100 D	780 D
PCB-174	ND	690	1,200	12,000	8,500	1,200	860	1,100	1,400	3,500	6,700	510	ND	1,100	40,000 D	5,700 D
PCB-175	ND	31	42	890	250	39	24	46	83	150	230	ND	ND	49	1,400 D	200 D
PCB-176	ND	100	130	2,000	960	140	95	140	180	440	810	32	ND	77	4,500 D	820 D
PCB-177	ND	570	730	7,500	4,900	690	500	650	910	2,000	3,800	380	ND	790	22,000 D	4,000 D
PCB-178	ND	200	290	3,500	1,700	250	210	260	350	820	1,400	97	ND	160	8,100 D	2,200 D
PCB-179	ND	350	550	6,900	3,600	620	400	530	690	1,700	3,100	170	ND	310	17,000 D	3,500 D
PCB-180	28	1,500	2,600	27,000	17,000	2,400	1,700	2,400	3,200	7,100	14,000	790	ND	2,100	94,000 D	11,000 D
PCB-183	ND	420	670	10,000	4,700	680	460	660	820	2,000	3,900	150	ND	350	23,000 D	3,300 D
PCB-184	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB-185	ND	70	140	1,800	1,100	120	100	140	170	430	830	42	ND	100	5,200 D	650 D
PCB-187	ND	970	1,400	21,000	11,000	1,400	1,100	1,400	1,800	4,700	7,600	450	ND	820	48,000 D	10,000 D
PCB-189	ND	60	56	2,000	670	110	65	51	76	86	230	21	ND	78	2,100 D	210 D
PCB-190; PCB-170	ND	830	1,100	13,000	7,500	1,100	830	1,100	1,400	2,600	5,800	540	ND	1,600	45,000 D	4,900 D
PCB-191	ND	28	44	770	320	37	30	42	56	110	240	ND	ND	47	1,900 D	210 D
PCB-193	ND	45	110	1,700	700	150	79	110	110	240	540	57	ND	130	3,600 D	520 D
PCB-194	ND	310	660	6,900	5,400	600	430	550	800	2,400	3,900	200	ND	910	37,000 D	3,200 D
PCB-195	ND	110	240	3,100	1,400	290	140	210	300	780	1,300	94	ND	330	14,000 D	1,300 D
PCB-197	ND	ND	ND	470	170	ND	ND	ND	ND	130	160	ND	ND	ND	1,000 D	160
PCB-198	ND	ND	ND	700	260	52	ND	ND	ND	180	270	ND	ND	ND	2,000 D	250
PCB-199	ND	34	87	1,700	690	120	56	76	110	800	630	26	ND	48	3,400 D	500 D
PCB-200	ND	37	96	1,500	680	140	63	76	120	1,000	670	ND	ND	28	3,700 D	670 D
PCB-201	ND	380	1,200	11,000	6,400	1,400	650	820	1,300	10,000	6,000	340	ND	670	53,000 D	7,600 D
PCB-202	ND	66	220	2,500	1,400	280	130	130	240	3,200	1,300	44	ND	60	7,000 D	1,500 D
PCB-203; PCB-196	ND	380	1,500	15,000	4,700	1,400	650	670	1,100	5,700	4,700	210	ND	580	140,000 D	18,000 D
PCB-205	ND	ND	36	920	300	35	23	33	65	95	200	ND	ND	62	2,600 D	220 D
PCB-206	ND	410	1,500	8,800	7,900	1,600	780	900	1,800	12,000	6,500	220	ND	440	98,000 D	15,000 D
PCB-207	ND	25	94	440	330	84	39	59	100	680	420	ND	ND	ND	4,300 D	910 D
PCB-208	ND	120	500	2,000	1,900	480	220	300	540	4,500	1,800	39	ND	52	32,000 D	5,600 D
PCB-209	ND	360	950	3,600	4,700	810	670	770	1,300	2,500	3,800	320	ND	230	120,000 D	40,000 D
Totals	**3,526**	**122,606**	**372,444**	**5,327,350**	**3,148,900**	**558,082**	**558,245**	**238,497**	**322,943**	**1,098,935**	**3,219,080**	**17,741**	**67**	**196,253**	**24,926,000**	**9,550,160**

Notes: ND- Not Detected D- Compound quantitated using a secondary dilution

Appendix E. PAH Results
ppb, dry weight

Station No.	Depth (cm)	Collection Date	Acenaphthene Value	Acenaphthene Detection Limit	Acenaphthylene Value	Acenaphthylene Detection Limit	Anthracene Value	Anthracene Detection Limit	Benzo(a)anthracene Value	Benzo(a)anthracene Detection Limit	Benzo(a)pyrene Value	Benzo(a)pyrene Detection Limit
6BCEF	Surficial	08/18/98	ND	60	ND	60	ND	60	160	60	230	60
6C	0-10	08/18/98	ND	60	ND	60	ND	60	82	60	120	60
6C	10-20	08/18/98	ND	60	ND	60	ND	60	ND	60	77	60
6C	20-30	08/18/98	ND	60	ND	60	62	60	220	60	280	60
6C	30-40	08/18/98	ND	60	ND	60	74	60	260	60	330	60
6C	40-50	08/18/98	ND	60	ND	60	71	60	280	60	370	60
6C	50-60	08/18/98	ND	60	ND	60	78	60	290	60	350	60
6C	60-70	08/18/98	ND	60	ND	60	140	60	600	60	640	60
6C	70-80	08/18/98	72	60	66	60	180	60	1000	60	1100	60
6C	80-90	08/18/98	100	50	190	50	320	50	870	50	760	50
6C	90-99	08/18/98	ND	60	280	60	320	60	960	60	980	60
6E	0-26	08/18/98	ND	60	ND	60	83	60	290	60	340	60
6E	26-40	08/18/98	ND	60	ND	60	100	60	410	60	470	60
6E	40-56	08/18/98	ND	60	ND	60	110	60	450	60	520	60
6E	56-74	08/18/98	80	60	110	60	250	60	1100	60	1100	60
6F	0-10	08/18/98	ND	60	ND	60	68	60	150	60	190	60
6F	10-28	08/18/98	300	60	ND	60	990	60	1400	60	1200	60
6F	28-52	08/18/98	170	60	74	60	290	60	960	60	940	60
6F	52-70	08/18/98	380	60	130	60	940	60	2100	60	2100	60
6F	70-110	08/18/98	380	50	230	50	1100	50	1800	50	1600	50
7ABC	Surficial	08/19/98	ND	60	ND	60	66	60	190	60	280	60
7A	0-20	08/19/98	ND	60	ND	60	76	60	290	60	480	60
7A	20-50	08/19/98	120	50	170	50	340	50	840	50	1200	50
7A	50-90	08/19/98	230	50	130	50	420	50	1100	50	940	50
7A	90-104	08/19/98	85	50	ND	60	200	50	470	50	370	50
7B	0-20	08/19/98	ND	60	ND	60	62	50	240	50	320	50
7B	20-58	08/19/98	280	50	ND	60	300	50	240	50	260	50
7B	58-66	08/19/98	ND	60	ND	60	ND	60	ND	60	ND	60
7C	0-20	08/19/98	ND	60	ND	60	170	50	590	50	690	50
7C	20-70	08/19/98	280	50	110	50	1100	50	1400	50	950	50
7C	70-83	08/19/98	ND	60	ND	60	120	50	350	50	220	50
8A	0-10	08/20/98	ND	60	ND	60	ND	60	120	50	110	50
8A	10-20	08/20/98	ND	60	ND	60	ND	60	240	50	510	50
8A	20-30	08/20/98	ND	60	ND	60	68	50	220	50	320	50
8A	30-40	08/20/98	ND	50	ND	50	64	50	160	50	260	50
8A	40-50	08/20/98	ND	50	ND	50	140	50	550	50	780	50
8A	50-60	08/20/98	ND	50	ND	50	76	50	230	50	300	50
8A	60-70	08/20/98	ND	50	ND	50	140	50	490	50	650	50
8A	70-80	08/20/98	54	50	ND	50	240	50	880	50	1100	50
8A	80-90	08/20/98	180	50	ND	50	540	50	1500	50	2200	50
8A	90-94	08/20/98	170	50	ND	50	540	50	860	50	950	50
9	Surficial	08/17/98	72	50	140	50	530	50	2000	50	1700	50
10	Surficial	08/18/98	ND	60	ND	60	ND	60	ND	60	ND	60
11	Surficial	08/17/98	250	60	ND	60	570	60	1500	60	1400	60
12	0-18	08/19/98	62	50	120	50	260	50	950	50	980	50
12	18-27	08/19/98	ND	60	69	50	240	50	630	50	760	50

Notes: D- Compound quantitated using secondary dilution.
E- Concentration exceeds calibration range, value estimated.
F- Reported value estimated due to interference

Appendix E. PAH Results, cont.

ppb, dry weight

			Benzo(b)fluoranthene			Benzo(e)pyrene		Benzo(g,h,i)perylene		Benzo(k)fluoranthene		
Station No.	Depth (cm)	Collection Date	Value		Detection Limit	Value	Detection Limit	Value	Detection Limit	Value		Detection Limit
6BCEF	Surficial	08/18/98	240		60	150	60	230	60	260		60
6C	0-10	08/18/98	130		60	80	60	110	60	120		60
6C	10-20	08/18/98	96		60	69	60	82	60	100		60
6C	20-30	08/18/98	260		60	180	60	240	60	280		60
6C	30-40	08/18/98	400		60	230	60	350	60	300		60
6C	40-50	08/18/98	330		60	270	60	380	60	340		60
6C	50-60	08/18/98	340		60	250	60	360	60	320		60
6C	60-70	08/18/98	490		60	530	60	690	60	380		60
6C	70-80	08/18/98	710		60	1000	60	1300	60	510		60
6C	80-90	08/18/98	850		50	450	50	670	50	790		50
6C	90-99	08/18/98	1100		60	500	60	840	60	1000		60
6E	0-26	08/18/98	350		60	220	60	320	60	320		60
6E	26-40	08/18/98	420		60	300	60	430	60	410		60
6E	40-56	08/18/98	410		60	380	60	430	60	380		60
6E	56-74	08/18/98	760		60	930	60	940	60	600		60
6F	0-10	08/18/98	220		60	130	60	190	60	190		60
6F	10-28	08/18/98	680		60	570	60	680	60	770		60
6F	28-52	08/18/98	670		60	790	60	890	60	590		60
6F	52-70	08/18/98	1200		60	870	60	1300	60	1300		60
6F	70-110	08/18/98	800		50	710	50	910	50	1100		50
7ABC	Surficial	08/19/98	250		60	170	60	220	60	280		60
7A	0-20	08/19/98	350		60	320	60	430	60	500		60
7A	20-50	08/19/98	740		50	830	50	1600	50	890		50
7A	50-90	08/19/98	640		50	470	50	600	50	830		50
7A	90-104	08/19/98	290		50	200	50	240	50	330		50
7B	0-20	08/19/98	280		50	210	50	280	50	340		50
7B	20-58	08/19/98	240		50	200	50	210	50	250		50
7B	58-66	08/19/98	ND		60	ND	60	ND	60	ND		60
7C	0-20	08/19/98	460		50	500	50	580	50	490		50
7C	20-70	08/19/98	560		50	450	50	450	50	660		50
7C	70-83	08/19/98	190		50	120	50	160	50	210		50
8A	0-10	08/20/98	220		50	120	50	130	50	200		50
8A	10-20	08/20/98	440		50	350	50	330	50	480		50
8A	20-30	08/20/98	330		50	210	50	260	50	310		50
8A	30-40	08/20/98	210	F	50	170	50	210	50	240	:	50
8A	40-50	08/20/98	740		50	420	50	610	50	770	:	50
8A	50-60	08/20/98	310		50	180	50	240	50	320		50
8A	60-70	08/20/98	600		50	360	50	570	50	660		50
8A	70-80	08/20/98	1200		50	580	50	930	50	1100		50
8A	80-90	08/20/98	2500		50	1200	50	1400	50	1900		50
8A	90-94	08/20/98	990		50	480	50	670	50	850		50
9	Surficial	08/17/98	1800		50	920	50	1400	50	1600		50
10	Surficial	08/18/98	ND		60	ND	60	ND	60	ND		60
11	Surficial	08/17/98	1400		60	710	60	1100	60	1400		60
12	0-18	08/19/98	800		50	580	50	830	50	860		50
12	18-27	08/19/98	690		50	410	50	580	50	760		50

Notes: D- Compound quantitated using secondary dilution.
E- Concentration exceeds calibration range, value estimated.
F- Reported value estimated due to interference

Appendix E. PAH Results, cont.
ppb, dry weight

			Chrysene		Dibenz(a,h)anthracene		Fluoranthene		Fluorene	
Station No.	Depth (cm)	Collection Date	Value	Detection Limit	Value	Detection Limit	Value	Detection Limit	Value	Detection Limit
6BCEF	Surficial	08/18/98	300	60	ND	60	370	60	ND	60
6C	0-10	08/18/98	130	60	ND	60	190	60	ND	60
6C	10-20	08/18/98	130	60	ND	60	140	60	ND	60
6C	20-30	08/18/98	360	60	ND	60	400	60	ND	60
6C	30-40	08/18/98	460	60	ND	60	550	60	ND	60
6C	40-50	08/18/98	500	60	66	60	490	60	ND	60
6C	50-60	08/18/98	480	60	63	60	510	60	ND	60
6C	60-70	08/18/98	1100	60	120	60	890	60	130	60
6C	70-80	08/18/98	2000	60	190	60	1100	60	250	60
6C	80-90	08/18/98	1400	50	150	50	2000	50	290	50
6C	90-99	08/18/98	1600	60	180	60	1900	60	180	60
6E	0-26	08/18/98	470	60	ND	60	560	60	ND	60
6E	26-40	08/18/98	640	60	77	60	660	60	ND	60
6E	40-56	08/18/98	830	60	83	60	720	60	150	60
6E	56-74	08/18/98	2100	60	180	60	1400	60	270	60
6F	0-10	08/18/98	270	60	ND	60	290	60	ND	60
6F	10-28	08/18/98	1800	60	190	60	1900	60	390	60
6F	28-52	08/18/98	1700	60	150	60	1300	60	290	60
6F	52-70	08/18/98	2400	60	300	60	2600	60	350	60
6F	70-110	08/18/98	2500	50	220	50	2500	50	330	50
7ABC	Surficial	08/19/98	360	60	ND	60	430	60	ND	60
7A	0-20	08/19/98	610	60	62	60	510	60	ND	60
7A	20-50	08/19/98	1500	50	570	50	1800	50	280	50
7A	50-90	08/19/98	2100	50	140	50	2000	50	290	50
7A	90-104	08/19/98	740	50	ND	60	730	50	150	50
7B	0-20	08/19/98	460	50	ND	60	420	50	ND	60
7B	20-58	08/19/98	420	50	ND	60	550	50	370	50
7B	58-66	08/19/98	ND	60	ND	60	ND	60	ND	60
7C	0-20	08/19/98	910	50	81	50	800	50	72	50
7C	20-70	08/19/98	1900	50	140	50	2100	50	440	50
7C	70-83	08/19/98	580	50	ND	60	520	50	100	50
8A	0-10	08/20/98	230	50	ND	60	310	50	ND	60
8A	10-20	08/20/98	420	50	ND	60	540	50	ND	60
8A	20-30	08/20/98	310	50	ND	60	450	50	ND	60
8A	30-40	08/20/98	270	50	ND	50	260	50	ND	50
8A	40-50	08/20/98	860	50	120	50	1600	50	67	50
8A	50-60	08/20/98	330	50	ND	50	540	50	ND	50
8A	60-70	08/20/98	750	50	100	50	1400	50	68	50
8A	70-80	08/20/98	1200	50	170	50	2600 D	50	130	50
8A	80-90	08/20/98	2100	50	270	50	6400 D	50	280	50
8A	90-94	08/20/98	1200	50	130	50	3000	50	350	50
9	Surficial	08/17/98	2200	50	290	50	4500 E	50	190	50
10	Surficial	08/18/98	ND	60	ND	60	ND	60	ND	60
11	Surficial	08/17/98	1900	60	240	60	3900 E	60	360	60
12	0-18	08/19/98	1300	50	160	50	1700	50	120	50
12	18-27	08/19/98	920	50	130	50	1400	50	110	50

Notes: D- Compound quantitated using secondary dilution.
E- Concentration exceeds calibration range, value estimated.
F- Reported value estimated due to interference

Appendix E. PAH Results, cont.
ppb, dry weight

			Indeno(1,2,3-cd)pyrene		Naphthalene		2-Methylnaphthalene		Perylene	
Station No.	Depth (cm)	Collection Date	Value	Detection Limit	Value	Detection Limit	Value	Detection Limit	Value	Detection Limit
6BCEF	Surficial	08/18/98	230	60	ND	60	ND	60	70	60
6C	0-10	08/18/98	150	60	ND	60	ND	60	ND	60
6C	10-20	08/18/98	79	60	ND	60	ND	60	ND	60
6C	20-30	08/18/98	250	60	ND	60	ND	60	88	60
6C	30-40	08/18/98	320	60	ND	60	ND	60	92	60
6C	40-50	08/18/98	310	60	ND	60	ND	60	120	60
6C	50-60	08/18/98	300	60	ND	60	ND	60	120	60
6C	60-70	08/18/98	360	60	81	60	140	60	140	60
6C	70-80	08/18/98	530	60	110	60	240	60	210	60
6C	80-90	08/18/98	660	50	150	50	160	50	180	50
6C	90-99	08/18/98	910	60	180	60	180	60	230	60
6E	0-26	08/18/98	310	60	ND	60	ND	60	110	60
6E	26-40	08/18/98	370	60	ND	60	ND	60	110	60
6E	40-56	08/18/98	410	60	73	60	130	60	130	60
6E	56-74	08/18/98	550	60	130	60	300	60	190	60
6F	0-10	08/18/98	190	60	ND	60	ND	60	67	60
6F	10-28	08/18/98	650	60	100	60	91	60	210	60
6F	28-52	08/18/98	520	60	300	60	130	60	180	60
6F	52-70	08/18/98	1200	60	200	60	140	60	700	60
6F	70-110	08/18/98	790	50	220	50	280	50	360	50
7ABC	Surficial	08/19/98	230	60	ND	60	ND	60	84	60
7A	0-20	08/19/98	400	60	ND	60	ND	60	170	60
7A	20-50	08/19/98	970	50	140	50	93	50	260	50
7A	50-90	08/19/98	710	50	210	50	160	50	260	50
7A	90-104	08/19/98	270	50	240	50	83	50	340	50
7B	0-20	08/19/98	310	50	ND	60	ND	60	96	50
7B	20-58	08/19/98	180	50	1800	50	470	50	190	50
7B	58-66	08/19/98	ND	60	ND	60	ND	60	ND	60
7C	0-20	08/19/98	330	50	92	50	71	50	170	50
7C	20-70	08/19/98	410	50	240	50	350	50	240	50
7C	70-83	08/19/98	160	50	200	50	81	50	110	50
8A	0-10	08/20/98	140	50	ND	60	ND	60	ND	60
8A	10-20	08/20/98	390	50	ND	60	ND	60	180	50
8A	20-30	08/20/98	250	50	ND	60	ND	60	150	50
8A	30-40	08/20/98	180	50	84	50	ND	50	130	50
8A	40-50	08/20/98	630	50	ND	50	ND	50	320	50
8A	50-60	08/20/98	220	50	ND	50	ND	50	250	50
8A	60-70	08/20/98	550	50	ND	50	ND	50	350	50
8A	70-80	08/20/98	1000	50	55	50	ND	50	420	50
8A	80-90	08/20/98	1300	50	80	50	74	50	680	50
8A	90-94	08/20/98	640	50	90	50	110	50	300	50
9	Surficial	08/17/98	1500	50	100	50	68	50	410	50
10	Surficial	08/18/98	ND	60	ND	60	ND	60	ND	60
11	Surficial	08/17/98	1200	60	120	60	66	60	310	60
12	0-18	08/19/98	740	50	480	50	300	50	230	50
12	18-27	08/19/98	650	50	140	50	89	50	200	50

Notes: D- Compound quantitated using secondary dilution.
E- Concentration exceeds calibration range, value estimated.
F- Reported value estimated due to interference

Appendix E. PAH Results, cont.
ppb, dry weight

Station No.	Depth (cm)	Collection Date	Phenanthrene Value		Phenanthrene Detection Limit	Pyrene Value		Pyrene Detection Limit
6BCEF	Surficial	08/18/98	150		60	360		60
6C	0-10	08/18/98	93		60	200		60
6C	10-20	08/18/98	86		60	160		60
6C	20-30	08/18/98	190		60	460		60
6C	30-40	08/18/98	210		60	590		60
6C	40-50	08/18/98	210		60	560		60
6C	50-60	08/18/98	310		60	560		60
6C	60-70	08/18/98	720		60	1100		60
6C	70-80	08/18/98	1200		60	1500		60
6C	80-90	08/18/98	1300		50	1900		50
6C	90-99	08/18/98	1100		60	2100		60
6E	0-26	08/18/98	290		60	620		60
6E	26-40	08/18/98	340		60	780		60
6E	40-56	08/18/98	590		60	900		60
6E	56-74	08/18/98	1600		50	1800		60
6F	0-10	08/18/98	180		60	340		60
6F	10-28	08/18/98	2900		60	3100		50
6F	28-52	08/18/98	1100		60	1800		60
6F	52-70	08/18/98	2300		60	3600	E	60
6F	70-110	08/18/98	2300		50	3600	E	50
7ABC	Surficial	08/19/98	230		60	460		60
7A	0-20	08/19/98	190		60	650		60
7A	20-50	08/19/98	1400		50	1800		50
7A	50-90	08/19/98	910		50	2400		50
7A	90-104	08/19/98	750		50	780		50
7B	0-20	08/19/98	200		50	500		50
7B	20-58	08/19/98	1200		50	680		50
7B	58-66	08/19/98	ND		60	ND		60
7C	0-20	08/19/98	600		50	1000		50
7C	20-70	08/19/98	3200	E	50	3200	E	50
7C	70-83	08/19/98	520		50	530		50
8A	0-10	08/20/98	ND		60	290		50
8A	10-20	08/20/98	ND		60	550		50
8A	20-30	08/20/98	2700		50	490		50
8A	30-40	08/20/98	150		50	380		50
8A	40-50	08/20/98	490		50	1400		50
8A	50-60	08/20/98	230		50	490		50
8A	60-70	08/20/98	630		50	1200		50
8A	70-80	08/20/98	1200		50	2100	D	50
8A	80-90	08/20/98	1900		50	5300	D	50
8A	90-94	08/20/98	2400		50	2500		50
9	Surficial	08/17/98	2400		50	3800	E	50
10	Surficial	08/18/98	ND		60	ND		60
11	Surficial	08/17/98	3400	E	60	3100	E	60
12	0-18	08/19/98	1000		50	1800		50
12	18-27	08/19/98	700		50	1400		50

Notes: D- Compound quantitated using secondary dilution.
E- Concentration exceeds calibration range, value estimated.
F- Reported value estimated due to interference

Appendix F.- Particle Size Analysis Results

U.S. Standard Sieve Size	Diameter (mm)	Station No. Depth (cm)	6BCEF Surficial	7ABC Surficial	7ABC (duplicate) Surficial	8A 20 to 30	10 Surficial	11 Surficial
			% Finer					
40 (Fine Sand)	**0.425**		98	95	85	99	97	58
100	**0.015**		87	83	72	88	90	23
200 (Silt)	**0.075**		79	71	63	77	80	17
Hydrometer	**0.04**		38	13	25	44	37	9
Hydrometer	**0.01**		11	7	<16	27	20	<8
		Visual Description	Silty Sediment	Silty Sediment	Silty Sediment	Not Reported	Silty Sediment	Sandy Sediment

Note: Analyses conducted by Maxim Technologies Inc.

Appendix G

Results of Toxicity Tests

Conducted August 22-September 2, 1998

for New York State

Department of Environmental Conservation

NYS DEC Case # BG098

NYS DEC SDG # 81698

Laboratory Sample ID	Client Sample ID	Species	Mean Survival (%)	Mean Dry Weight (mg)
6647	06BCEF	*Chironomus tentans*	94	1.96
6648	07ABC	*Chironomus tentans*	98	0.33 *
6649	8A	*Chironomus tentans*	96	2.41
6650	Laboratory Control	*Chironomus tentans*	96	1.33
6647	06BCEF	*Hyalella azteca*	98	0.143
6648	07ABC	*Hyalella azteca*	99	0.139
6649	8A	*Hyalella azteca*	96	0.200
6650	Laboratory Control	*Hyalella azteca*	88	0.146

* Statistically significantly different from the laboratory control sediment ($p \leq 0.05$)

TESTS CONDUCTED: Ten day whole sediment toxicity tests. Midge, *Chironomus tentans,* Larval Survival and Growth; Amphipod*, Hyalella azteca*, Survival and Growth

METHODS:

The procedures followed in conducting these toxicity tests were based on methods described by the USEPA (EPA 600/R-94/024).

PROTOCOL DEVIATIONS:

Protocol deviations were not encountered.

QUALITY ASSURANCE:

A standard reference toxicant SRT test was conducted for *Chironomus tentans, and Hyalella azteca*; the resulting LC50 values fell within control chart limits and were viewed as being acceptable.

Midge (*Chironomus tentans*) Sediment Toxicity Test Results

BTR Number: 2218 Project Number: 98048 Test Start Date: 8/23/98

Species: *Chironomus tentans* Test End Date: 9/2/98

Aquatec Biological Sciences

Project Description: New York State DEC

Sample Number	Replicate	Start Count	Total No. Surviving	*Proportion Surviving*	*Mean Proportion Surviving*	Initial Boat Weight (mg)	Total Dry Weight (mg)	No. of Organisms Weighed	*Mean Weight Within Replicate (mg)*	*Mean Weight Over All Replicates (mg)*
6647	A	10	9	0.90		37.51	55.45	9	1.993	
	B	10	10	1.00		44.62	63.51	10	1.889	
	C	10	10	1.00		38.37	56.85	10	1.848	
	D	10	10	1.00		41.93	62.18	10	2.025	
	E	10	9	0.90		47.71	66.01	9	2.033	
	F	10	9	0.90		42.32	58.61	9	1.810	
	G	10	10	1.00		45.87	62.60	10	1.673	
	H	10	8	0.80	0.94	45.06	64.09	8	2.379	1.956
6648	A	10	10	1.00		45.28	49.16	10	0.388	
	B	10	10	1.00		48.51	52.34	10	0.383	
	C	10	8	0.80		39.17	42.11	8	0.368	
	D	10	10	1.00		39.22	41.24	10	0.202	
	E	10	10	1.00		42.18	46.10	10	0.392	
	F	10	10	1.00		47.22	51.80	10	0.458	
	G	10	10	1.00		44.26	46.82	10	0.256	
	H	10	10	1.00	0.98	42.26	44.46	10	0.220	0.333
6649	A	10	9	0.90		40.14	59.99	9	2.206	
	B	10	10	1.00		43.24	67.86	10	2.462	
	C	10	10	1.00		43.25	70.33	10	2.708	
	D	10	9	0.90		43.59	65.96	9	2.486	
	E	10	10	1.00		41.26	66.11	10	2.485	
	F	11	11	1.00		43.39	67.57	11	2.198	
	G	10	10	1.00		41.44	65.44	10	2.400	
	H	10	9	0.90	0.96	41.81	63.15	9	2.371	2.414
6650	A	10	10	1.00		48.25	62.78	10	1.453	
	B	10	10	1.00		42.13	55.29	10	1.316	
	C	10	10	1.00		41.77	50.92	10	0.915	
	D	10	10	1.00		42.34	54.90	10	1.256	
	E	10	9	0.90		39.64	52.53	9	1.432	
	F	10	8	0.80		43.54	57.08	8	1.693	
	G	10	10	1.00		44.03	55.85	10	1.182	
	H	10	10	1.00	0.96	42.40	56.20	10	1.380	1.328

Amphipod (*Hyalella azteca*) Sediment Toxicity Test Results

BTR Number: 2218 Project Number: 98048 Test Start Date: 8/22/98

Species: *Hyalella azteca* Test End Date: 9/1/98

Aquatec Biological Sciences

Project Description: New York State DEC

Sample Number	Replicate	Start Count	Total No. Surviving	*Proportion Surviving*	*Mean Proportion Surviving*	Initial Boat Weight (mg)	Total Dry Weight (mg)	No. of Organisms Weighed	*Mean Weight Within Replicate (mg)*	*Mean Weight Over All Replicates (mg)*
6647	A	10	10	1.00		44.21	45.50	10	0.129	
	B	10	9	0.90		46.14	47.09	9	0.106	
	C	10	10	1.00		43.16	44.87	10	0.171	
	D	10	10	1.00		43.45	44.85	10	0.140	
	E	10	9	0.90		44.46	45.60	9	0.127	
	F	10	10	1.00		47.62	49.47	10	0.185	
	G	10	10	1.00		47.66	48.89	10	0.123	
	H	10	10	1.00	0.98	45.02	46.67	10	0.165	0.143
6648	A	10	10	1.00		42.23	43.27	10	0.104	
	B	10	10	1.00		42.08	43.55	10	0.147	
	C	10	10	1.00		46.60	47.46	10	0.086	
	D	10	10	1.00		43.11	45.10	10	0.199	
	E	10	10	1.00		41.90	42.94	10	0.104	
	F	10	9	0.90		43.32	44.24	10	0.092	
	G	10	10	1.00		40.09	41.85	9	0.196	
	H	10	10	1.00	0.99	45.48	47.35	10	0.187	0.139
6649	A	10	10	1.00		48.15	49.77	10	0.162	
	B	10	8	0.80		45.38	46.87	8	0.186	
	C	10	9	0.90		43.88	44.96	9	0.120	
	D	10	10	1.00		45.91	48.49	10	0.258	
	E	10	10	1.00		44.83	46.87	10	0.204	
	F	10	10	1.00		43.43	44.97	10	0.154	
	G	10	10	1.00		42.94	45.51	10	0.257	
	H	10	10	1.00	0.96	47.40	49.97	10	0.257	0.200
6650	A	10	10	1.00		43.05	44.10	10	0.105	
	B	10	9	0.90		43.90	45.20	9	0.144	
	C	10	10	1.00		49.56	51.61	10	0.205	
	D	10	10	1.00		38.46	40.29	10	0.183	
	E	10	9	0.90		42.34	43.30	9	0.107	
	F	10	4	0.40		41.42	41.96	4	0.135	
	G	10	10	1.00		42.28	43.79	10	0.151	
	H	10	8	0.80	0.88	38.51	39.64	8	0.141	0.146

Appendix H.-Summary of Radionuclide Counting Data

Sediment Core 6C

This is an excellent core that appears to contain a continuous record of sediment accumulated from ca. 1954 to the date of coring (98230).

- Be-7, a short-lived (half-life = 53.4 days) natural radionuclide produced in the atmosphere by cosmic ray spallation of N_2 and O_2, was detected in the 0-2 cm section. This indicates that this sample contains a significant component of particles deposited within a year of sample collection.
- A peak in Cs-137 activity is seen in the 64-68 cm section. We assign this peak activity to the 1963-64 global fallout maximum and calculate an average net sedimentation rate of about 1.9 cm/y between 1963 and 1997.
- The deepest detection of Cs-137 occurs at about 78 cm. We associate this horizon with the onset of large-scale atmospheric testing of nuclear weapons in about 1954. We calculate an average net sedimentation rate of about 1.8 cm/y between 1954 and 1997.
- The fairly high particle accumulation rate produces a fairly low surface Pb-210 activity (6.71 $\pm$ 0.84 dpm/g). As expected, total Pb-210 levels show a general decrease with depth, however, because of the low surface activity, quantitative dating information cannot be obtained.

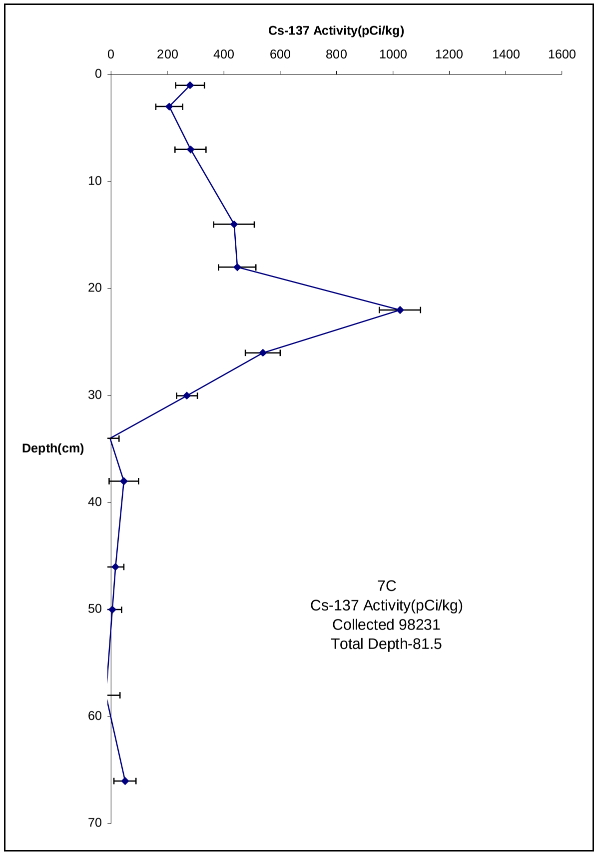
Sediment Core 7C

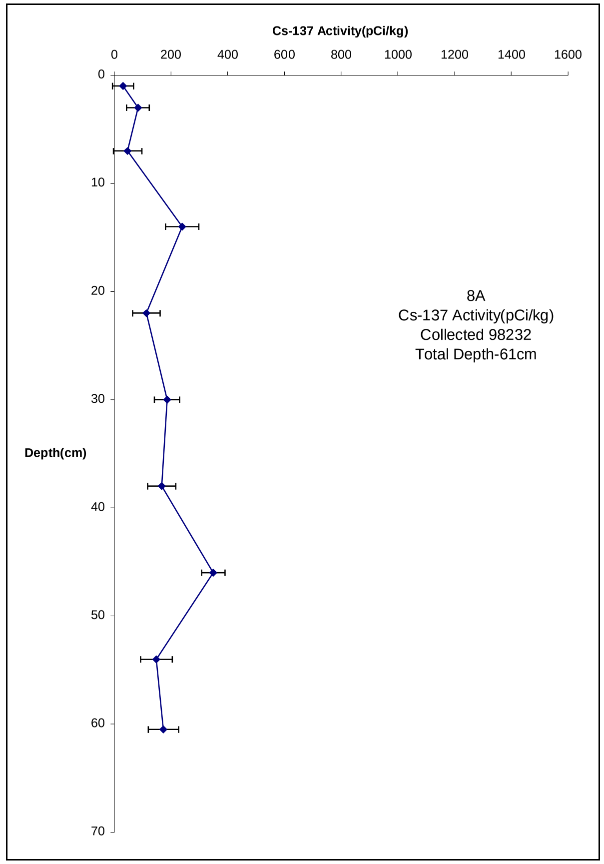
A very good core, containing sediment deposited between about 100 years ago and the date of collection (98231). Key features include:

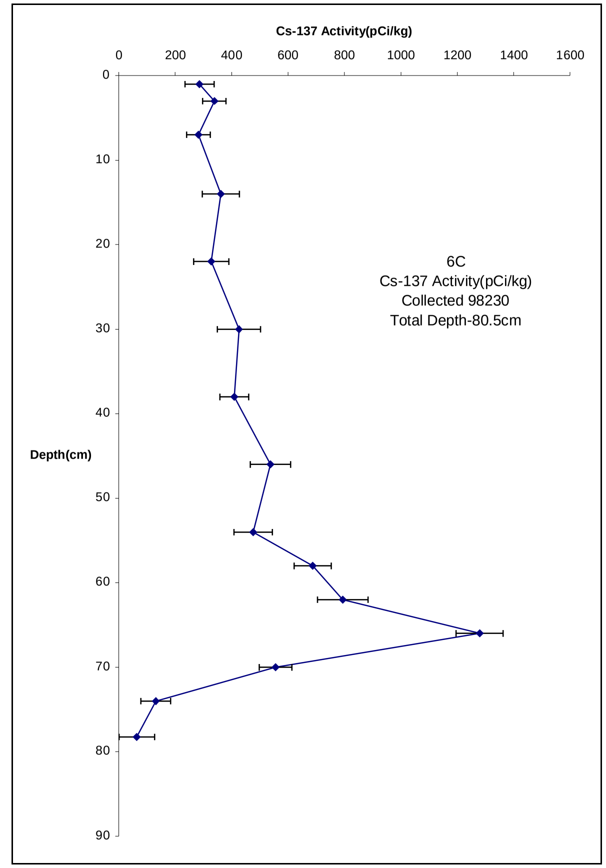
- Detectable Be-7 activity in the 0-2 cm section.
- A peak Cs-137 activity (1963-64) in the 20-24 cm section and the deepest detectable activity (ca. 1954) in the 28-32 cm section. Both of these time indicators are consistent with a net sediment accumulation rate of about 0.65 cm/y.
- Fairly low surface Pb-210 activity (6.46 $\pm$ 0.81 dpm/g) that generally decreases with depth (as expected), but cannot provide quantitative dating information.
- Extrapolation of the Cs-137 derived sedimentation rate suggests that the bottom section of the core (64-68 cm) contains sediment deposited around 1900.

Sediment Core 8A

This 61 cm long core was collected on 98232. It is a rather poor core from a dating perspective. The Be-7 content of the 0-2 cm section was positive, but less than 2σ greater than zero. Total Pb-210 activities were low and variable, 4.15 $\pm$ 0.66 dpm/g in the 0-2 cm section. Cs-137 activity was detected to the bottom section of the core, but the levels were low and the profile was not readily interpretable. Detectable Cs-137 activity in most sections indicates that much of the core contains a significant component of particles deposited since 1954.


Cs-137 Activity(pCi/kg)
Depth(cm)
7C
Cs-137 Activity(pCi/kg)
Collected 98231
Total Depth-81.5


Cs-137 Activity(pCi/kg)
Depth(cm)
8A
Cs-137 Activity(pCi/kg)
Collected 98232
Total Depth-61cm


Cs-137 Activity(pCi/kg)
Depth(cm)
6C
Cs-137 Activity(pCi/kg)
Collected 98230
Total Depth-80.5cm

Radiodating Results

Core 6C

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	286	52	1203	552	6.71	0.84	17446.6	1392.8
2-4	338	41	369	413	6.57	0.65	18079.9	1191.5
6-8	282	42					18343.2	1300.5
12-16	362	66					19256.9	1735.0
20-24	328	62			5.92	0.91	19231.3	1641.1
28-32	426	77			6.48	1.37	16352.8	1765.8
36-40	409	51			6.06	0.75	16783.8	1276.6
44-48	537	72					19204.6	1703.9
52-56	476	68			4.45	0.85	18300.3	1589.0
56-60	688	66			4.40	0.71	15506.9	1274.6
60-64	794	89			5.25	1.04	12462.5	1512.8
64-68	1279	84			3.50	0.57	15837.1	1152.9
68-72	556	58			3.00	0.65	15451.3	1245.4
72-76	130	53			3.15	0.85	15466.3	1501.0
76-80.5	63	63			4.13	1.04	18041.1	1883.9

Core 7C

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	280	51	1543	557	6.46	0.81	15019.3	1256.8
2-4	206	47	542	525	6.33	0.77	15298.5	1247.0
6-8	282	55			5.97	0.82	16130.5	1389.6
12-16	436	72			3.95	0.96	14205.8	1537.1
16-20	448	66			5.22	0.88	16151.0	1465.0
20-24	1025	74					12415.4	986.6
24-28	538	62			4.14	0.69	12807.4	1154.9
28-32	269	37			2.39	0.50	13845.6	998.7
32-36	-4	32			2.02	0.52	14397.9	1069.3
36-40	45	52			2.51	0.86	17250.4	1624.0
44-48	15	30			3.87	0.57	17074.3	1196.7
48-52	4	34			2.59	0.55	17504.6	1246.0
56-60	-19	50			3.44	0.88	15806.5	1552.9
64-68	49	39			2.02	0.65	18253.0	1417.6

Core 8A

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	31	37	576	432	4.15	0.66	16027.2	1228.5
2-4	84	40	518	467	4.62	0.68	18083.5	1338.6
6-8	47	50			4.73	0.95	16347.4	1515.7
12-16	240	59			5.84	1.01	16936.2	1624.5
20-24	114	49			5.54	0.92	15676.1	1429.2
28-32	186	44			5.14	0.76	14657.2	1236.8
36-40	168	50			4.12	0.93	16309.7	1473.4
44-48	349	41			4.18	0.58	20106.3	1306.0
52-56	149	55			2.95	0.90	15552.1	1507.5
60-61	174	53			5.10	0.87	16726.3	1455.5