36726

42

PHASE 1 REPORT - REVIEW COPY
INTERIM CHARACTERIZATION AND EVALUATION

HUDSON RIVER PCB REASSESSMENT RI/FS

EPA WORK ASSIGNMENT NO. 013-2N84

AUGUST 1991

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region II

ALTERNATIVE REMEDIAL CONTRACTING STRATEGY (ARCS)
FOR
HAZARDOUS WASTE REMEDIAL SERVICES

EPA Contract No. 68-S9-2001

VOLUME 1
(BOOK 2 OF 2)

TAMS CONSULTANTS, Inc.
and
Gradient Corporation

TAMS CONSULTANTS, INC./GRADIENT CORPORATION

PHASE 1 REPORT

INTERIM CHARACTERIZATION AND EVALUATION

HUDSON RIVER PCB REASSESSMENT RI/FS

ABBREVIATED CONTENTS*

* SEPARATE, DETAILED TABLES OF CONTENTS PRECEDE THE INTRODUCTION, PARTS A, B AND C, TABLES, FIGURES AND PLATES.

TABLES

PHASE 1 REPORT

INTERIM CHARACTERIZATION AND EVALUATION

HUDSON RIVER PCB REASSESSMENT RI/FS

CONTENTS

The TAMS/Gradient Database is the source of all data, except as noted on tables where appropriate.

PAGE INTENTIONALLY LEFT BLANK

Table A.1-1
Mean Annual Flow for Hudson River Tributaries

River Mile	Tributary	Drainage Area[1] sq. mi.	Flow[2] cfs	% of[3] ΣFlow
154	Hudson River[4]	8089	12500	64.0
145	Normans Kill	179	260[5]	1.3
122	Kinderhook Creek	473	700[5]	3.6
113	Catskill Creek	988	1460[5]	7.5
102	Esopus Creek	425	380[5]	1.9
91	Wallkill River	764	1070	5.5
91	Rondout Creek	386	340[5]	1.7
67	Wappinger Creek	210	290	1.5
60	Fishkill Creek	194	290	1.5
58	Moodna Creek	198	290[5]	1.5
34	Croton River	378	350[5]	1.8
0 to 154	Remaining Minor Tributaries	1083	1600[5]	8.2
	TOTAL HUDSON	13367	19530	100.0
1 to -5	NY + NJ Sewage		2540[6]	
150	Albany Area Sewage		100[7]	

Notes:

1 Drainage Areas from Wagner, L.A., Geological Survey Water Resources Investigations Open File Report 81-1055 (1982).

2 Source: Long term averages from <u>Geological Survey Water Supply Paper No. 1902 (1970):</u> flow values rounded to nearest ten cfs.

3 Percentage of grand total excluding sewage.

4 The last gauging station on the main axis of the Hudson River above tidal water is located at the Federal Dam at Troy. This total includes ≈5300 cfs from the Mohawk River and ≈7100 cfs from the Upper Hudson.

5 Does not include water drawn for municipal use.

6 From Mueller et al. (1982) plus 2.6% to account for subsequent increase in municipal usage up to 1984. This includes only those sewage outfalls which enter the Hudson estuary. The outfalls to Long Island Sound, Raritan Bay, etc. are not included.

7 From Darmer (1987).

Source: Garvey (1990).

Table A.1–2
Public Water Supplies on the Lower Hudson River

Supply Name	Owner City	County	Type	River Mile	Design Capacity (mgd)	Current Average Production (mgd)
Castle Point Medical Center	Castle Point	Dutchess	I	64	0.15	0.0830
Poughkeepsie WTP	Poughkeepsie	Dutchess	M	77	15.20	9.6500
Rhinebeck WTP	Rhinebeck	Dutchess	M	93	1.00	0.5500
Firthcliffe WD	Cornwall	Orange	M			0.0170
Highland WD	Highland	Ulster	M	76	1.00	0.5600
Port Ewen WD	Port Ewen	Ulster	M	90	0.50	0.3750
Camp Woodcliff	Kingston	Ulster	I		NA	NA
Marist Brother Camp	Jamaica	Ulster	I		NA	0.0024
Marist Preparatory School	Jamaica	Ulster	I		NA	NA

Notes:

I = Institutional
M = Municipality
WTP = Water Treatment Plant
WD = Water District

Sources: NYS Department of Health (1991) and for design capacity
Malcolm Pirnie, Inc. (1984).

Table A.2-1
Aroclor Mixtures

	Percentage of Group within Mixture				
	Aroclor Mixture				
PCB Homologue Group	1016	1221	1242	1254	1260
Biphenyl	<0.1	11	<0.1	<0.1	--
Monochlorobiphenyl	1	51	1	<0.1	--
Dichlorobiphenyl	20	32	16	0.5	--
Trichlorobiphenyl	57	4	49	1	--
Tetrachlorobiphenyl	21	2	25	21	1
Pentachlorobiphenyl	1	<0.5	8	48	12
Hexachlorobiphenyl	<0.1	--	1	23	38
Heptachlorobiphenyl	--	--	<0.1	6	41
Octachlorobiphenyl	--	--	--	--	8
Nonachlorobiphenyl	--	--	--	--	--
Decachlorobiphenyl	--	--	--	--	--

Source: USEPA, "Environmental Transport and Transformation of Polychlorinated Biphenyls." EPA 560/5-83-025. Office of Pesticides and Toxic Substances. Washington, DC (1983).

Table A.2-2
Summary of Non-Point Source Loads to the Lower Hudson River

Source	Range of Load Estimates[1] (lb/day)
Tributaries	0.2 - 2.3
Sewage	3 - 4.6
Combined Sewer/Storm Water Outfalls and Storm Water Outfalls	2 - 3
Atmospheric Deposition	0.1 - 0.5
Landfill Leachate	0 - 0.7

Notes:

[1] Sources, discussed in text, base estimates on only a few measurements and must be considered uncertain.

Table A.3-1
Inventory of PCBs in the Sediments of the Lower Hudson River

	Location	PCB burden (kg)
1)	New York Harbor (*in situ*)	23,000
2)	Coves and Marginal Area	
	a) Coves and bays	10,000
	b) Haverstraw Bay and the Tappan Zee	16,000
3)	Low Deposition Areas (Channel and Subtidal Bank)	13,000
4)	Upstream Areas of High Deposition	
	a) Albany turning basins (River Mile 143, 144), mp 109.5 and Lent's Cove (River Mile 43.2)	2,000
	b) Kingston area (River Mile 85-93)	21,000
Total PCBs associated with sediments of the Lower Hudson (*in situ*)		85,000
Total PCBs dredged from New York Harbor		37,000

Sources: PCB burden figures Bopp (1979), except for Kingston area (Bopp and Simpson, 1989).

Table A.3-2

Comparison of PCB Concentrations in Suspended Matter and Sediment Core Tops Near River Mile 3

		PCB Concentration Selected Aroclor 1242 Homologues (mg/kg)
1980	Suspended Matter at River Mile 3	2.0
1981	River Mile 2.7 Sediment Core Tops (0-2 cm)	1.9
1982	River Mile 2.3 Sediment Core Top (0-2 cm)	1.6
1984	Suspended Matter at River Mile 3	1.7-1.9

Source: Bopp and Simpson (1984).

Table A.3-3

Count of Fish Samples by Year [1]

LOWER HUDSON: Mile 0-152								
Year	Sample	STB	PKSD	LMB	BB	AS	AMEL	Other
1970 [2]	Unknown			7				2
1972 [2]	Unknown		3					36
1970-2 [2]	Unknown	3		18				9
1973 [2]	Fillet					14		
	Unknown	22						
1975 [2]	Whole	2						6
	Fillet	37						3
	Unknown			12	1	6	7	23
1975	Fillet	30		2	1	3	9	24
	Whole	2		6				10
	Other	5				1		1
1976	Fillet	111				77	3	7
	Whole							
1977	Fillet			27	8			23
	Whole							
	Other	1				3		
1978	Fillet	375		18		151	45	136
1979	Fillet	30					103	168
	Whole		70					
	Other							4
1980	Fillet	202		20		125	75	75
	Whole		50					
	Other	2						5
1981	Fillet	213		35		30	89	70
	Whole							
1982	Fillet	181		18		30	75	101
	Whole		72					
	Other	51						1
1983	Fillet	157		20		30	43	105
	Whole		90					
1984	Fillet	289	75	20		30		81
	Whole	44				10		
1985	Fillet	388	7	20		30		20
	Whole		22					
1986	Fillet	286	49	20				43
1987	Fillet	209	14					
1988	Fillet	215		59				
	Whole		27					27
Totals		2855	479	302	10	540	449	980

NOTES:

[1] One sample generally includes 1-3 fish.

[2] 1970, 1972, 1973 data, and some data from 1973 and 1975 taken from Spagnoli & Skinner, 1977.

STB Striped Bass
AMEL American Eel
PKSD Pumpkinseed
GLDF Goldfish
LMB Largemouth Bass
GLDF Goldfish
AS American Shad
BB Brown Bullhead

Table A.3-4
Hudson River Fish
Species and Percent Lipid

Abbreviation	Species	Average Percent Lipid [1]
ALW	Alewife	7.6
ANED	Atlantic Needlefish	2.94
AS	American Shad	14.84
ATS	Atlantic Sturgeon	4.37
ATTC	Atlantic Tomcod	0.54
BB	Brown Bullhead	2.83
BBH	Blueback Herring	6.75
BLC	Black Crappie	0.82
BLUE	Bluefish	1.31
CARP	Carp	9.85
CHP	Chain Pickerel	0.15
GLDF	Goldfish	9.36
LMB	Largemouth Bass	1.31
NOP	Northern Pike	1.66
PKSD	Pumpkinseed	3.08
RB	Rock Bass	1.4
RBRS	Red Breasted Sunfish	1.4
RS	Rainbow Smelt	2.23
SMB	Smallmouth Bass	0.88
SNS	Shortnose Sturgeon	4.22
STB	Striped Bass	6.77
TML	Tiger Muskelunge	1.58
WC	White Catfish	5.37
WEYE	Walleye	1.81
WP	White Perch	4.95
WS	White Sucker	4.56
YP	Yellow Perch	0.7

NOTES:

[1] Average calculated for all fish fillet samples collected for each species.

Table A.3-5
Striped Bass, Total PCBs (ppm)
Lower Hudson

	Lower Estuary (river mile 12-76)						River Mile 27					
Year	n	Max.	Med.	Mean	SE [1]	95% CB [2]	n	Max.	Med.	Mean	SE	95% CB
1975	21	85.7	13.9	19.8	4.23	28.6	7	37.8	6.5	9.7	4.40	20.1
1976	110	169.9	6.0	12.0	2.24	16.4	51	169.9	6.2	14.8	4.51	23.8
1978	375	237.6	9.9	18.1	1.45	20.9	135	128.7	7.6	11.2	1.30	13.8
1979	30	26.2	4.8	6.7	1.07	8.9	30	26.2	4.8	6.7	1.07	8.9
1980	201	52.1	3.8	6.1	0.52	7.1	62	41.6	3.8	5.9	0.81	7.5
1981	213	39.5	3.0	4.8	0.40	5.6	30	14.8	3.5	4.3	0.63	5.6
1982	181	28.3	2.7	5.1	0.51	6.1	50	16.9	3.0	3.6	0.40	4.4
1983	130	32.9	3.7	4.8	0.38	5.6	50	32.9	4.1	6.0	0.87	7.7
1984	267	47.8	2.7	4.1	0.30	4.6	61	14.1	2.8	3.6	0.31	4.2
1985	338	60.3	3.2	5.4	0.36	6.1	65	31.2	2.8	3.8	0.55	4.9
1986	258	31.5	3.0	4.5	0.28	5.0	60	15.7	2.3	3.1	0.34	3.8
1987	186	23.2	2.4	3.5	0.27	4.0	40	21.6	2.0	3.1	0.59	4.3
1988	193	28.5	2.7	4.0	0.31	4.6	40	17.2	2.1	3.1	0.45	4.0

	Upper Estuary (river mile 91-153)						River Mile 153					
	n	Max.	Med.	Mean	SE	95% CB	n	Max.	Med.	Mean	SE	95% CB
1975	9	52.2	13.2	19.1	4.60	29.5						
1976												
1978												
1979												
1980	4	25.0	17.8	15.8	3.47	25.5	3	25.0	17.8	19.2	2.46	27.0
1981												
1982												
1983	20	56.8	4.4	8.3	2.73	14.0						
1984	28	17.6	5.1	6.9	0.94	8.9	6	17.0	5.6	8.7	2.38	14.5
1985	70	47.7	7.3	10.2	1.06	12.3	20	47.7	17.8	18.9	2.19	23.4
1986	64	51.9	11.2	13.2	1.34	15.8	36	51.9	14.4	16.4	1.64	19.8
1987	53	21.2	7.3	7.6	0.66	8.9	30	21.2	10.0	10.1	0.76	11.6
1988	30	16.2	4.8	6.3	0.86	8.1	8	16.2	11.9	10.4	1.57	14.0

NOTES:

All concentrations reported in parts per million (ppm) wet weight.

[1] **SE = Standard Error (Standard Deviation divided by square root of N).**

[2] **95% CB = 95% upper confidence bound on mean : 95%CB = mean + t(0.975) * SE.**

Table A.3-6
Striped Bass Lipid-Adjusted
Aroclor Concentrations (ug/g-lipid)

Year	Aroclor 1016 [2] Number	Aroclor 1016 [2] Mean	Aroclor 1254 [2] Number	Aroclor 1254 [2] Mean	Ratio 1254/1016
1975	12	341.9	23	204.5	0.60
1976	108	98.1	110	105.9	1.08
1977	2	132.0	2	384.4	2.91
1978	375	141.1	375	118.2	0.84
1979	30	50.7	30	92.7	1.83
1980	207	41.1	207	121.5	2.96
1981	213	30.5	213	128.0	4.20
1982	181	23.0	181	87.5	3.81
1983	157	11.7	157	64.0	5.47
1984	350	17.3	350	71.2	4.11
1985	408	18.9	408	77.5	4.10
1986	322	14.0	322	71.4	5.11
1987	239	14.8	239	57.3	3.87
1988	223	9.2	223	52.6	5.70

NOTES:

[1] All samples collected at mile 153 and below.

[2] Aroclor levels adjusted for lipid content of sample according to:
PCB(adjusted) = PCB(sample)/g-lipid(sample)

Table A.3-7
Total PCBs (ppm), Various Fish Species
Lower Hudson

LARGEMOUTH BASS

	River Mile 68						River Mile 112					
Year	n	Max.	Med.	Ave.	SE [1]	95% CB [2]	n	Max.	Med.	Ave.	SE	95% CB
1975	1	23.7		23.7			1*	9.7		9.7		
1977							27	85.9	26.4	29.5	3.65	37.0
1978							18	64.8	31.2	28.9	4.86	39.1
1980							20	3.1	0.9	1.0	0.15	1.3
1981							35	6.3	1.9	1.9	0.21	2.3
1982							18	5.1	2.3	2.3	0.25	2.8
1983							20	46.8	4.0	8.1	2.32	13.0
1984							20	26.3	3.3	6.7	1.61	10.1
1985							20	15.2	7.2	6.7	0.91	8.6
1986							20	35.9	10.2	11.1	1.89	15.1
1988							20	16.7	5.2	5.9	0.82	7.6

* - Sample collected at River Mile 110

PUMPKINSEED

	River Mile 60						River Mile 142					
Year	n	Max.	Med.	Ave.	SE	95% CB	n	Max.	Med.	Ave.	SE	95% CB
1979	25	4.1	3.0	3.0	0.13	3.3	22	8.3	6.3	5.8	0.67	7.2
1980	25	7.2	4.9	4.6	0.29	5.2	25	22.5	17.0	16.7	0.48	17.7
1982	35	3.2	1.9	1.9	0.09	2.1	37	39.6	6.9	8.6	1.03	10.7
1983	37	3.3	2.6	2.5	0.06	2.6	53	25.4	6.4	6.9	0.55	8.0
1984	50	2.0	1.1	1.0	0.09	1.2	25	5.6	4.3	4.3	0.16	4.7
1985	21	3.9	2.8	2.8	0.15	3.1	8	5.7	3.9	3.7	0.52	4.9
1986	25	5.1	3.2	3.3	0.16	3.6	24	3.0	2.2	2.1	0.08	2.3
1987	14	3.2	2.4	2.4	0.10	2.6						
1988	20	3.3	2.2	2.2	0.15	2.5	7	3.1	2.7	2.7	0.11	2.9

BROWN BULLHEAD

							River Mile 112					
Year							n	Max.	Med.	Ave.	SE	95% CB
1977	--	--	--	--	--	--	8	10.0	1.2	2.0	1.09	4.5

NOTES:
All concentrations reported in parts per million (ppm) wet weight.
[1] SE = Standard Error (Standard Deviation divided by square root of N).
[2] 95% CB = 95% upper confidence bound on mean : 95%CB = mean + t(0.975) * SE.

Table B.1-1
Water Quality Rating Criteria

	Water Quality Assessment				
Media/Parameters	Very Poor	Poor	Fair	Good	Excellent
Fish Advisory	Eat None	Limited Advisory	No Advisory	No Advisory	No Advisory
Macroinvertebrate Assessment	Severely Impacted	Moderately Impacted	Slightly Impacted	Non-Impacted	Non-Impacted
# of Water Quality Parameters of Concern	>5	≥4	2-4	0-2	None
Toxicity Test (# Toxic in Two Years)	>3	>2	1-2	None	None
# of Fish/Macroinvertebrate Metals Levels above Background	>4	≥3	2-3	0-1	None
# of Bottom Sediment Metals Levels above Background	>4	≥3	2-3	0-1	None

Source: NYS Department of Environmental Conservation, Biennial Report Rotating Intensive Basin Studies, Water Quality Assessment Program for 1987-1988, December 1990.

Table B.1-2
Public Water Supplies on the Upper Hudson River

Supply Name	Owner City	County	Type	River Mile	Design Capacity (mgd)	Current Average Production (mgd)
Winebrook Hills WD	Newcomb	Essex	M			0.0200
Waterford WTP	Waterford	Saratoga	M	158	2.80	1.1000
Queensbury WD	Queensbury	Warren	M	210	5.00	2.8000

Notes:

M = Municipality
WTP = Water Treatment Plant
WD = Water District

Sources: NYS Department of Health (1991) and for design capacity Malcolm Pirnie, Inc. (1984).

Table B.1-3
Fish Species Occurrence Summary
Between Fort Edward and the Federal Dam

Common Name	Scientific Name	1933	1960	1970	1975	1983	1985
Alewife (M)	*Alosa pseudoharengus*			*	*		
American Eel (M)	*Anguilla rostrata*	*	*			*	*
Banded Killifish	*Fundulus diaphanus*	*		*		*	
Black Bullhead (note 1)	*Ictalurus melas*					*	
Black Crappie	*Pomoxis nigromaculatus*	*	*			*	
Blackchin Shiner (note 2)	*Notropis heterodon*	*				*	
Blacknose Dace	*Rhinichthys atratulus*	*					
Blueback Herring (M)	*Alosa aestivalis*		*			*	
Bluegill	*Lepomis machrochirus*	*	*	*		*	*
Bluntnose Minnow	*Pimephales notatus*	*				*	
Bridle Shiner	*Notropis bifrenatus*	*				*	
Brook Trout	*Salvelinus fontinalis*	*					
Brown Bullhead	*Ictalurus nebulosus*	*	*		*	*	*
Brown Trout	*Salmo trutta*	*	*	*	*		*
Central Mudminnow	*Umbra limi*					*	
Chain Pickerel	*Esox niger*	*			*	*	*
Comely Shiner	*Notropis amoenus*					*	
Common Carp	*Cyprinus carpio*	*			*	*	
Common Shiner	*Notropis cornutus*	*				*	*
Creek Chub	*Semotilus atromaculatus*	*		*		*	*
Cutlips Minnow	*Exoglossum maxillingua*	*					
Eastern Silvery Minnow	*Hybognathus regius*	*				*	
Emerald Shiner	*Notropis atherinoides*	*				*	
Fallfish	*Semotilus corporalis*	*			*	*	*
Fathead Minnow	*Pimephales promelas*					*	
Gizzard Shad	*Dorosoma cepedianum*				*	*	
Golden Shiner	*Notemigonus crysoleucas*	*	*		*	*	*
Goldfish	*Carassius auratus*		*	*	*	*	
Johnny Darter (note 3)	*Etheostoma nigrum*	*	*	*	*	*	
Largemouth Bass	*Micropterus salmoides*	*	*	*	*	*	*
Logperch	*Percina caprodes*	*			*	*	
Longnose Dace	*Rhinichthys cataractae*	*					
Northern Hog Sucker	*Hypentelium nigricans*					*	
Northern Pike	*Esox lucius*	*	*			*	*
Pearl Dace	*Semotilus margarita*	*					
Pumpkinseed	*Lepomis gibbosus*	*	*	*	*	*	*
Northern Redbelly Dace	*Phoxinus eos*	*					

Table B.1-3 (continued)

Common Name	Scientific Name	1933	1960	1970	1975	1983	1985
Redbreast Sunfish	*Lepomis aurita*	*				*	
Redfin Pickerel	*Esox americanus*	*					
Rock Bass	*Ambloplites rupestris*	*			*	*	*
Rosyface Shiner	*Notropis rubellus*	*				*	
Satinfin Shiner	*Notropis analostanus*	*				*	
Sea Lamprey (M)	*Petromyzon marinus*					*	
Silver Lamprey	*Ichthyomyzon unicuspis*		*				
Slimy Sculpin	*Cottus cognatus*	*					
Smallmouth Bass	*Micropterus dolomieui*	*			*	*	*
Spotfin Shiner	*Notropis spilopterus*					*	
Spottail Shiner	*Notropis hudsonius*	*				*	*
Striped Bass (M)	*Morone saxatilis*				*	*	
Tadpole Madtom	*Noturus gyrinus*	*					
Trout-perch	*Percopsis omiscomaycus*	*			*	*	*
Walleye	*Stizostedion vitreum*	*			*	*	*
White Catfish	*Ictalurus catus*				*		
White Crappie	*Pomoxis annularis*					*	
White Perch	*Morone americana*				*	*	
White Sucker	*Catostomus commersoni*	*	*	*	*	*	*
Yellow Bullhead	*Ictalurus natalis*			*	*	*	*
Yellow Perch	*Perca flavescens*	*	*		*	*	*
Misc. Shiners	*Notropis sp.*			*		*	
Misc. Minnows			*	*	*		
Total No. of Species		41	16	13	24	46	20
(M) migratory species							

Notes:

(1) Smith and Lake (1990) consider there is only a remote possibility that the Black bullhead actually occurs in the Hudson. He has been unable to find specimens for verification of this midwestern species.

(2) The Blackchin shiner is listed as a species of Special Concern by the NYSDEC (1991).

(3) Smith and Lake (1990) believe that the true Johnny darter, a midwestern species, does not occur in the Hudson. The Tessellated darter was formerly a subspecies of the Johnny darter. Given what Smith and Lake state, it seems reasonable that the tessellated darter has been misidentified as the Johnny darter in the above cited studies.

References:
Greeley and Bishop (1933); DEC Annon. Report (1960); Lane (1970);
Shupp (1975); Makarewicz (1983); and Green (1985).

Table B.2-1
Current Permitted PCB Discharges
Upper Hudson River Drainage Basin

Facility/SPDES #	Receiving Water	Outfall	Final Effluent Limitations on PCBs		Frequency of Sampling/ Type	Discharge Limitations		Period
			Daily Avg.	Daily Max		Daily Avg.	Frequency	
General Electric Co. Old Fort Edward Site Remediation Project Fort Edward, NY NY0202037	Old Champlain Canal	001G - Treated Groundwater	Monitor	0.5 μg/l (ppb) of PCB Aroclor 1242 or minimum reliable detection limit	Monthly Grab	Monitoring only (no limits)	Monthly	7/86 - 7/91
General Electric Co. Capacitor Products Division Hudson Falls, NY NY0202151	Unnamed tributary to Moses Kill	001M - Leachate from Ft. Miller Landfill Site	Monitor	0.5 μg/l for total PCBs or minimum reliable detection limit	Monthly Grab	Monitor	Monthly	7/87 - 7/92
General Electric Co. Capacitor Products Division Ft. Edward, NY NY0007048	Hudson River	004A - Final: treated sanitary sewage, process wastewater, cooling water, boiler blowdown, surface runoff and contaminated groundwater (GW)	a. 0.0042 lb/d (during GW pumping) b. 0.0022 lb/d (no GW pumping)	a. 0.022 lb/d b. 0.022 lb/d PCB Aroclors 1016 and 1242	Daily 24 hour comp.	Monitor	Continuous	3/85 - 3/90
South Glens Falls Mill James River Corp. One River Street South Glens Falls, NY NY0007226	Hudson River	001P - Process Outfall		1 μg/l PCB-1242	Quarterly 24 hour comp.	Monitor	Continuous	3/86 - 3/91
Stevens & Thompson Paper Co., Inc. Greenwich, NY NY0007013	Batten Kill	001A - Process Outfall 001Q - Final	Detection limit of 0.065 μg/l for PCB-1242 (USEPA method 608)	0.00054 lb/d	Quarterly 24 hour comp.	Monitor	Continuous	7/89 - 7/94
The Columbia Corp. Walloomsac Division Rt. 67 North Hoosic, NY NY0005061	Walloomsac River (tributary to Hoosic River)	001A - Process Wastewater Outfall	Detection limit-effluent specific (USEPA method 608)		Monthly Grab	Monitor	Continuous	3/91 - 3/96

e: NYSDEC SPDES Permits and Discharge Monitoring Reports (1991).

Table B.2-2
Inactive Disposal Sites
Located near Upper Hudson River

Site	County	Type/Size	Hazardous Waste Disposed of, Dates	Class Code	Remarks/Sampling
Niagara Mohawk-Queensbury Corinth Road Queensbury, NY	Warren	Open Dump/ .5 acre	PCBs (unknown quantity)	2	a. Located approx. 0.8 miles upstream of Queensbury WTP b. Surface soils, riverbank: PCB conc. = 37,737 ppm Sediment, river bottom: PCB conc. = 86.5 ppm c. NM conducted partial clean-up of riverbank d. Contaminated soil eroding into Hudson River
West Glens Falls PCB Disposal Site Luzerne Road Queensbury, NY	Warren	Landfill/ 7 acres	PCBs (13,000 cubic yards) 1979	4	a. Chemical waste landfill with PCB capacitors and contaminated soils b. Monthly monitoring assures that PCB wastes are contained, not released into environment
Glens Falls Landfill Luzerne Road Queensbury, NY	Warren	Landfill/ 15 acres	a. PCBs (unknown) b. Ink sludges (approx. 5 tons) 1961 - 1977	2	a. Municipal waste plus some PCB capacitors b. PCB Aroclor 1016 at 62 ppb in downgradient monitoring well
Queensbury Landfill Ridge Road Queensbury, NY	Warren	Landfill/ 50 acres	a. PCB capacitors b. Wastes from Hercules c. Heavy metal sludge d. Phenols and Benzene (a-d suspected)	2a	a. Active portion takes municipal waste from Town of Queensbury b. Inactive portion was neither lined nor closed properly c. Sand and gravel operation d. Contaminated groundwater e. Survey of nearby private wells in 1990
Luzerne Road Site Luzerne Road Queensbury, NY	Warren	Open dump/ 1-2 acres	PCBs (unknown quantity) 1958 - 1968	2	a. Former junkyard with scraps and buried capacitors b. Capacitors and 13,000 cu yd of contaminated soil removed in 1979 and secured in West Glens Falls PCB disposal facility c. Organic cap placed over site, 1980 d. GW contamination by PCBs, however, all area homes are served by public water

Table B.2-2 continued

Site	County	Type/Size	Hazardous Waste Disposed of, Dates	Class Code	Remarks/Sampling
General Electric-Moreau (formerly Caputo Dump) N. of Bluebird Rd. Moreau, NY	Saratoga	Open dump/ 1-2 acres	a. PCB liquid, 905,000 lbs b. NiCd Batteries (quantity not stated) 1955 - 1968	4	a. EPA ROD (1987) endorsed removal and encapsulation of PCB contaminated soils and air stripper on Reardon Brook water b. 30 year maintenance and monitoring program c. Site accepted for NPL
Moreau Landfill West of Rt 9 Moreau, NY	Saratoga	Active Landfill/ 55 acres	a. PCBs (suspected, unknown quantity) b. Paper Mill waste (unknown quantity)	2a	a. Active landfill currently used for domestic waste and paper mill sludges (with PCB conc. of 50-200 ppm) b. Suspected disposal of PCB capacitors and septic tank wastes c. Leachate flowing into surface water, running toward river d. Contaminated groundwater in immediate vicinity
Albany Waste Oil Corporation Waite Road Site Clifton Park, NY	Saratoga	Lagoon/ ±4 acres	a. Waste oil with PCBs (unknown quantities) b. Waste solvent To 1980	2	a. Action against GE and Niagara Mohawk b. Significant PCB and petroleum contamination of surface soils c. Site fenced d. Remedial action construction in 1990 followed by post-closure monitoring and maintenance
South Glens Falls Dragstrip Route 9 Moreau, NY	Saratoga	Open dump/ ±40 acres	PCB oil (11,000-27,500 gal) 1960s-1970s	2	a. PCB laden oil used for dust control on track and in parking lots b. Soil contamination up to 1800 ppm of PCBs c. GE/EPA pilot remediation study d. Action: remedial investigation and remediation
Tee-Bird Country Club Reservoir Road Moreau, NY	Saratoga	Open dump/ ±0.75 acres	Waste oil with PCBs (11,000-27,500 gals)	3	a. Waste oil used to control dust in driveway and parking areas b. Soil samples reveal 0.04-6800 ppm of PCBs c. Area paved to prevent volatilization, interim measure d. Remedial investigation needed

Table B.2-2 continued

Site	County	Type/Size	Hazardous Waste Disposed of, Dates	Class Code	Remarks/Sampling
Whitestone Motel Route 9 South Glens Falls, NY	Saratoga	Open dump/ 1 acre	Waste oil with PCBs (unknown quantity)	3	a. Waste oil used to control dust on parking lot b. PCBs in soil up to 750 ppm c. Paved in 1985, interim measure d. 1989 sampling-- up to 13,000 ppm of PCBs in soils e. Remedial investigation needed
Hudson River PCB Sediments Hudson River Fort Edward to Troy Owner: NYSDOT	Saratoga	40 mile stretch of river	PCBs, approx. 500,000 lbs by GE Fort Edward and Hudson Falls	2	a. Site (Code 546031) of this USEPA study b. Fishing ban in some areas of river c. Action plan recommends research continue on alternate technologies with ultimate goal of permanently decontaminating sediments
Old Moreau Dredge Spoil Area West River Road Moreau, NY Owner: NYSDOT	Saratoga	Landfill/ 8.9 acres	a. NYSDOT dredge spoil from Hudson b. Plastic waste from now defunct paper plant	2a	a. Soil: PCB levels up to 40 ppm GW: PCB levels up to 90 ppb Monthly inspections by DOT and DEC b. Contaminated GW discharging to Hudson and may contribute to ongoing fish contamination problem c. Site is capped
Special Area 13 County Route 29 Moreau, NY Owner: NYSDOT	Saratoga	Landfill/ 12 acres	PCBs (191,000 cu yds at 75 ppm average) 1977 - 1978	2	a. PCB contaminated dredge spoils from Hudson b. Leachate from the site discharges to GW running towards the Hudson River and may contribute to ongoing fish contamination problem c. Site is capped
Moreau Dredge Spoil Disposal Site County Route 29 Moreau, NY Owner: NYSDOT	Saratoga	Landfill/ 12 acres	PCBs (100,000 cu yds at 1000 ppm average) 1977 - 1978	2	a. Cell provides containment of solids with two leachate discharges; site is capped b. Leachate recharging aquifer or discharging via overland flow to Hudson River, may contribute to ongoing fish contamination problem

Table B.2-2 continued

Site	County	Type/Size	Hazardous Waste Disposed of, Dates	Class Code	Remarks/Sampling
Fort Edward Landfill Burgoyne Avenue Ft Edward, NY	Washington	Landfill/ 9.1 acres	a. PCB capacitors b. Paper mill waste c. Paint waste Total=1080 tons	2	a. GE dumped approx. 850 tons of scrap capacitors with PCB oil, approx. 78.7% of total hazardous wastes at site b. Overburden aquifer contaminated with PCBs and solvents c. Proposed closure/remedial action
Old Fort Edward Landfill Burgoyne & McIntyre Avenues Fort Edward, NY	Washington	Open dump/ 1.5 acres	a. PCBs, scrap capacitors (310 tons) b. Paint waste 1940 - 1952	4	a. GE implemented remedial plan; leachate once flowed toward Old Champlain Canal; groundwater is now intercepted and treated; in-place containment b. GE to re-evaluate off-site impacts
Fort Miller Landfill Patterson Road Fort Edward, NY	Washington	Open dump/ 2-3 acres	PCB capacitors (unknown quantity) 1953 - 1965	4	a. Operated as municipal burning landfill b. Closure completed in 1982 c. GE operates an on-site leachate treatment facility under a SPDES permit discharging to an unnamed tributary of Moses Kill
GE Capacitor Products Division (Fort Edward) Route 4 Fort Edward, NY	Washington	Open dump/ 10 acres	PCBs and other material (unknown quantities) 1940s-1970s	2	a. PCB soil contamination is in a secured area b. On and off-site GW remediation in progress c. Parking lot covers spilled area d. Site rejected from NPL
Kingsbury Landfill Burgoyne Avenue Kingsbury, NY	Washington	Landfill/ 9.8 acres	a. PCB capacitors (2190 tons) b. Paper mill and paint wastes 1930s-1977	2	a. GE disposed of approx. 1900 tons of hazardous waste (87% of the total) b. Leachate flowed into private pond, Old Champlain Canal and feeder/tow canal c. GW, surface water, and sediments impacted d. On-site remediation in operation and maintenance phase

Table B.2-2 continued

Site	County	Type/Size	Hazardous Waste Disposed of, Dates	Class Code	Remarks/Sampling
GE Capacitor Products Division (Hudson Falls) Route 4 Hudson Falls, NY	Washington	Open dump/ 25 acres	PCB oils (unknown quantity) To 1970s	2	a. PCB contamination of GW and soils; GW flow and surface drainage are directly into Hudson River b. Interim remedial measure (IRM) for removal of PCB sludge under building in 1989
Buoy 212 NYS Routes 4 & 32 Fort Edward, NY Owner: NYSDOT	Washington	Landfill/ 4 acres	PCBs (77,000 cu yds at 75-100 ppm) 1977 - 1978	2	a. Tempoary disposal area for dredge spoils from Hudson b. Monthly monitoring by DOT and DEC c. Contaminated GW probably discharging to Hudson River

Source: NYSDEC, "Inactive Hazardous Waste Disposal Sites in New York State," Volume 5 (1990).

Table B.3-1
Studies of PCB Contamination in the Hudson[a]

Type of Assessment	Year(s)	Location	Investigators
Sediment Surveys			
• Over 40 Mile Reach (>1,000 samples)	1976 - 1978	Ft. Edward to Albany; Some Lower Hudson	NYSDEC
• Approx. 9 Mile Reach (62 Samples)	1983	Thompson Is. Pool/Other	USEPA
• Approx. 5 Mile Reach (>2,000 samples)	1984	Thompson Is. Pool	NYSDEC
• Selected Upper & Lower Hudson Areas (Dated Core Samples)	1980's	Upper & Lower Hudson	Lamont Doherty
River Flow & Water Quality			
• River Flow (Dicharge)	1908 - Present	Upper Hudson to Hadley	USGS
• Water Quality/Sediment/PCBs	≈1975 - Present	Hadley to Green Island	USGS
• Dissolved & Solid-Phase PCBs	1983	Upper Hudson	Lamont Doherty/NYSDEC
Fish/Biota			
• Fish Samples Prior to GE Hearings	1970 - 1975	Upper Hudson and Estuary	NYSDEC, R. Boyle, USEPA, NYSDOH
• Fish Collection/Analysis Program	1976 - Present	Upper Hudson and Estuary	NYSDEC
• Macroinvertebrate	1976 - 1985	Upper Hudson and Estuary	NYSDOH
Air	Late 1970's - Early 1980's	Ft. Edward and Dump Sites	NYSDEC/DOH and Boyce Thompson Inst.
	1986/87	Ft. Edward Area	NYSDEC
Plant/Crop Uptake			
• Tree species/Some Crop and Forage Plants	Early 1980's	Ft. Edward Area, Dump Sites, Dam Tailwater	Boyce Thompson Inst./NYSDEC
• Perrenial and Crop Plants	1984/5	Hudson River/Albany Area	NYSDOH
Groundwater	1977	Dredge Spoils	Weston Environ. Consultants/DEC
Baseline Remnant Remediation Studies and Current GE Investigations[b]			
• Water Column	1989 - 1990	Near Remnant Areas	General Electric
• Sediment[c]	1989 - 1990	13 Upper Hudson Locations	General Electric
• Air	1989	Remnants, Ft. Edward, Farm	General Electric
• Multiplate/Biota	1989	Near Remnant Areas	General Electric

[a] Adapted from Limburg et al. (1986).

[b] *Additional remnant monitoring activities not necessarily included.*

[c] A portion of General Electric's current sediment sample results have been provided; complete results are unavailable at this time.

Table B.3-2
Hudson River Sediment Database Summary

TAMS/Gradient Database[a]					Cited in Published Reports[b]				
Month	Type of Sample	No. Samples	PCB Analyses	Total/Vol. Solids	Sample Collection	Date	Sample Type	No. Samples	
SEP 76	G	43	43	43					
	C	21	45	44					
OCT 76	G	21	10	10					
	C								
NOV 76	G	190	188	189	NYSDEC	Fall 1976	?	80	
	C				NAI	Winter 1976-77	C	24	
Total 1976	Grab	254	241	242			?	80	
	Core	21	45	44		Totals	Core	24	
JAN 77	G	3	3	3					
	C								
MAR 77	G	42	42	41					
	C	23	105	106					
APR 77	G	20	20	20					
	C								
MAY 77	G	237	236	204					
	C								
JUN 77	G								
	C	214	742	834	NAI	Summer 1977	C	200	
JUL 77	G	30	30	7	NAI	Summer 1977	G	672	PCB on 470
	C								
AUG 77	G	5	7	5	?	Summer 1977	G	20	
	C								
SEP 77	G	35	37	35					
	C								
OCT 77	G	16	16	15	?	Fall 1977	C	8	
	C								
NOV 77	G	38	37	29					
	C	9	45	45					
DEC 77	G	20	20	20					
	C								
Total 1977	Grab	446	448	379		Total 1977	Grab	692	
	Core	246	892	965			Core	208	
JAN 78	G								
	C	2	16	16					
FEB 78	G								
	C	8	53	54					
MAR 78	G	15	14	15					
	C								
APR 78	G	8	8	6	MPI	Spring 1978	?	200	Remnants
	C	16	39	34					
JUN 78	G	48	3	3	NYSDEC	Summer 1978	?	200	
	C	28							
Yearly Total 1978	Grab	71	25	24					
	Core	54	108	104					
	All	125	133	128		Total 1978	?	400	
	Grab	771	714	645			Grab	692	
	Core	321	1,045	1,133			Core	232	
							?	480	
Total 1976-1978	All	1,092	1,759	1,778		Total 1976-1978	All	1,404	

Table B.3-2
Hudson River Sediment Database Summary

TAMS/Gradient Database[a]					Cited in Published Reports[b]			
Month	Type of Sample	No. Samples	PCB Analyses	Total/Vol. Solids	Sample Collection	Date	Sample Type	No. Samples
Total 1983 [USEPA]	Grab	12			USEPA	1983	Grab	50
	Core	54					Core	12
AUG 84	G	36	8					
	C							
SEP 84	G	288	162					
	C							
OCT 84	G	256	141		NAI	1984	G	607
	C						C	586
NOV 84	G	153	164					
	C				NAI	Nov-84	C	12
Total 1984	Grab	733	475			Totals 1984	Grab	607
	Core	408	1,183				Core	598
Total 1985					NYSDEC	February 198	Core	21
TOTALS	Grab	1,516	1,189	645			Grab	1,349
	Core	783	2,228	1,133			Core	842
							?	480
TOTALS	All	2,299	3,417	1,778			All	2,671

NOTES:

C Core
G Grab
? Sample Type Not specified

USEPA	U.S. Environmental Protection Agency.
NYSDEC	New York State Department of Environmental Conservation.
NAI	Normandeau Associates, Inc.
MPI	Malcolm Pirnie, Inc.

SOURCES:

[a] TAMS/Gradient 1976-78 data from NYSDEC computer print-out; 1983 data from NUS (1984); 1984 from USEPA/NYSDEC computer files.

[b] 1976-78 sampling rounds reported in NYSDEC Tech. Rept. 56 (Tofflemire and Quinn, 1979); 1983 & 1984 samples cited in Brown et al. (1988).

Table B.3-3
Comparison of Sediment Samples by River Mile

TAMS/Gradient Database					Cited in Reports [a]	
					Number of Samples	
Mile Point	River Reach	Sample Type	Number of Samples	Date of Sample Collection (No distinction for Cores/Grabs)	NAI	DEC*
< 153.9	0	G	37 [1]	9/77, 3/78, 4/78, 6/78,	?	?
		C	16 [2]	6/77, 11/77, 1/78, 2/78	?	?
153.9 - 159.5	1	G	84	10/76, 3/77, 7/77, 4/77, 6/78, 9/76, 1/77, 8/77	0	7
		C	10	9/76, 6/77	9 #	2
159.5 - 163.4	2	G	16	10/76, 5/77, 9/76	13	4
		C	11	6/77	10	2
163.4 - 165.8	3	G	19	6/78, 5/77	12	0
		C	13	3/77, 6/77, 6/78	11	0
165.8 - 168	4	G	38	6/78, 5/77, 8/77, 9/77	24	4
		C	19	3/77, 6/77	18	1
168 - 183.2	5	G	89	5/77, 10/76, 9/76	292	14
		C	69	3/77, 6/77, 6/78, 9/76	60	6
183.2 - 186	6	G	112	10/76, 5/77, 9/76, 8/77, 10/77	120	10
		C	32	3/77, 6/77, 11/77, 9/76	25	6
186 - 188.4	7	G	59	10/76, 11/77, 6/78, 10/77, 9/76	0	60
		C	30	6/78, 3/77, 6/77, 11/77, 9/76	23	4
188.4 - 193.7	8	G	272	9-11/76, 3-5/77, 7/77, 9/77, 11-12/77, 6/78	211	18
		C	81	9/76, 3/77, 6/77, 11/77, 6/78	67	13
=> 193.7	9	G	44	10/76, 4/77, 7/77, 11/77, 3/78, 4/78, 6/78	0	9 @
		C	40	6/77, 6/78, 4/78	8	0
TOTAL		G	770		672	126
		C	321		231	34
Thompson Is. (1984 Survey)	8	G	733	8/84, 9/84, 10/84, 11/84		
		C	408			

Notes:

[a] = 1976-78 Results Reported in Tofflemire and Quinn (1979); 1984 results reported in Brown et al. (1988).

[1] = No river mile listed for any of these samples.
[2] = 10 of these samples had no river mile listed. The others were at 153.5 or less.
* = Includes Sept. 1976 NYSDEC survey, Ft. Miller to Thompson Island NYSDEC survey, Vibra Core Survey and miscellaneous 1977 samples, not summer 1978 samples which significantly increase the samples in Reaches 1, 3, 4, and 9.
\# = 4 cores and one transect were taken below the Federal Dam.
@ = 10 Malcolm Pirnie transects- 4-5 grbs.

Table B.3-4

PCB Levels in 1976-1978 Sediment Samples

Grab Samples

		Aroclor 1016				Aroclor 1221				Aroclor 1254				Total PCBs			
Reach	N	Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median
1	75	0.06	435	22.1	6.4	0.02	258	6.1	0.15	0.01	56	3.6	0.46	0.17	705	32	7
2	15	1	71	10.6	6.2	0.22	5.7	1.3	1	1	2.8	1.3	1	3	75	13	8
3	12	2.9	340	46.1	21.5	1	23	3.2	1	1	21	3.0	1.05	4.9	384	52	24
4	33	1	250	27.6	9	1	130	7.2	1	0.84	14	2.6	1	3	268	37	11
5	83	0.02	73	9.1	1	0.01	9.3	1.7	1	0.01	69	8.5	2.4	0.04	85	19	9
6	111	0.06	1000	60.4	11	0.02	150	7.5	1	0.1	180	6.5	2.3	3	1121	74	22
7	51	0.09	250	32.0	14	0.05	97	7.3	1	0.01	260	10.4	2.4	2.28	319	50	20
8	259	0.06	2100	64.7	18	0.01	570	27.9	2.1	0.01	170	7.9	1.6	0.08	2684	101	28
9	35	0.02	1100	71.1	8.4	0.02	4.2	1.0	1	0.05	130	17.6	1.8	0.09	1214	90	14

Core Samples

	Aroclor 1016					Aroclor 1221					Aroclor 1254					Total PCBs				
Reach	N	Min	Max	Mean	Median	N	Min	Max	Mean	Median	N	Min	Max	Mean	Median	N	Min	Max	Mean	Median
0	24	1	1300	95.1	1.5	24	1	240	19.4	1	24	1	170	13.7	1	24	3	1710	128	3.5
1	36	0.04	180	10.9	1	36	0.01	1.8	0.9	1	36	0.03	4.2	1.3	1	36	0.08	184	13	3
2	15	1	29	6.7	2.8	15	1	1	1	1	15	1	11	2.8	1	15	3	35	11	5.4
3	26	1	78	16.5	5.6	26	0.04	2.4	1.0	1.1	26	0.07	15	2.4	1.1	26	3	91	20	8.1
4	51	0.23	91	14.4	2.5	49	0.02	22	2.2	1	50	0.01	36	3.0	1	51	0.4	114	20	4.2
5	230	0.02	220	9.2	1	230	0.01	57	1.7	0.1	230	0.01	25	1.3	0.3	230	0.09	224	12	2.7
6	107	0.01	1200	57.0	11	108	0.01	153	5.1	1	108	0.03	163	8.0	1	108	0.09	1205	70	13.3
7	93	0.02	580	43.7	7.3	93	0.01	180	10.2	1	93	0.01	67	6.9	1.8	93	0.08	783	61	14.4
8	316	0.02	1827	65.9	12.2	316	0.01	538	13.3	1	316	0.01	442	11.5	1.5	316	0.04	2273	91	20.9
9	87	0.07	680	26.6	5.5	87	0.5	46	5.6	1	87	0.5	160	14.4	1	87	2.1	841	47	10.7

Note: All concentrations in ppm.

TABLE B.3-5
1984 Thompson Island Pool Sediment Summary

Grab Samples

Parameter	# Samples/ # Detects	Min	Max	Mean	Standard Deviation	Median
Aroclor 1242 (ppm)	287/287	0.1	1,348	38	99	15
Aroclor 1254 (ppm)	287/211	nd	51	1	4	0.3
Aroclor 1260 (ppm)	287/196	nd	95	2	7	0.2
Total PCBs (ppm)	288/287	nd	1,589	55	124	23
% Dry Solids	320/	11	83	62	17	68
% Volatile Solids	287/	0.5	35	6	6	4
Specific Weight (g/cm^3)	320/	0.1	5	1	0.4	1

Core Sections

Parameter	# Samples/ # Detects	Min	Max	Mean	Standard Deviation	Median
Aroclor 1242 (ppm)	561/391	nd	4,596	43	205	7
Aroclor 1254 (ppm)	561/154	nd	144	1	7	nd
Aroclor 1260 (ppm)	561/329	nd	57	2	5	0.2
Total PCBs (ppm)	614/ 422	nd	6,588	56	280	8
% Dry Solids	836/	10	98	66	15	71
% Volatile Solids	567/	0.6	55	7	6	6
Specific Weight (g/cm^3)	835/	0.2	3	1	0.4	1

Notes:

(1) PCB concentrations are for GC quantitated samples only; samples that were mass-spec screened but not GC quantitated are not included.

(2) Non-detects counted as zero in calculation of mean and standard deviation.

TABLE B.3-6
Texture Classifications from 1984 Sediment Study

Texture	Grab		Core		Total	
	Number	Percent	Number	Percent	Number	Percent
GRAVEL	380	51.8	366	28.4	746	36.9
FN-SND	184	25.1	341	26.5	525	26.0
FS-WC	29	4.0	197	15.3	226	11.2
CLAY	5	0.7	185	14.4	190	9.4
CS-SND	53	7.2	56	4.4	109	5.4
GR-WC	18	2.5	58	4.5	76	3.8
CS-WC	25	3.4	26	2.0	51	2.5
MUCK	20	2.7	1	0.1	21	1.0
FS-GR	6	0.8	9	0.7	15	0.7
CS-GR	1	0.1	13	1.0	14	0.7
FS-CL	0	0.0	11	0.9	11	0.5
CL-GR	0	0.0	7	0.5	7	0.3
SILT	6	0.8	0	0.0	6	0.3
GR-CL	0	0.0	5	0.4	5	0.2
CL-WC	0	0.0	3	0.2	3	0.1
FS-CS	0	0.0	2	0.2	2	0.1
CS-CL	0	0.0	2	0.2	2	0.1
WC-GR	0	0.0	2	0.2	2	0.1
FC-WC	1	0.1	1	0.1	2	0.1
SC-SND	1	0.1	1	0.1	2	0.1
WOOD	0	0.0	1	0.1	1	0.05
GR-MK	1	0.1	0	0.0	1	0.05
SAND	1	0.1	0	0.0	1	0.05
SC-WC	1	0.1	0	0.0	1	0.05
SILTWC	1	0.1	0	0.0	1	0.05
Total	733	100.0	1287	100.0	2020	100.0

*** Textures are abbreviations used in file received from NYSDEC;**

probable definitions:

CL - clay
CS - coarse
FN - fine
FS - fine or fine sand
GR - gravel
MK - muck
SND - sand
WC - wood chips

TABLE B.3-7

GE Baseline Remnant Remediation Sediment Monitoring

Location		#Samples/ #Detects	Min	Max	Mean	Standard Deviation	Median
C-1	Above Sherman Is. Dam	7/7	0.06	0.25	0.13	0.07	0.11
C-2	Below Bakers Falls	4/4	0.19	3.5	1.7	1.7	1.4
E-0	Remnant Area	4/4	0.17	99	42	49	34
E-1	Remnant Area	6/6	2.5	44	17	16	13
E-2	Remnant Area	4/4	3.7	11	7.6	3.0	7.9
E-3	Remnant Area	3/3	0.38	1.7	0.85	0.73	0.47
E-4	Remnant Area	5/5	0.82	9.3	4.3	3.2	3.2
E-5	Rogers Is.	6/6	8.9	44	23	14	16
E-6	Nr. Lock 6	8/7*	<0.15	8.7	3.2	3.0	2.1
E-7	Nr. Waterford	6/5*	<0.05	4.2	1.1	1.6	0.64

Source: Harza/Yates & Auberle (1990).

Non-detected aroclors not included in sum for total PCB concentration.

Only aroclors 1242 and 1254 were detected.

* If no aroclors were detected in sample, sample detection limit was used in calculations.

TABLE B.3-8
Total PCB's in Sediments - GE's 1990 Study and Comparison to Earlier Studies

All Sections
(PCB Concentrations in ppm)

Hot Spot #/ GE #	River Mile	N	Min	Max	Mean	Standard Deviation	Median
3/14	193.9	1	0.87	0.87	-	-	-
5/H-7	193	150	0.1	2,188	118	310	7
6/4	192	8	4.9	427	143	178	61
14/5 and 18	190	23	0.8	2,921	386	677	126
16/6	189	9	8.9	428	202	170	172
18/7	188.5	11	42.6	3,661	965	1,335	570
19/8	188.5	10	11.3	5,310	804	1,630	136
28/9	185.5	9	0.1	238	41	77	4
31/10	184.5	7	0.5	51	11	18	5
36/11	169.5	29	0.7	630	107	171	37
39/12	163.5	9	10.7	297	76	90	61
40/13	163.5	9	8.6	283	107	94	84

Depth Averaged Cores

		PCB Concentration (ppm)*		
Hot Spot #/ GE #	River Mile	GE Data [1990]	MPI [1978]	EPA [1983]
3/14	193.9	0.87 (1)		
5/H-7	193	103 (62)	62 (6)	30 (3)
6/4	192	203 (3)	69 (17)	55 (7)
14/5 and 18	190	421 (8)	279 (20)	32 (11)
16/6	189	237 (3)	380 (12)	46 (4)
18/7	188.5	918 (3)	94 (9)	17 (11)
19/8	188.5	619 (3)	83 (1)	
28/9	185.5	27 (3)	109 (18)	23 (4)
31/10	184.5	16 (3)	516 (3)	
36/11	169.5	125 (8)	51 (11)	
39/12	163.5	85 (3)	161 (3)	
40/13	163.5	136 (3)	62 (1)	

Derived from data provided by GE at meeting with EPA and its consultants on Feb. 28, 1991.

* Numbers in parentheses are number of samples.

Table B.3-9

Daily Flows for Upper Hudson USGS Gauging Stations

USGS Station	Period of Record	Average Daily Flow (cfs)	Maximum Daily Flow (cfs)	Minimum Daily Flow (cfs)
Hudson River at Hadley (#01318500)	10/1/1921 - 9/30/1990	2,919	38,100	292
Sacandaga River at Stewarts Bridge (#01325000)	10/1/1907 - 9/8/1990	2,138	33,500	5
Hudson below Sacandaga River* (#01318501)	10/1/1921 - 9/8/1990	5,057	52,400	309
Hudson River at Fort Edward (#01327750)	12/1/1976 - 9/30/1990	5,244	34,100	652
Hudson River at Schuylerville (#01329650)	10/1/1977 - 9/30/1979	7,448	42,100	932
Hudson River at Stillwater (#01331095)	3/10/1977- 9/30/1990	6,559	44,100	900
Hudson River at Waterford (#01335754)	10/1/1976- 9/30/1990	7,933	62,000	1,170
Hudson River at Green Island (#01358000)	10/1/1946 - 9/30/1989	13,642	152,000	882

* Hudson below Sacandaga River is a "dummy" station formed by adding Hudson River at Hadley and Sacandaga River at Stewarts Bridge.

Table B.3-10

Suspended Sediment Monitoring Summary

Station	Sediment Concentration (mg/ℓ)	Sediment load (tons/day)*	Fines (% < .062 mm)
Fort Edward (01327755) 4/21/75- 9/1/89	n = 424 a = 9.1 m = 4.0 s = 13.4 min = 0 max = 93	n = 379 a = 520.5 m = 48 s = 1155 min = 0 max = 8443	n = 0
Fort Miller (01328730) 6/13/86- 9/11/89	n = 42 a = 7.2 m = 5 s = 6.2 min = 1 max = 28	n = 42 a = 146 m = 79 s = 163 min = 13 max = 591	n = 0
Schuylerville (01329650) 3/24/76- 9/15/89	n = 287 a = 18.6 m = 7 s = 6.2 min = 0 max = 150	n = 284 a = 1232 m = 110 s = 2371 min = 0 max = 12185	n = 35 a = 76.7 m = 75 s = 12.8 min = 52 max = 100
Stillwater (01331095) 3/14/76- 9/15/89	n = 424 a = 21.2 m = 7 s = 33.1 min = 0 max = 206	n = 424 a = 1365 m = 126 s = 3027 min = 0 max = 16881	n = 23 a = 73.6 m = 80 s = 24.7 min = 0 max = 98
Waterford (01335770) 8/29/75- 9/15/89	n = 585 a = 62.5 m = 12 s = 140 min = 1 max = 1000	n = 543 a = 7890 m = 433 s = 23919 min = 6 max = 177638	n = 116 a = 81.6 m = 86.5 s = 16.7 min = 0 max = 100

<u>Key</u>
n: number of samples
a: average
m: median
s: standard deviation
min: minimum
max: maximum

---

* **Sediment load calculated from USGS measurements of instantaneous sediment concentration and daily average discharge. Daily average discharge at Fort Miller, Schuylerville and Stillwater estimated from USGS monitoring station at Fort Edward.**

Table B.3-11

Total PCBs in the Water Column – USGS Stations

	Fort Edward (#01327755)	Fort Miller (#01328730)	Schuylerville (#01329650)	Stillwater (#01331095)	Waterford (#01335770)
Period of Record	1977-1989	1986-1989	1977-1989	1977-1989	1975-1989
Sample size	432	36	291	368	419
# detects	273	32	212	276	328
Detection frequency (%)	63	89	73	75	78
Average[a] (µg/l)	0.15[d]	0.04[c]	0.26	0.29	0.23
Std. Dev. (µg/l)	3.70	0.04	0.39	0.43	0.26
Maximum (µg/l)	77.0	0.17	3.6	5.1	2.6
Average[b] (µg/l)	0.13[d]	0.04	0.25	0.28	0.22

Notes:

Reported PCB detection limit 0.1 µg/l through Sept. 1986, 0.01 µg/l thereafter.

[a] Average with nondetects reported at detection limit.

[b] Average with nondetects reported as one half detection limit.

[c] Low value attributable to short period of record.

[d] Averages for Fort Edward calculated omitting single observation reported at 77 µg/l. With inclusion of this value, averages are 0.33 and 0.31 µg/l.

Table B.3-12

Current (1986-89) Average Water Column PCB Concentrations - USGS Stations

	MEAN CONCENTRATION (µg/l)		
	Method of Nondetect Analysis		
Station	Nondetect = 1/2 Det. Lim.	Adjusted Maximum Likelihood	Log Probit Method
Fort Edward	0.053 (.107)	0.047 (.063)	0.053 (.107)
Fort Miller	0.043 (.040)	0.043 (.047)	0.043 (.040)
Schuylerville	0.038 (.033)	0.036 (.030)	0.036 (.030)
Stillwater	0.037 (.031)	0.034 (.036)	0.033 (.028)
Waterford	0.030 (.025)	0.029 (.021)	0.028 (.019)

Upper 95% Confidence Interval on Mean

Station	Nondetect = 1/2 Det. Lim.	Adjusted Maximum Likelihood	Log Probit Method
Fort Edward	0.075	0.060	0.075
Fort Miller	0.056	0.058	0.056
Schuylerville	0.046	0.044	0.044
Stillwater	0.045	0.043	0.040
Waterford	0.035	0.034	0.032

Table B.3-13
Summer Average Water Column PCB Concentrations ($\mu g/l$)
USGS Monitoring Stations

Year	Rogers Island at Fort Edward	Schuylerville	Stillwater	Waterford
1975	-	-	-	0.40 (0.10) [3]
1976	-	-	-	0.72 (0.46) [6]
1977	-	0.66 (0.57) [15]	0.74 (0.31) [15]	0.42 (0.24) [17]
1978	0.22 (0.10) [19]	0.73 (0.23) [6]	0.57 (0.26) [11]	0.48 (0.31) [16]
1979	0.17 (.092) [27]	0.80 (0.29) [7]	0.59 (0.14) [16]	0.38 (0.10) [15]
1980	0.18 (0.11) [35]	0.32 (0.11) [16]	0.32 (0.11) [16]	0.30 (0.27) [28]
1981	.097 (.030) [35]	0.16 (0.11) [20]	0.17 (0.12) [19]	0.14 (0.10) [15]
1982	0.11 (.031) [16]	0.13 (.071) [13]	0.12 (.045) [15]	0.12 (0.12) [13]
1983	.060 (.076) [11]	0.15 (.087) [13]	0.12 (.066) [14]	0.12 (.048) [20]
1984	.089^a (—) [9]	0.14 (0.28) [10]	0.16 (0.19) [10]	.074 (0.13) [9]
1985	0.11^a (—) [5]	0.15 (.098) [6]	0.12 (.055) [7]	<0.10^b (–) [5]
1986	— (—) [0]	<0.10^b (–) [9]	— (—) [0]	— (—) [0]
1987	.045 (.035) [2]	0.05 (—) [1]	0.06 (—) [1]	0.06 (.014) [2]
1988	.035 (.025) [16]	.046 (.060) [9]	.029 (.018) [9]	.033 (.015) [7]
1989	.026 (.007) [10]	.038 (.011) [13]	.045 (.012) [12]	.033 (.015) [10]

All Data from USGS Stations.
Values in ( ) brackets are standard deviations; [ ] brackets give number of samples.

Averages calculated by Robust Log Probit Method to account for nondetects, except for the following:

[a] Only one observation greater than detection limit, average calculated by setting nondetects to one half of detection limit.
[b] All observations were less than detection limit, which is shown.

Table B.3-14
Upper Hudson Yearly Fish Count [1]

Year	Sample	STB	PKSD	LMB	BB	AS	AMEL	GLDF	Other
1970 [2]	Unknown								1
1972 [2]	Unknown								
1970-2 [2]	Unknown								
1973 [2]	Fillet								
	Unknown								
1975 [2]	Whole			2					6
	Fillet			1					3
	Unknown				3		2		49
1975	Fillet			3	1		2		47
	Whole			2					8
	Other				1				2
1976	Fillet			1					2
	Whole		1	18	1			17	9
1977	Fillet			16	60			14	90
	Whole								
	Other			4				2	2
1978	Fillet		7	30	11			60	30
1979	Fillet			30	72				52
	Whole		33						
	Other								8
1980	Fillet	3		26	51	4		29	54
	Whole		49						
	Other			2	2			6	20
1981	Fillet		1		30				32
	Whole		75						
1982	Fillet			20	30		20	20	24
	Whole		77						
	Other								
1983	Fillet		2	24	48			26	35
	Whole		95						
1984	Fillet	6	25	50	39			11	73
	Whole	11				5			
1985	Fillet	20	27	41	37			18	20
	Whole		16						
1986	Fillet	36	45	39	80		8	11	11
1987	Fillet	30	38	8	53				36
1988	Fillet	8		20	63			20	6
	Whole		89						
Totals		114	491	337	582	9	32	234	620

NOTES:

[1] Upper Hudson Samples River Mile 153-205, supplied by NYSDEC.

[2] 1970, 1972, 1973 data, and some data from 1973 and 1975 taken from Spagnoli & Skinner (1977).

STB Striped Bass	AMEL American Eel	PKSD Pumpkinseed	GLDF Goldfish
LMB Largemouth Bass	GLDF Goldfish	AS American Shad	BB Brown Bullhead

Table B.3-15

Average Aroclor Levels in Upper Hudson Fish

(1975 - 1988 NYSDEC Samples, River Miles 153-195)

Species	Number of Samples (N)	Average % Lipid	Aroclor 1254 (ppm)	Aroclor 1016 (ppm)	Aroclor 1221 (ppm)
Largemouth Bass	372	1.43	8.9 (11.7) [4.1]	17.0 (37.2) [3.3]	1.3 (3.6) [0.14]
Brown Bullhead	525	3.07	6.0 (6.3) [3.6]	10.8 (23.0) [3.5]	1.3 (3.6) [0.20]
Goldfish (Carp)	234	9.65	32.0 (34.3) [19.0]	91.6 (185) [21.1]	13.1 (37.7) [1.6]
Pumpkinseed	347	2.58	3.5 (1.8) [3.0]	6.3 (4.4) [4.7]	0.13 (0.15) [0.08]
White Perch	195	6.09	10.9 (7.9) [8.2]	28.4 (45.6) [8.2]	2.9 (5.0) [0.40]
Yellow Perch	88	0.97	5.7 (10.1) [2.2]	14.1 (31.9) [4.3]	0.67 (0.69) [0.37]

(1986 - 1988 NYSDEC Samples, River Miles 153-195)

Species	Number of Samples (N)	Average % Lipid	Aroclor 1254 (ppm)	Aroclor 1016 (ppm)	Aroclor 1221 (ppm)
All Fish	540	4.26	6.8 (8.9) [3.6]	3.7 (6.1) [1.8]	0.5 (2.1) [0.08]
Total PCBs: (ppm)	$\bar{x}$ = 10.9 s_x = 14.1 $\bar{x}_{.95}$ = 12.0				

Aroclor concentrations are reported as ppm wet weight. Values in ( ) brackets are the sample standard deviation; [ ] brackets show the geometric mean.

$\bar{x}$, s_x = mean and standard deviation.

$\bar{x}_{.95}$ = Upper 95% confidence bound on the mean ($\bar{x}_{.95} = \bar{x} + t_{.975}\, s_x/N^{1/2}$).

Table B.3-16
Total PCBs (ppm) in Largemouth Bass
Upper Hudson - NYSDEC Monitoring

	River Mile 153-155						River Mile 175					
Year	n	Max.	Med.	Ave.	SE [1]	95% CB [2]	n	Max.	Med.	Ave.	SE [1]	95% CB [2]
1975							4	40.8	20.5	26.2	5.8	42.8
1976							18	164.4	60.0	72.0	9.6	92.4
1977	2	35.2		18.3	16.9	232.7	16	234.9	67.7	70.0	14.5	101.0
1978							30	369.7	142.8	153.1	14.9	183.4
1979	30	18.9	2.9	5.0	0.9	7.0						
1980	1	18.0		18.0			25	66.9	6.3	10.4	2.8	16.1
1981												
1982							20	23.9	2.3	3.6	1.1	5.9
1983							20	20.8	5.6	6.7	1.1	9.1
1984							20	22.6	4.5	6.3	1.3	9.1
1985							21	26.6	8.0	9.2	1.5	12.5
1986							21	15.7	5.0	6.0	0.9	7.9
1987	8	3.9	1.6	2.0	0.5	3.1						
1988	19	17.5	2.2	3.6	1.0	5.8	20	7.0	1.4	2.5	0.5	3.6

	River Mile 190-195						River Mile 200-205					
Year	n	Max.	Med.	Ave.	SE	95% CB	n	Max.	Med.	Ave.	SE	95%CB
1975												
1976	1	104.5		104.5								
1977	2	82.5	67.7	67.7	14.8	255.7						
1978												
1979												
1980	2	38.9	31.7	31.7	7.2	123.4						
1981												
1982												
1983	2	17.8	15.8	15.8	2.0	41.3	1	0.1		0.1		
1984	30	68.9	16.0	18.7	2.6	24.1						
1985	20	61.4	14.3	20.2	3.5	27.4						
1986	18	19.3	9.8	9.9	1.3	12.6						
1987												
1988	20	22.3	8.6	8.8	1.4	11.7						

NOTES:

All concentrations reported in parts per million (ppm) wet weight.

[1] SE = Standard Error (Standard Deviation divided by square root of N).

[2] 95% CB = 95% upper confidence bound on mean : 95%CB = mean + t(.975) * SE.

Table B.3-17
Total PCBs (ppm) in Pumpkinseed
Upper Hudson - NYSDEC Monitoring

	River Mile 153-155						River Mile 175					
Year	n	Max.	Med.	Ave.	SE [1]	95% CB [2]	n	Max.	Med.	Ave.	SE [1]	95% CB [2]
1976							1	5.5		5.5		
1977												
1978	7	13.8	9.4	9.5	1.1	12.2						
1979							16	25.4	19.4	19.9	0.6	21.2
1980							25	30.8	20.3	21.7	0.8	23.5
1981							49	22.4	14.7	14.3	0.7	15.7
1982							43	18.7	8.9	9.0	0.4	9.8
1983							45	15.1	9.9	10.1	0.3	10.6
1984							25	12.0	8.1	7.9	0.3	8.5
1985							22	11.6	7.0	7.6	0.4	8.4
1986							21	9.6	6.2	6.4	0.3	7.0
1987	14	6.9	2.8	3.2	0.5	4.3						
1988							25	7.3	5.3	5.0	0.2	5.5

	River Mile 190-195						River Mile 200-205					
Year	n	Max.	Med.	Ave.	SE	95% CB	n	Max.	Med.	Ave.	SE	95% CB
1979							17	0.6	0.3	0.4	0.02	0.4
1980							24	0.8	0.5	0.5	0.02	0.6
1981							26	0.5	0.4	0.4	0.01	0.4
1982							34	0.6	0.2	0.2	0.03	0.3
1983							50	0.7	0.3	0.4	0.01	0.4
1984												
1985							21	0.4	0.2	0.3	0.02	0.3
1986							24	0.5	0.5	0.4	0.04	0.4
1987	11	9.2	2.2	3.9	0.9	5.9	13	0.2	0.2	0.2	0.01	0.2
1988	41	20.3	3.3	6.4	0.8	8.1	23	2.6	0.2	0.3	0.10	0.5

NOTES:

All concentrations reported in parts per million (ppm) wet weight.

[1] SE = Standard Error (Standard Deviation divided by square root of N).

[2] 95% CB = 95% upper confidence bound on mean : 95%CB = mean + t(.975) * SE.

Table B.3-18
Total PCBs (ppm) in Brown Bullhead
Upper Hudson - NYSDEC Monitoring

	River Mile 153-155						River Mile 175					
Year	n	Max.	Med.	Ave.	SE [1]	95% CB [2]	n	Max.	Med.	Ave.	SE [1]	95% CB [2]
1975							1	12.7		12.7		
1976							1	8.2		8.2		
1977	30	110.2	33.2	37.9	5.1	48.3	30	242.2	108.3	107.0	9.2	125.9
1978	11	43.2	20.2	25.2	3.2	32.2						
1979	22	48.0	4.8	7.1	2.1	11.4	30	61.5	4.2	8.8	2.3	13.4
1980	21	7.8	1.8	2.0	0.4	2.8	30	30.1	11.9	12.3	1.2	14.8
1981	30	12.6	3.1	4.4	0.6	5.5						
1982	10	12.6	4.0	4.9	1.1	7.3	20	27.6	9.5	10.3	1.2	12.8
1983	24	14.7	6.8	7.6	0.7	9.0	20	28.0	17.0	16.8	1.2	19.3
1984	19	9.3	2.2	3.0	0.5	4.0	20	27.7	8.4	11.0	1.4	13.9
1985	18	12.5	4.2	4.5	0.6	5.8	19	41.5	13.2	15.0	2.3	19.8
1986	16	4.9	2.8	2.7	0.3	3.3	23	26.4	11.6	11.9	1.0	13.9
1987	15	5.9	1.1	1.6	0.4	2.3						
1988	23	4.1	2.2	2.4	0.1	2.7	20	37.3	9.2	10.2	1.6	13.7

	River Mile 190-195						River Mile 200-205					
Year	n	Max.	Median	Ave.	SE	95% CB	n	Max.	Median	Ave.	SE	95% CB
1975	2	70.3	60.4	60.4	9.8	185.4						
1977												
1978												
1979							20	1.2	0.2	0.2	0.05	0.3
1980												
1981												
1982												
1983							2	0.2		0.2	0.07	1.0
1984												
1985												
1986	20	102.4	29.6	38.3	5.0	48.7	21	1.4	0.6	0.6	0.06	0.7
1987	24	27.7	13.3	13.5	1.6	16.9	14	1.3	0.1	0.2	0.08	0.4
1988	20	51.3	13.3	15.4	2.3	20.3						

NOTES:

All concentrations reported in parts per million (ppm) wet weight.

[1] SE = Standard Error (Standard Deviation divided by square root of N).

[2] 95% CB = 95% upper confidence bound on mean : 95%CB = mean + t(.975) * SE.

Table B.3-19
Lipid-Based Total PCBs [1]
for All Fish Species
NYSDEC Database

Year	Number Samples [2]	Maximum	Median	Average	Standard Error [3]	Upper 95% Confidence Bound [4]
UPPER HUDSON (River Mile 153-195)						
1975	27	5251	1011	1885	300.8	2505
1976	49	16504	1263	1810	328.3	2467
1977	189	39968	1829	2767	248.0	3256
1978	142	99861	1345	2913	708.3	4301
1979	150	4883	483	710	62.4	834
1980	211	3762	708	879	47.4	972
1981	111	1301	381	360	20.9	401
1982	157	2020	338	403	24.6	451
1983	174	1600	415	451	23.7	498
1984	220	4533	263	484	42.9	568
1985	158	2700	266	448	39.5	526
1986	180	3201	347	518	39.7	596
1987	138	4302	152	335	42.2	418
1988	222	2467	271	430	27.8	484
LOWER HUDSON (River Mile 0-152)						
1973	1	5089		5089		
1975	47	2154	268	345	61.1	468
1976	178	1575	81	146	16.0	177
1977	64	6178	1343	1567	163.0	1893
1978	725	4342	129	310	17.6	344
1979	375	1431	70	130	9.1	148
1980	554	1835	85	144	7.4	159
1981	438	1827	120	173	9.5	192
1982	478	1798	99	139	6.8	152
1983	445	1620	82	138	8.3	154
1984	549	646	62	103	4.7	112
1985	487	1340	52	97	6.1	109
1986	398	1040	59	105	6.6	118
1987	223	326	45	63	3.6	70
1988	289	604	39	75	5.8	86

NOTES:

Samples for which no lipid information was available were not used in this summary.

[1] All concentrations reported in micrograms total PCBs per gram of fish lipid.
PCB(adj) = PCB(sample)*100/%Lipid(sample).

[2] All fish species included in summary: frog, crab, and unknown species identification are excluded.

[3] SE = Standard Error (Standard Deviation divided by square root of n).

[4] Upper 95% confidence bound on the mean = Mean+ t(.975)*SE.

Table B.3-20
Other Chemicals in Fish Samples

Chemical	#Samples	#Detects	#Non-Detects	Average Conc. [ppm]	Median Conc. [ppm]
Aldrin	32	0	32	0	0
Arsenic	31	0	31	0	0
Cadmium	81	35	46	0.12	0
Chromium	31	19	12	0.10	0.05
Copper	45	33	12	1.86	0.62
Dieldrin	3994	293	3701	0.001	0
Endrin	189	5	184	0.001	0
Heptachlor/epoxide	215	63	152	0.005	0
Hexachlorobenzene	167	104	63	0.004	0
Lead	31	19	12	0.37	0.41
Mercury	192	180	12	0.55	0.37
Mirex	3968	7	3961	1E-06	0
Nickel	25	0	25	0	0
Total Chlordane	168	49	119	0.008	0
Total DDT	3947	686	3261	0.02	0
Total Hexachlorocyclohexane	140	51	89	0.005	0
Total Nonachlor	3946	326	3620	0.003	0
Zinc	81	69	12	16.61	10.7

Data from Dr. Ron Sloan (NYSDEC) contained in the TAMS/Gradient database.

Table B.3-21
PCBs in Air

LOCATION	Sampling Period	PCB Concentration (ug/cu.m)			Comments	Reference
		min.	max.	Samples		
Ft. Edward Area	early-mid 1970's	0.3	1		threefold decrease measured when GE halted use of PCBs	Limburg (1984)
Ft. Edward Area						
Caputo dump	1979	130*	300	?	* = average	NYSDEC Tech. Paper 63 (1981)
Ft. Miller dump		24*	35	?	? = not reported	
Remanant Area		9*	10	?		
Moreau & Site 3A		5.6*	15	?		
Bouy 212		0.7		?		
Old Moreau w/o Site 3A		0.3		?		
Caputo Dump						
Before Capping		118*		20		Shen (1982)
After Capping		0.26*		7		
LOCK 6 tailwater	1978	0.073	0.180	3	Samples immediately adjacent to the river	Buckley and Tofflemire (1983)
	1981	0.02	0.064	12		
	8/80 - 9/80	nd	nd	2	Aroclor 1221	
		0.11	0.52	2	Aroclor 1242	
		nd	nd	2	Aroclor 1254	
	8/81 - 9/81	nd	nd	7	Aroclor 1221	
		0.031	0.06	7	Aroclor 1242	
		nd	0.0013	7	Aroclor 1254	
Fort Edward Area						
Lock 7	8/86		0.083	3D	2 - 3 sets of duplicate grab samples over 4 hours at each site (4 - 6 samples)	Draft Joint Supplement to the Final EIS (USEPA/NYSDEC, 1987)
Ft. Edward Landfill			<0.007	3D		
Site G			<0.007	3D		
Burgoyne Ave School			NA	2D	NA – not available	
				#Det/#Samples		
Kingsbury Landfill	4/87 - 5/87	nd	0.49	76/105	Aroclor 1016/1242	NYSDEC (June 23, 1987) Memo from W.Webster to J. VanHoesen
		nd	0.52	5/105	Aroclor 1248	
Ft. Edward Area	1989					
(A2 – north of remnant 3)		<.050	0.230	3/84	Aroclor 1260	GE Baseline Monitoring Study (Harza, 1990)
(A4 – east of remnant 5)		<.050	0.061	3/84		
(A5 – 2 mi. south of Ft Edward near Dead Creek)		<.050	0.177	1/84		
Other NYS Locations						
Lake Placid (rural)			0.0069		368 Samples Statewide Aroclor 1016/1242 & 1254 were predominant species; Aroclor 1221 – 1 sample Aroclor 1260 not detected.	NYS Toxics Air Monitoring Report (1982 - 4)
East Rochester (industrial)			0.0039			
Niagara Falls (industrial/residential)			0.003			
Syracuse (urban)			0.002			
Rensselaer (urban/industrial)			0.002			
Poughkeepsie (residential/Hudson River)			0.004			
Hempstead, Long Is. (urban)			0.005			
Brooklyn (industrial)			0.0062			
Staten Is. (residential)			0.0072			

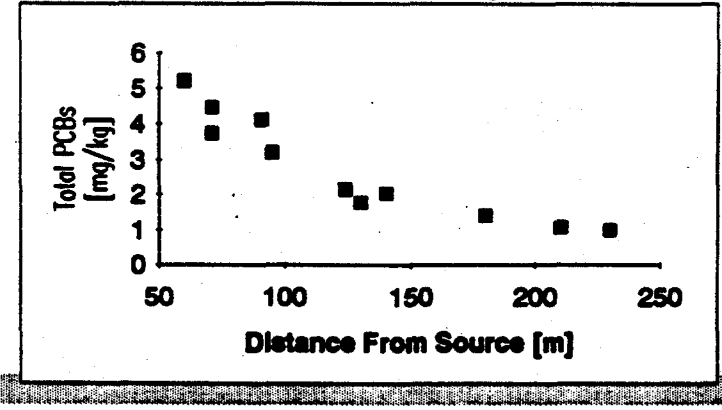
Table B.3-22
PCBs in Plants

Location	Sampling Period	Species	Total PCB Conc. (mg/kg- dry weight)				Referenc
Background Levels			Ave.			# Samples	
Washington/Saratoga Counties (representative results)	Sep-79	alfalfa /hay	0.05	+/-	0.015	12	Buckley (1987
		red clover /hay	0.05	+/-	0.013	6	
		perennial rye/hay	0.08	+/-	0.012	6	
		corn / leaves	0.08	+/-	0.006	18	
		corn / silage	0.02	+/-	0.003	6	
		corn/grain on ears	<0.001			6	
		timothy / hay	0.09	+/-	0.014	8	
		brome grass / hay	0.12	+/-	0.022	6	
		trembling aspen/leaves	0.09	+/-	0.013	8	
		large-tooth aspen/leaves	0.09	+/-	0.008	6	
		stag sumac/leaflets	0.10	+/-	0.007	14	
		sm.sumac/leaflets	0.10	+/-	0.008	6	
		goldenrod/leaves	0.25	+/-	0.045	15	
Washington/Saratoga Counties (time trends)	Sep-78	goldenrod	0.32	+/-	0.026	4	Buckley (1983)
	Sep-79		0.25	+/-	0.045	15	
	Sep-80		0.18	+/-	0.023	6	
	Sep-78	trembling aspen	0.12	+/-	0.01	2	
	Sep-79		0.09	+/-	0.013	8	
	Sep-80		0.07	+/-	0.014	8	

Hudson Study Area Samples

			PCB Concentrations (mg/kg-dry wt)			
			aspen	sumac	goldenrod	
Samples Near (<1200 m) Patterson Rd. PCB dump, Fort Miller, New York	Sep-79	Site 1	0.1	0.11	0.26	Buckley (1982)
		Site 2	1.2	1.3	3.5	
		Site 3	1.32	2.05	4.45	
		Site 4	--	19.1	56.5	
		Site 5	58.2	68.8	182	

Sep-80	smooth/staghorn sumac	5.20	60 m from source
		3.74	71m
		4.46	71m
		4.11	91m
		3.19	95 m
		2.13	124 m
		1.76	130 m
		2.03	140 m
		1.40	180 m
		1.07	210 m
		0.97	230 m



			PCB Concentrations (mg/kg-dry wt--except air)		#	
			min	max	Samples	Buckley and Tofflemire (1983
LOCK 6 (Near Tailwater)	1978	sumac	1.36	1.65	2	
		aspen		2.43	1	
		Air [ug/cu.m.]	0.073	0.18	3	
	1981	sumac	0.42	1.07	9	
		aspen	0.28	0.33	2	
		Air [ug/cu.m.]	0.015	0.064	12	

Table B.4-1

Flood Recurrence Intervals at Fort Edward

Recurrence Interval (years)	Peak Flow* 1930-1990 data (cfs)	Daily Ave. Flow* 1930-1990 data (cfs)	Peak Flow FEMA (1984) (cfs)
5	29,234	27,588	
10	33,316	31,272	38,800
25	38,046	35,484	
50	41,306	38,351	48,300
100	44,372	41,021	52,400
500	50,952	46,667	62,200

Water year 1930-1976 flows at Fort Edward estimated from peak and daily flows in the Hudson River at Hadley and daily average flows in the Sacandaga River at Stewarts Bridge; post 1976 flows at Fort Edward have been measured at Rogers Island.

*Estimated using a Log-Pearson Type III extreme value distribution (USGS, 1982).

Table B.4-2
Regression Analysis: PCBs in Water Column

$$\log(PCB) = \alpha + \beta_1 \cdot Q + \beta_2 \cdot 1/Q + \beta_3 \cdot TSS + \beta_4 \cdot YR + \beta_6 \cdot MO + \epsilon$$

	α	β_1	β_2	β_3	β_4	β_6
High Flow Model Parameters						
Fort Edward (>11,000 cfs) SE = 0.74 R^2 = 0.25	4.027	5.6×10^{-6}	--	--	-0.0912	--
Schuylerville (>12000 cfs) SE = 0.85 R^2 = 0.45	9.19	5.0×10^{-5}	--	0.012	-0.153	--
Stillwater (>16,000 cfs) SE = 0.73 R^2 = 0.63	14.499	--	-6.05×10^{4}	0.0062	-0.176	0.14
Waterford (>19,200 cfs) SE = 0.75 R^2 = 0.64	13.071	6.1×10^{-5}	--	--	-0.207	--
Low Flow Model Parameters						
Fort Edward (<11,000 cfs) SE = 0.71 R^2 = 0.42	9.487	--	1059.5	--	-0.153	--
Schuylerville (<12,000 cfs) SE = 0.72 R^2 = 0.65	16.761	--	2047.3	--	-0.237	--
Stillwater (<16,000 cfs) SE = 0.68 R^2 = 0.69	17.793	--	1730.9	--	-0.249	--
Waterford (<19,200 cfs) SE = 0.66 R^2 = 0.70	16.222	--	1714.63	--	-0.231	--

PCB = concentration of PCBs in water (μg/l)
Q = daily average flow (cfs)
YR = year since 1900
MO = calendar month of year
TSS = suspended sediment concentration (mg/l)
ϵ = random error term

Nondetects are set to 1/2 of the detection limit.

Table B.4-3

Published PCB Mass Loading Past Waterford (kg/yr)

Year	Tofflemire (1980) (Water Year)[a]	Brown & Werner (1983) (Calendar Year)	Barnes (1987) (Water Year)[a]
1977	2,900	3,000	2,100
1978	1,900	1,800	2,200
1979	4,100	2,800	2,400
1980	1,100	600	800
1981	680	1,000	700
1982		700	700
1983			1,100
1984			700
1985			300
1986			100

All figures rounded to two significant digits.

[a] Water Year is measured from October 1 - September 31.

Table B.4-4

Estimated TAMS/Gradient Yearly Average PCB Loads (kg/year)

Calendar Year	Fort Edward		Schuylerville		Stillwater		Waterford	
	Uncorrected Mean	Corrected Mean	Uncorrected Mean	Corrected Mean	Uncorrected Mean	Corrected Mean	Uncorrected Mean	Corrected Mean
1977	n=0		6200 n=33	4600 s=1308	7200 n=35	3800 s=1428	7900 n=52	4100 s=1146
1978	400 n=48	570 s=52	3000 n=12	2700 s=489	2400 n=31	3200 s=676	2600 n=31	2000 s=327
1979	1200 n=34	730 s=144	12000 n=15	4600 s=12836	8300 n=36	3300 s=901	8000 n=37	3200 s=787
1980	1000 n=53	310 s=27	2100 n=15	1100 s=312	1600 n=28	990 s=225	1500 n=43	720 s=84
1981	730 n=58	260 s=17	5400 n=34	940 s=356	3400 n=33	950 s=150	3600 n=25	670 s=98
1982	1400 n=49	440 s=49	2300 n=34	770 s=106	4700 n=44	920 s=169	3200 n=33	730 s=158
1983	4200 n=42	1700 s=2083	3900 n=42	1100 s=280	6300 n=50	2000 s=858	3900 n=51	980 s=172
1984	910 n=16	580 s=57	1900 n=30	640 s=140	2800 n=32	1200 s=250	1000 n=39	740 s=110
1985	290 n=15	370 s=70	330 n=15	290 s=39	330 n=17	300 s=42	220 n=6	200 s=37
1986	438 n=8	820 s=611	400 n=11	390 s=80	400 n=11	340 s=100	730 n=11	410 s=46
1987	2100 n=15	200 s=72	1200 n=10	300 s=57	1400 n=8	570 s=198	800 n=23	460 s=66
1988	150 n=35	120 s=36	110 n=20	190 s=26	150 n=23	140 s=37	150 n=21	140 s=35
1989	400 n=23	170 s=54	260 n=20	220 s=38	260 n=19	210 s=33	260 n=26	210 s=35

Nondetects included at ½ the detection limit.

Abreviations:

n = number of measurements
s = standard deviation (kg/yr)

Table B.4-5
Trends in Aroclor Concentrations at River Mile 175 (μg/l)

(Mann Kendall Trend Test)

Medians Year	Largemouth Bass		Brown Bullhead		Pumpkinseed		Goldfish	
	Aroclor 1254	Aroclor 1016	Aroclor 1254	Aroclor 1016	Aroclor 1254	Aroclor 1016	Aroclor 1254	Aroclor 1016
1975	6.99	14.31	7.99	4.66	-	-	-	-
1976	23.06	34.4	3.5	4.68	3.85	1.62	33.92	74.87
1977	12.3	50.1	13.45	85.1	-	-	59.8	450.5
1978	32.35	102.0	-	-	-	-	34.05	139.0
1979	1.32	1.5	1.765	2.72	6.74	12.4	-	-
1980	3.01	3.27	6.1	5.37	6.0	14.5	30.65	27.65
1981	-	-	-	-	4.41	9.87	-	-
1982	1.14	0.965	4.84	3.6	3.5	5.3	5.73	3.015
1983	3.4	2.11	8.535	6.755	3.78	6.18	7.46	2.675
1984	2.91	1.17	4.31	4.53	2.24	5.46	17.2	8.67
1985	3.93	3.57	5.14	6.67	2.59	4.435	14.75	3.745
1986	3.3	1.6	7.2	3.5	3.11	2.97	0.65	1.87
1987	-	-	-	-	-	-	-	-
1988	1.065	0.27	3.905	3.57	2.15	2.77	-	-
S[a]	-26	-30	-5	-9	-31	-21	-22	-24
Prob	.087	.046[*]	.76	.53	.007[*]	.073	.028[*]	.016[*]

[a] Mann-Kendall Trend test "S" statistic.

[*] A statistically signicant decline in PCB concentrations are indicated at the 95% confidence level.

Table B.6-1
Exposure Assumptions: Fish Ingestion

Exposure Parameter	Value
Average Daily Intake (g/d)	30
Exposure Frequency	daily
Exposure Duration (yr)	30
Exposure Concentration (mg/kg)	
1986 - 1988 Mean[a]	12.0
30 Year Projected Mean[b]	1.5
Absorption Fraction (%)	100
Average Weight Over Exposure Duration (kg)	70
Average Lifetime (yr)	70

[a] Upper 95% confidence bounds on the mean for all fish River Miles 153 - 190.

[b] Upper 95% confidence bounds on the mean (see B.4).

Table B.6-2
Exposure Assumptions: Dermal Contact with Sediments

	Age Group		
Parameter	1 - 6	7 - 18	Adult
Skin Surface Area for Contact (cm^2)	3,931	7,420	5,170
Sediment to Skin Adherence (mg/cm^2)	1	1	1
Exposure Frequency (d/yr)	7	24	7
Exposure Duration (years)	6	12	12
Exposure Concentration[a] (mg/kg)	66.2	66.2	66.2
Absorption Fraction (%)	3	3	3
Average Weight Over Exposure Duration (kg)	15	42	70
Average Lifetime (years)	70	70	70

[a] Upper 95% confidence bound for surface sediment – Thompson Island Pool.

Table B.6-3
Exposure Assumptions: Sediment Ingestion

	Age Group		
Parameter	**1 - 6**	**7 - 18**	**Adult**
Daily Sediment Intake (mg)	200	100	100
Exposure Frequency (d/yr)	7	24	7
Exposure Duration (yr)	6	12	12
Exposure Concentration (mg/kg)	66.2	66.2	66.2
Absorption Fraction (%)	100	100	100
Average Weight Over Exposure Duration (kg)	15	42	70
Average Lifetime (yr)	70	70	70

[a] Upper 95% confidence bound for surface sediment -- Thompson Island Pool

Table B.6-4
Exposure Assumptions: Dermal Contact with River Water

	Age Group		
Parameter	**1 - 6**	**7 - 18**	**Adult**
Skin Surface Area for Contact (full body) (cm^2)	6,880	13,100	18,150
Permeability Constant (cm/hr)	3.2×10^{-2}	3.2×10^{-2}	3.2×10^{-2}
Exposure Frequency (d/yr)	7	24	7
Duration of Event (hr/d)	2.6	2.6	2.6
Exposure Concentration (μg/l)	0.06	0.06	0.06
Exposure Duration (yr)	6	12	12
Average Weight Over Exposure Duration (kg)	15	42	70
Average Lifetime (yr)	70	70	70

Table B.6-5

Cancer Risk Estimates

Pathway		Chronic Daily Intake (mg/kg-d)	Cancer Risk
Fish Consumption	[a]	2.2×10^{-3}	2×10^{-2}
	[b]	2.8×10^{-4}	2×10^{-3}
Drinking Water		7.3×10^{-7}	6×10^{-6}
Sediment -- Dermal	Age 1-6	8.6×10^{-7}	7×10^{-6}
	Age 7-18	3.9×10^{-6}	3×10^{-5}
	Adult	4.8×10^{-7}	4×10^{-6}
		5.3×10^{-6}	4×10^{-5}
Sediment -- Ingestion	Age 1-6	1.5×10^{-6}	1×10^{-5}
	Age 7-18	1.8×10^{-6}	1×10^{-5}
	Adult	3.1×10^{-7}	2×10^{-6}
		3.5×10^{-6}	2×10^{-5}
River Water Contact	Age 1-6	3.8×10^{-9}	3×10^{-8}
	Age 7-18	1.8×10^{-8}	1×10^{-7}
	Adult	4.3×10^{-9}	3×10^{-8}
		2.6×10^{-8}	2×10^{-7}

[a] Scenario 1: 1986-1988 upper 95% confidence bound on mean.
[b] Scenario 2: 30 year mean trend.

Table B.6-6

Hazard Quotient Estimates

Pathway		Average Daily Dose (mg/kg-d)	Hazard Quotient
Fish	[a]	5.1×10^{-3}	51
	[b]	6.4×10^{-4}	6
Drinking Water		1.7×10^{-6}	<1
Sediment -- Dermal	Age 1-6	1.0×10^{-5}	<1
	Age 7-18	2.3×10^{-5}	<1
	Adult	2.8×10^{-6}	<1
Sediment -- Ingestion	Age 1-6	1.7×10^{-5}	<1
	Age 7-18	1.0×10^{-5}	<1
	Adult	1.8×10^{-6}	<1
River Water Contact	Age 1-6	4.4×10^{-8}	<1
	Age 7-18	1.0×10^{-7}	<1
	Adult	2.5×10^{-8}	<1

[a] Scenario 1: 1986-1988 upper 95% confidence bound on mean.
[b] Scenario 2: 30 year mean trend.

Table B.6-7
Epidemiological Studies: PCB Carcinogenicity in Humans

Population Studied	Number/Sex Studied	Results	Statistically Significant (endpoint)	References
Employees of a petrochemical plant where PCBs were used	72 (sex NR, 31 with high exposure)	Three cases of malignant melanoma (2 cases in heavily exposed group, only 0.04 cases expected).	Yes (melanoma)	Bahn et al., 1977; Bahn et al, 1976
Workers in two plants where PCBs were used in the manufacture of electrical capacitors	2567 total (1309 females, 1258 males)	Excess mortality for rectal cancer (4 observed vs. 1.19 expected) and liver cancer (3 observed vs. 1.07 expected), although neither excess was statistically significant.	No	Brown and Jones, 1981
Update of previous study with 7 years additional observations	2588 total (1318 females, 1270 males)	A statistically significant excess in deaths was observed in the disease category that includes cancer of the liver, gall bladder, and biliary tract (5 observed vs. 1.9 expected; $p < 0.05$). Most of the excess was observed in women employed in one plant.	No (review of pathology reports found that 2 liver tumors were not primary tumors)	Brown, 1987
Workers in a plant engaged in the manufacture of capacitors impregnated with PCBs	2100 (1556 females, 544 males)	For male workers, cancer deaths (14 observed vs. 7.6 expected) were significantly increased, as were deaths due to cancer of the gastrointestinal tract (6 observed vs. 2.2 expected); in female workers, cancer deaths (12 observed vs. 5.3 expected) and hematologic neoplasms (4 observed vs. 1.1 expected) were significantly higher than expected compared with the local population.	Yes; males and females: (total cancer deaths); males only: (gastrointestinal tract cancer); females only: (hematologic neoplasms)	Bertazzi et al., 1987
Swedish capacitor manufacturing workers exposed to PCBs used as capacitor dielectricum	142 males	No indication of any excess mortality or cancer incidence in this study population.	No	Gustavsson et al., 1986
Patients in the state of Ohio with ocular melanoma	698 (ca. 50% of each sex)	The distribution of ocular melanoma was fairly uniform throughout Ohio; no correlation was seen between the distribution of PCBs and the incidence of ocular melanoma.	No	Davidorf and Knupp, 1979
Yusho patients in Japan; persons exposed to PCBs as the results of contaminated cooking oil	1665 (sex NR)	Malignant neoplasms accounted for the largest number of deaths in Yusho patients (11 of 31 deaths); stomach and liver cancer were listed as contributing to the cause of death in 5 patients.	No	Urabe et al., 1979

Table B.6-7 (cont.)

Population Studied	Number/Sex Studied	Results	Statistically Significant (endpoint)	References
Yusho patients in Japan; person exposed to PCBs as the result of contaminated cooking oil	1761 (874 females, 887 males)	Significant increase in total cancer mortalities for males, but not females. For cancer of the liver, an increased mortality was noted in males (9 observed vs. 1.61 expected) and in females (2 observed vs. 0.36 expected), but the excess was statistically significant only in males. Significant increase in cancer of the respiratory system in males. Elevated mortality form malignant stomach neoplasms in males.	Yes; males only (total cancer, liver cancer, respiratory system cancer)	Ikeda et al., 1986; Kuratsune et al., 1987
Workers in a Monsanto PCB production plant	89 (sex NR)	No liver cancers among 30 deaths; statistically significant increase in circulatory disease in white males.	Yes; males only (circulatory disease)	Brown, 1987; Zack and Musch, 1979
Workers at an electric c apacitor manufacturing facility exposed to PCBs in dielectric fluid	3588 total (2742 males, 846 females)	Statistically significant excess of melanoma (8 cases observed, 2 cases expected, $p < 0.001$). Nonsignificant excess of cancers of the brain and nervous system (5 cases observed, 2.8 cases expected). Statistically significant association between mortality from brain cancer and cumulative PCB exposure ($p < 0.001$)	Yes (melanoma, brain cancer)	Sinks et al., 1990
Workers at a transformer manufacturing facility that used PCBs	1073 total (800 males, 273 females)	For workers in an "ever exposed" job excess mortality from brain cancer (4 cases observed, 0.8 expected, $p = 0.01$), and prostate cancer (5 cases observed, 1.2 cases expected, $p = 0.008$) was reported for workers ever in high intensity, frequent exposure jobs excess mortality was reported for lymphatic and hematopoietic tumors (2 cases observed, 0.7 cases expected, $p = 0.139$)		Liss, 1990

Note: NR = not reported

Source: Adapted from Silberhorn et al., (1990).

Table B.6-8
Epidemiological Studies Non-Cancer PCB Effects in Humans

Population Studied	Number Studied	Exposure and Duration Data	Results	References
People potentially exposed to PCBs, dioxins, and furans from Binghamton, NY electrical transformer fire	482	Yes	(1) One year after exposure: no clinical evidence of exposure-related disorders. Levels of liver enzymes and lipids significantly correlated with serum PCB concentrations, but association disappears after adjustment for relevant covariables. (2) Three years after exposure: number of deaths, cancers, fetal deaths, and infants with low birth weight were similar to comparison populations. Significant increase in self-reported weight loss, muscle pain, frequent coughing, skin color changes, and nervousness or sleep problems.	Fitzgerald et al., 1989 Fitzgerald et al., 1986
Cross-section study: infants with Bayley Scales of Infant Development test scores available	802	Yes; transplacental exposure data and exposure due to breast feeding	Higher transplacental exposure to PCBs associated with lower psychomotor scores at both 6 months and 12 months of age. Exposure through breast feeding was not related to test scores.	Gladen et al., 1988
Electrical transformer repairmen exposed to PCBs	55 exposed, 56 controls	Yes; serum PCB levels and adipose tissue PCB levels measured	Statistically significant positive correlation between serum PCB and gamma-glutamyl transpeptidase, and negative correlation between adipose PCB and 17-hydroxycorticosteroid excretion.	Emmett et al., 1988
Neonates transplacentally exposed to PCBs	912	Yes	Birth weight, head circumference, and neonatal jaundice showed no relationship to transplacental PCB exposure. higher transplacental PCB exposure was associated with hypotonicity and hyporeflexra as measured by the Brazelton Neonatal Behavioral Assessment Scales.	Rogan et al., 1986
Capacitor workers occupationally exposed to PCBs	NR (in abstract)	Yes; serum PCB levels measured	Forced vital capacity and forced expiratory volume at one second were correlated with PCB exposure and serum PCB levels (lower homologs) in females (but not in males) during period when PCB exposure was occurring, but not three years following termination of exposure.	Lawton et al., 1986
Capacitor workers occupationally exposed to PCBs	NR (in abstract)	Yes; plasma levels of total PCBs measured. In addition, levels of high-chlorinated homologs and low-chlorinated homologs measured.	Liver function tests showed significant correlation between LDH and serum levels of both total PCB and the highly-chlorinated homologs in female workers. Among male workers, gamma-glutamyl transpeptidase (gamma-GTP) correlated significantly with serum levels of the highly-chlorinated homolog, and, in a follow-up test, with total PCBs. Both male and female workers showed increased incidence of abnormal gamma-GTP levels.	Fischbein, 1985

Table B.7-1

Estimated Ecological PCB Exposure Levels for Indicator Species

Indicator Species	Ambient Water[a] ($\mu g/l$)	Ambient Sediment[a] ($\mu g/g$)	Concentration in Diet ($\mu g/g$)	Body Tissue Level ($\mu g/g$)
Benthic Organism Chironomid larvae	0.034 - 0.06	66.2	NA	5 - >7
	(H)	(M)	NA	(M)
Benthic Fish Brown Bullhead	0.034 - 0.06	66.2	NA (see text)	2.3 - 48.7[b]
	(H)	(M)		(H)
Carnivorous Fish Largemouth Bass	0.034 - 0.06	66.2	NA (see text)	3.1 - 12.6[b]
	(H)	(M)		(H)
Bird Herring Gull	NA	NA	1 - 25 $\mu g/g$ (0.1-5 $\mu g/g_{dw}$-d)	93-2,325 (body) 32-800 (eggs)
			(L[d])	(L[e])
Mammal Mink	NA	NA	1 - 25 $\mu g/g$ (0.15-3.8 $\mu g/g_{dw}$-d)	NA
			(L[d])	

Notes: $\mu g/l$ = ppb
$\mu g/g$ = ppm
NA = not assessed

H = high level of confidence in value based on extensive data
M = moderate level of confidence, monitoring data may lack coverage in time and/or space.
L = low level of confidence based on limited or no monitoring data.

[a] Water column values are the range of 95% upper confidence bounds on mean PCB concentrations for Fort Edward - Waterford (1986-89); sediment value is the 95% upper confidence bound mean of the 1984 Thompson Island Pool results.

[b] Range of PCBs in fish are 95% upper confidence bounds on the mean for 1986-88 Upper Hudson data (see text).

[d] Assumes 50% of diet is from local (contaminated) fish.

[e] Based on estimated dietary intake and literature bioaccumulation factor (BAF) values.

Table B.7-2

Summary of Observed PCB Effects in Biota

Species	Aroclor	Concentration	Medium	Effects/Remarks	Reference
Plankton/Algae					
unspecified	NS	1.3 - 2,000 μg/l	water	NS	USEPA (1980)
green algae	1254	0.1 - 10 μg/l	water	reduced growth C-fixation	USEPA (1980)
amphipod	1242	30 μg/l	water	no effects	Borgmann *et al.* (1990)
		100 μg/l		complete mortality	
Daphnia magna	1248	1.2 μg/l	water	lethal	Eisler (1986)
	1254	2.5 μg/l		lethal	
Macroinvertebrates & Insects					
Chironomid larvae	1254	0.5 - 1.2 μg/l	water	NS	Eisler (1986)
mosquito larvae	1254	1.5 μg/l	water	inhibited larval emergence	Sanders and Chandler (1972)
crayfish	1242	30 μg/l	water	7-day LC_{50}	Mayer *et al.* (1977)
	1254	100 μg/l		7-day LC_{50}	
Freshwater Fish					
rainbow trout	1248	3.4 μg/l	water	25-day LC_{50}	Mayer *et al.* (1977)
	1254	27 μg/l		25-day LC_{50}	
bluegill	1248	78 μg/l	water	30-day LC_{50}	Mayer *et al.* (1977)
	1254	177 μg/l		30-day LC_{50}	
channel catfish	1248	75 μg/l	water	30-day LC_{50}	Mayer *et al.* (1977)
brook trout, bass	NS	0.7 - 1.5 μg/l	water	mortality	USEPA (1980)
lake trout	NS	1 μg/g	diet	reduced survival	Willford *et al.* (1981)
rainbow trout	NS	0.4 μg/g	body tissue	reproductive impairment	Eisler (1986)
		0.33 μg/g	egg	reduced hatch; fry deformities	Eisler (1986)
Marine Fish					
Atlantic Salmon	NS	0.6 - 1.9 μg/g	eggs/fry	46 - 100% mortality	NOAA (1990)
Atlantic Salmon	NS	1.9 - 6.5 μg/g (lipid)	eggs	no effects	NOAA (1990)
Baltic flounder	NS	>0.12 μg/g	ovaries	reproductive failure	NOAA (1990)
Starry flounder	NS	0.2 μg/g	ovaries	reduced reproductive success; MFO induction	NOAA (1990)
Striped Bass	NS	1.4 μg/g	gonads	reproductive failure	NOAA (1990)

Table B.7-2 (cont.)

Species	Aroclor	Concentration	Medium	Effects/Remarks	Reference
Birds					
bobwhite	NS	604 - 6,000 μg/g	diet	acute LD_{50}	Eisler (1986)
mallard duck	NS	1,975 - 3,182 μg/g	diet	acute LD_{50}	Eisler (1986)
leghorn chicken	1242	20 - 80 μg/g (5.4 - 6.2 μg/g)	diet (egg yolk)	reproductive/behavioral alterations (chronic)	Britton & Houston (1973)
leghorn chicken	1242	0.4 μg/g	whole egg	reduced hatchability	Kubiak (1991) -- Calculated from Britton & Houston (1973)
cowbirds, grackles, starlings, blackbirds	1254	349 - 763 μg/g 1,500 μg/g	brain tissue diet	mortality no mortality	Stickel *et al.* (1984)
cormorants	NS	76 - 180 μg/g	brain	mortality	Eisler (1986)
Mammals					
mink	1254	0.64 μg/g	diet	reproductive impairment	Platanow & Karstad (1973)
	NS	2 μg/g	diet	reproductive failure	Aulerich & Ringer (1977)
	1242 1254	8.6 μg/g 6.7 μg/g	diet	long term LD_{50}	Ringer (1983), Eisler (1986)
	NS	≈1 μg/g (0.225 μg/gBW-day)	diet (dose)	reproductive impairment	Ringer *et al.* (1973)
Plants					
soybean	1254	1 - 1,000 μg/g	soil	decreased height/biomass	Weber *et al.* (1979)
duckweed (aquatic)	1242	5,000 μg/l 100,000 μg/l	water	decreased colony formation complete growth inhibition	Mahanti (1975)

Notes: NS = Not Specified
μg/l = ppb
μg/g = ppm (wet weight in diet/tissue; dry weight in soil/sediment)

Table B.7-3
Summary of Proposed Ecological Guidelines for PCBs[a]

Medium or Organism	Basis	PCB Concentration	Reference
Water (Fresh)			
EPA Ambient Criteria (AWQC)	chronic exposure/uptake (mink as sensitive species)	0.014 µg/l	U.S. EPA (1980)
EPA Ambient Criteria	acute exposure (based on LC$_{50}$)	2 µg/l	U.S. EPA (1980)
NYS Ambient Criteria	chronic exposure (based on acute LC$_{50}$)	0.001 µg/l	NYSDEC (1985)
Sediments			
	AET & COA[b]	<1 µg/g - 1,141 µg/g	NOAA (1990)
	Equilibrium Partitioning (EP)[c]	≈0.4 µg/g (@ 1% organic carbon)	NOAA (1990)
Fish			
body tissue	reproductive impairment in fish	0.4 µg/g	USFWS (Eisler, 1986)
body tissue	hazard to fish-eating wildlife (LOEL: 0.64 µg/g concentration in mink diet)	0.13 µg/g	NYSDEC (Newell *et al.*, 1987)
eggs	decreased egg hatch; fry deformalities	0.33 µg/g	USFWS (Eisler, 1986)
Birds			
diet	high PCB levels in Owl eggs	3 µg/g	USFWS (Eisler, 1986)
brain	bird mortality	54 µg/g	USFWS (Eisler, 1986)
whole egg	decreased egg hatch	0.4 µg/g	USFWS (Kubiak, 1991; pers. comm.)
Mammals			
mink[d]	dose	1.54 µg/kg$_{BW}$-d	USFWS (Eisler, 1986)

Notes: µg/l = ppb
µg/g = ppm (wet weight in diet/tissue; dry weight in soil/sediment)

[a] NONE OF THESE VALUES ARE ENFORCEABLE STANDARDS.
[b] AET and COA methods are based on PCB concentration in sediment and biological indicators.
[c] EP method based on sediment-water chemical partitioning; value given is that which yields pore water concentration of Aroclor 1254 equal to ambient water quality criteria (0.014 µg/l) for 1% organic carbon content in sediment.
[d] Platanow and Karstad (1973) report a Lowest Observed Effects Level (dietary intake) of 0.64 µg/g.

Table C.2-1
Remedial Technologies and Process Options
Sediment

General Response Action	Remedial Technology Type	Process Options
Non-Removal	Containment	
	Capping	Clay/Silt/Sand/Cement
		Active Materials
		Geotextiles
		Multimedia Cap
	Retaining Structures	Dikes/Berms
		Sheet Piling
	In-Situ Treatment	Chemical/Physical Treatments
		Biodegradation
	No Action (with Institutional Controls)	
Removal	Excavation	Clamshell
		Watertight Clamshell
		Dragline
		Scraper
		Dozers & Loaders
		Bucket Wheel
		Backhoe
		Gradall
	Dredging	
	Mechanical	Clamshell
		Watertight Clamshell
		Dragline
		Dipper
		Bucket Ladder
		Backhoe
	Hydraulic	Cutterhead
		Plain Suction
		Dustpan
		Hopper
		Sidecasting
		Bucketwheel
	Special Purpose	Mud Cat
		Airlift
		Pneuma
		Oozer
		Clean-up
		Refresher
		Waterless
		Hand Held
		Matchbox

Source: Compiled from information supplied by equipment manufacturers and USEPA (1990a).

Table C.2-1 Continued
Remedial Technologies and Process Options
Sediment

General Response Action	Remedial Technology Type	Process Options
Treatment	Physical	Soil Aeration
		Centrifugation
		Solvent Extraction *
		Solidification/Stabilization
		In-Situ Adsorption
		Molten Glass
		Steam Stripping
		Liquified Gas Extraction *
		Vitrification
		Distillation
		Acid Leaching
		Wet Air Oxidation
	Chemical	Alkali Metal Dechlorination *
		Electrolytic Oxidation
		Hydrolysis
		Chemical Immobilization
		Polymerization
		UV/Ozone/Ultrasonic
	Thermal	Thermal Desorption
		Electric Reactors
		Fuel Blending
		Industrial Boilers
		Fluidized Bed Incineration
		Infrared Incineration
		Liquid Injection Incineration
		Molten Salt Incineration
		Multiple Hearth Incineration
		Plasma Arc Incineration
		Rotary Kiln Incineration
		Pyrolysis Processes *
		Supercritical Water Oxidation
	Biological	Bioreactors
		Composting
		Land Farming
Disposal	On Site	Confined Disposal Facility
	Upland	Lined Landfill
	Offsite	Permitted Disposal Facility

* Treatability study recommended in Phase 2.

TABLE C.3-1
POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES AND GUIDANCE

Medium/Authority	Requirement	Status	Requirement Synopsis	Consideration in the RI/FS
Surface Water				
Federal Regulatory Requirements	Federal Food, Drug and Cosmetic Act	Relevant and Appropriate	This sets forth FDA limit of 2 ppm for PCB concentrations in commercial fish and shellfish.	To be determined.
New York State Standards	6NYCRR701	Applicable	Establishes water quality standards for various classes of surface water.	Potential ARAR will affect treatments which discharge to area surface waters.
Federal Criteria, Advisories, and Guidance	Federal Ambient Water Quality Control (AWQC)	Applicable	Federal AWQC are health-based criteria developed for 95 carcinogenic and noncarcinogenic compounds.	To be determined.
Air				
Federal Regulatory Requirements	CAA - National Ambient Air Quality Standards (NAAQS) 40 CFR 50	Relevant and Appropriate	These standards were primarily developed for particulates and fugitive dust emissions.	Standards for particulate matter will be used when assessing excavation and emission controls for sediment treatments.
New York State	Clean Air Act (6NYCRR 256 and 257)	Applicable	Establishes an air quality classification system and air quality standards.	Standards for emissions from remedial activities.
Federal Criteria, Advisories, and Guidance	Threshold Limit Value (TLV)	To Be Considered	These standards were issued as consensus standards for controlling air quality in workplace environments.	TLVs could be used for assessing site inhalation risks for soil removal operations.
Sediment				
New York State	Sediment Criteria December 1989	To Be Considered	Guidance document used by the Bureau of Environmental Protection, Division of Fish and Wildlife, for evaluating contaminant levels in sediment.	Standards for determining river sediment clean-up levels.

Source: Laws and regulations as cited in Table.

TABLE C.3-2
POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES AND GUIDANCE

Medium/Authority	Requirement	Status	Requirement Synopsis	Consideration In The RI/FS
Wetlands/Floodplains				
Federal Regulatory Requirements	Clean Water Act (CWA) 40 CFR Part 404 and Rivers and Harbors Act of 1899 (40 CFR Part 230 and 33 CFR Part 320-329)	Applicable	Under this requirement, no activity that adversely effects a wetland shall be permitted if a practicable alternative that has less effect is available. If there is no other practical alternative, impacts must be mitigated. A permit is required for construction of any structure in a navigable water. Section 307, effluent standards of 1-ppb concentration of PCB, is incorporated into this section by reference. The 1-ppb effluent discharge standard is to be considered for guidance levels.	During the identification, screening, and evaluation of alternatives, the effects on wetlands are evaluated. Effluent levels will be used as guidance levels to which alternatives will be evaluated.
	RCRA Location Standards (40 CFR 264.18)	Relevant and Appropriate	This regulation outlines the requirements for constructing a RCRA facility on a 100-year floodplain.	A facility located on a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous waste by a 100-year flood, unless waste may be removed safely before floodwater can reach the facility or no adverse effects on public health and the environment would result if washout occurred.
Federal Nonregulatory Requirements	Wetlands Executive Order (EO 11990)	To be Considered	Under this regulation, federal agencies are required to minimize the destruction loss or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Remedial alternatives that involve construction must include all practicable means of minimizing harm to wetlands. Wetlands protection considerations must be incorporated into the planning and decision-making about remedial alternatives.

Source: Laws and regulations as cited in Table.

TABLE C.3-2 (Continued)
POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES AND GUIDANCE

Medium/Authority	Requirement	Status	Requirement Synopsis	Consideration In The RI/FS
	Floodplains Executive Order (EO 11988)	To be Considered	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	The potential effects of any action must be evaluated to ensure that the planning and decision-making reflect consideration of flood hazards and floodplain management, including restoration and preservation of natural undeveloped floodplains.
New York State Freshwater Wetlands Law	ECL Article 24 & 71 in Title 23	Applicable	Regulates activities conducted in a wetlands area to minimize the destruction, loss or degradation of the wetlands.	Remedial alternatives that involve construction must include means to protect wetlands.
New York State Freshwater Wetlands Permit Requirements Regulations	6 NYCRR Part 663	Applicable	Regulates the procedural requirements to be followed in undertaking different activities in wetlands and in areas adjacent to wetlands.	Remedial alternatives that involve construction must include means to protect wetlands.
Endangered Species Act	16 USC 1531	Applicable	FWS and NMFS are required to not jeopardize the continued existence of endangered/threatened species or adversely modify or destroy the critical habitats of such species.	Potential ARAR as threatened or endangered species may inhabit the site.
Farmland Protection Policy Act of 1981 (FPPA)	7 USC 4201 et seq	Applicable	Regulates the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses.	Potential ARAR for remedial alternatives.
Endangered and Threatened Species of Fish and Wildlife Requirements	6 NYCRR 182	Applicable	Restricts activities in areas inhabited by endangered species.	Potential ARAR as many fish and wildlife species inhabit the site.

Source: Laws and regulations as cited in Table.

TABLE C.3-3
POTENTIAL ACTION-SPECIFIC ARARS

ARARS	Requirement Synopsis	Action To Be Taken To Attain ARARS If A Remedy Is Selected For Which These Requirements Are ARAR
RCRA - General Facility Standards (40 CFR 264.10 - 264.18)	General facility requirements outline general waste analysis, security measures, inspections and training requirements.	Any facilities will be constructed, fenced, posted and operated in accordance with this requirement. All workers will be properly trained. Process wastes will be evaluated for the characteristics of hazardous wastes to assess further landfilling requirements.
RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31)	This regulation outlines requirements for safety equipment and spill control.	Safety and communication equipment will be installed at the site; local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Plans will be developed and implemented during site work including installation of monitoring wells, and implementation of site remedies.
RCRA - Releases from Solid Waste Management Units (40 CFR 264.90 - 264.109)	This regulation details requirements for a groundwater monitoring program to be installed at the site.	A groundwater monitoring program is a component of all alternatives. RCRA regulations will be utilized as guidance during development of this program.
RCRA - Closure and Post-closure (40 CFR 264.110 - 264.120)	This regulation details specific requirements for closure and post-closure of hazardous waste facilities.	Those parts of the regulation concerned with long-term monitoring and maintenance of the site will be incorporated into the design.
RCRA - Surface Impoundments Items (40 CFR 264.220 - 264.249)	This regulation details the design, construction, operation, monitoring, inspection and contingency plans for a RCRA surface impoundment. Also provides three closure options for CERCLA sites; clean closure, containment closure, and alternate closure.	To comply with clean closure, owner must remove or decontaminate all waste. To comply with containment closure, the owner must eliminate free liquid, stabilize remaining waste, and cover impoundment with a cover that complies with the regulation. Integrity of cover must be maintained, groundwater system monitored, and runoff controlled. To comply with alternate closure, all pathways of exposure to contaminants must be eliminated and long-term monitoring provided.
RCRA - Waste Piles (40 CFR 264.250 - 264.269)	Details procedures, operating requirements, and closure and post-closure options for waste piles. If removal or decontamination of all contaminated subsoils is not possible, closure and post-closure requirements for landfills must be attained.	According to RCRA, waste piles used for treatment or storage of non-containerized accumulation of solid, non-flowing hazardous waste may comply with either the waste pile or landfill requirements. The temporary storage of solid waste on-site, therefore, must comply with one or the other subpart.

TABLE C.3-3 (Continued)
POTENTIAL ACTION-SPECIFIC ARARS

ARARS	Requirement Synopsis	Action To Be Taken To Attain ARARS If A Remedy Is Selected For Which These Requirements Are ARAR
RCRA - Landfills (40 CFR 264.300 - 264.339)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements, for a RCRA landfill.	Disposal of contaminated materials if determined to be RCRA characteristic hazardous wastes from the river would be to a RCRA-permitted facility that complies with RCRA landfill regulations, including closure and post-closure. On-site disposal would include a RCRA-designed cap.
RCRA - Incinerators (40 CFR 264.340 - 264.599)	This regulation specifies the performance standards, operating requirements, monitoring, inspection, and closure guidelines of any incinerator burning hazardous waste.	On-site thermal treatment must comply with the appropriate requirements specified in this subpart of RCRA, if determined to be RCRA characteristic hazardous wastes.
RCRA - Miscellaneous Units (40 CFR 264.600 - 264.999)	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations for treatment, storage, and disposal units.	Units not previously defined under RCRA must comply with these requirements.
TSCA Disposal Requirements (40 CFR Part 761.60)	Liquid PCBs at concentrations greater than 50 ppm, but less than 500 ppm, must be disposed of either in an incinerator, or in a chemical waste landfill, or by another technology capable of providing equal treatment. Liquid PCBs at concentrations greater than 500 ppm must be disposed of in an incinerator or treated by an alternate technology capable of equal treatment. Dredged materials with PCB concentrations greater than 50 ppm may be disposed of by alternative methods which are protective of public health and the environment, if shown that incineration or disposal in a chemical waste landfill is not reasonable or appropriate.	PCB treatment must comply with these regulations during remedial action.
OSHA - General Industry Standards (29 CFR Part 1910)	These regulations specify the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 9910.120.	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the specified concentrations. Workers performing remedial activities would be required to have completed specified training requirements.
OSHA - Safety and Health Standards (29 CFR Part 1926)	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	All appropriate safety equipment will be on-site. In addition, safety procedures will be followed during on-site activities.

TABLE C.3-3 (Continued)
POTENTIAL ACTION-SPECIFIC ARARS

ARARS	Requirement Synopsis	Action To Be Taken To Attain ARARS If A Remedy Is Selected For Which These Requirements Are ARAR
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	These requirements apply to all site contractors and subcontractors and must be followed during all site work.
CWA - 40 CFR Part 403	This regulation specifies pretreatment standards for discharge to a publicly owned treatment works (POTW).	If a leachate collection system is installed and the discharge is sent to a POTW, the POTW must have an approved pretreatment program. The collected leachate runoff must be in compliance with the approved program. Prior to discharging, a report must be submitted containing identifying information, list of approved permits, description of operations, flow measurements, measurement of pollutants, certification by a qualified professional, and a compliance schedule.
Regulations on Disposal Site Determinations Under the Water Act (40 CFR 231)	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill materials into U.S. waters, which include wetlands.	The dredged or fill material should not be discharged unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact on the wetlands.
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-171.5)	This regulation outlines procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	Contaminated materials will be packaged, manifested and transported to a licensed off-site disposal facility in compliance with these regulations.
New York State Pollutant Discharge Elimination System (6 NYCRR 750-757)	Establishes water quality standards, effluent limitations, standards of performance, toxic effluent standards and prohibitions, and pretreatment standards.	To be determined.
New York State RCRA Hazardous Waste Regulations (6 NYCRR 370-372)	Outlines design specifications and standards of performance for disposal facilities and treatments.	To be determined.
New York State RCRA Hazardous Waste Regulations (6 NYCRR 373)	Establishes requirements for the closure (clean closure and waste-in-place closure) and long-term management of a hazardous disposal facility.	To be determined.
New York State Solid Waste Regulations (6 NYCRR 360-361)	Requirements for landfill operation and closure, incineration, and other solid waste management activities.	To be determined.
New York State Air Pollution Control Regulations (6 NYCRR [illegible]0-221)	Establishes maximum ambient levels for criteria pollutants and establishes emissions limitations for sources which emit VOCs into [illegible] air.	To be determined.

Table C-4.1
Physical/Chemical Technologies Reviewed
by NUS (1984) and MPI (1985)

Technologies	NUS (1984)	MPI (1985)
Chemical Dechlorination		
Acurex	X	
Goodyear Process	X	
Hydrothermal Process	X	
KOHPEG	X	X
NaPEG	X	
Ozonation	X	
PCBX	X	
Physical Destruction		
Photodecomposition	X	
Ultraviolet/Ozone	X	
Wet Air Oxidation	X	
Wright-Malta	X	X
ATDT		X

Table C.4-2
Initial Screening of Physical/Chemical Treatment Processes

Process	Contact	Development Advanced since 1987
1 <u>Chemical Dechlorination</u>		
KOHPEG	Galson Remediation Corporation East Syracuse, NY 13057	Yes
2 <u>Solvent Extraction</u>		
OHM Extraction	OH Materials Findley, OH	No
EPRI Solvent Wash	Electric Power Research Institute Palo Alto, CA	No
Basic Extraction Sludge Treatment (B.E.S.T.)	Resources Conservation Co. Ellicott City, MD	Yes
Propane Extraction	CF Systems Woburn, MA	Yes
Low Energy Extraction Process (LEEP)	ART International, Inc. Randolph, NJ	Yes
3 <u>Physical Destruction</u>		
LARC	Atlantic Research Corporation Alexandria, VA	No
UV/Ultrasonics Technology	Ozonic Technology, Inc. Closter, NJ	Yes
MODAR Supercritical Water Process	Modar, Inc. Houston, TX	No
Vitrification	Battelle Pacific Northwest Laboratory Richland, WA	No

Source: Compiled from RTI (1987) and personal communication with process developers.

Table C.4-3
Bench and Pilot-Scale Tests of Physical/ Chemical Sediment Treatment Technologies

Estuary and Lower Harbor/Bay Feasibility Study

Technology	Scale	Vendor	Response from Vendor
Solidification/ Stabilization	Bench	Test Conducted by U.S. Army Corps of Engineers Waterways Experiment Station Vicksburg, Mississippi	No
Solvent Extraction			
B.E.S.T. Process	Bench	Resources Conservation Co. Bellvue, Washington	Yes
Liquified Gas Extraction		Pilot CF Systems Corporation Woburn, MA 01801	Yes
Alkali Metal Dechlorination			
KOHPEG Process	Bench	Galson Remediation Corporation East Syracuse, New York	Yes
Vitrification (Modified in-site)	Bench	Battelle Pacific Northwest Laboratories Richland, Washington	No

Source: EBASCO (1990).

FIGURES

PHASE 1 REPORT

INTERIM CHARACTERIZATION AND EVALUATION

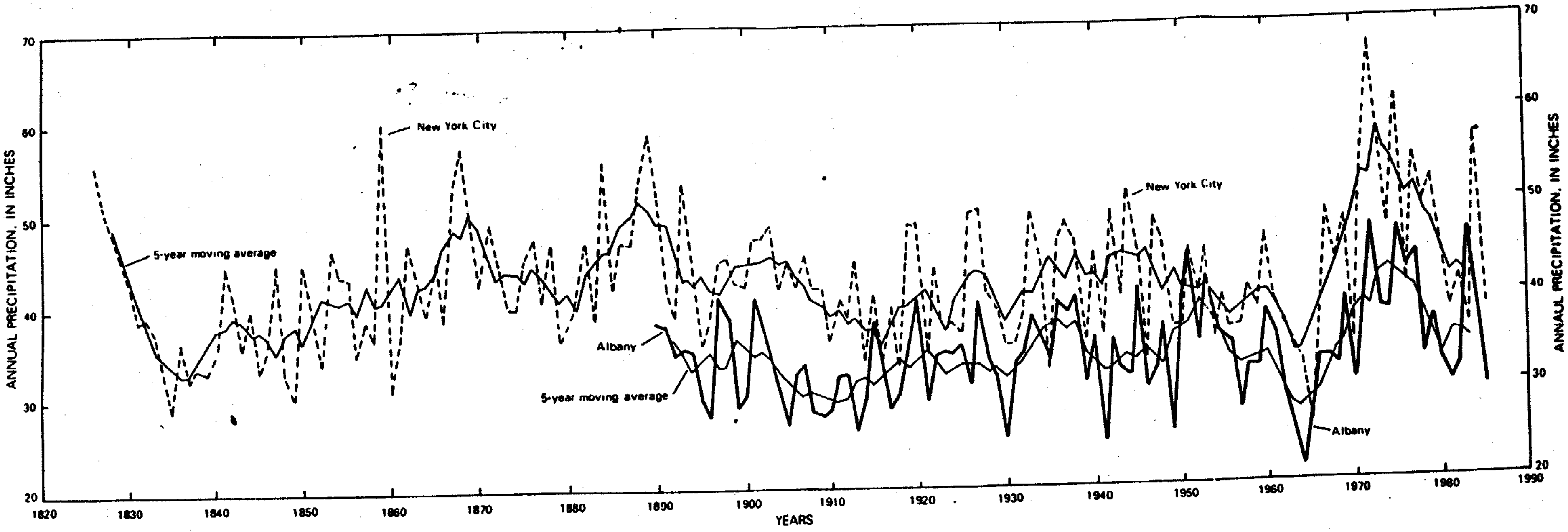
HUDSON RIVER PCB REASSESSMENT RI/FS

CONTENTS

The TAMS/Gradient Database is the source of all data, except as noted on figures where appropriate.

Figure A.1-1

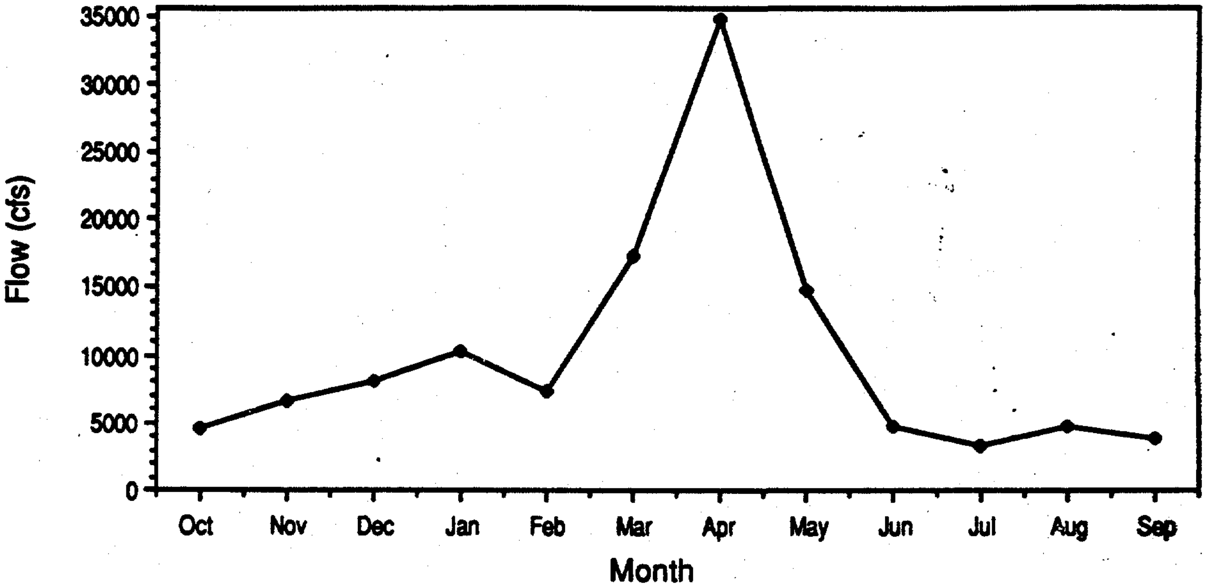
Annual Precipitation for Albany (1890-1985) and New York City (1826-1985)



Source: Darmer (1987).

Figure A.1-2

Mean Monthly Flow of the Hudson River at Federal Dam in Water Year 1962



Source: Hammond (1975).

Figure A.1-3

Comparison of Hudson River Upper Basin and Lower Basin Runoff

Figure A.1-3a: Mean Monthly Flow For Water Year 1986

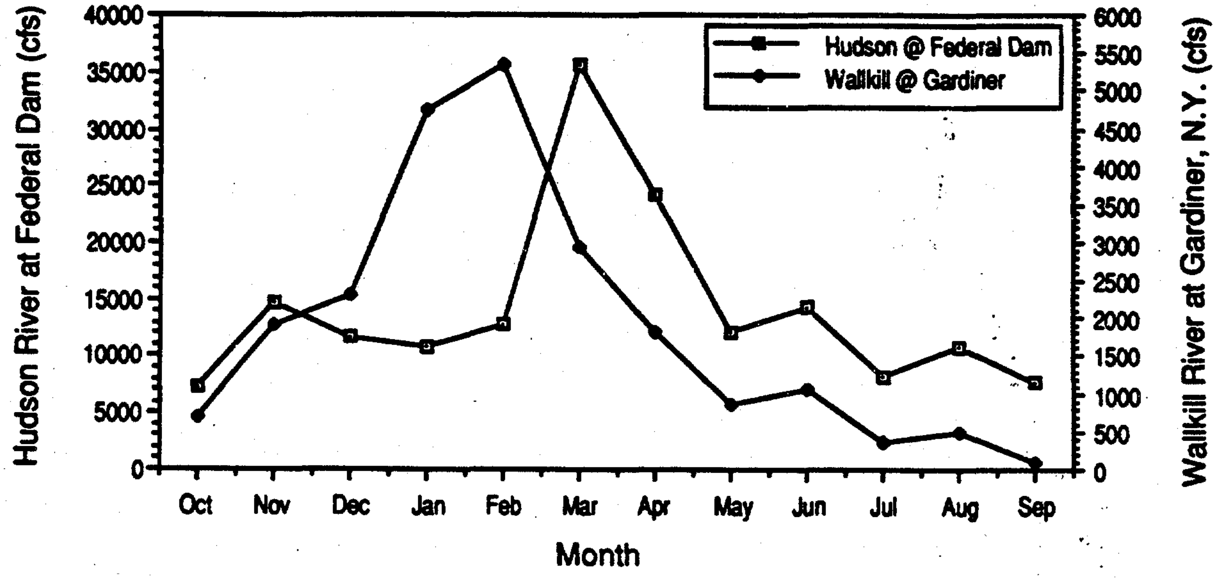
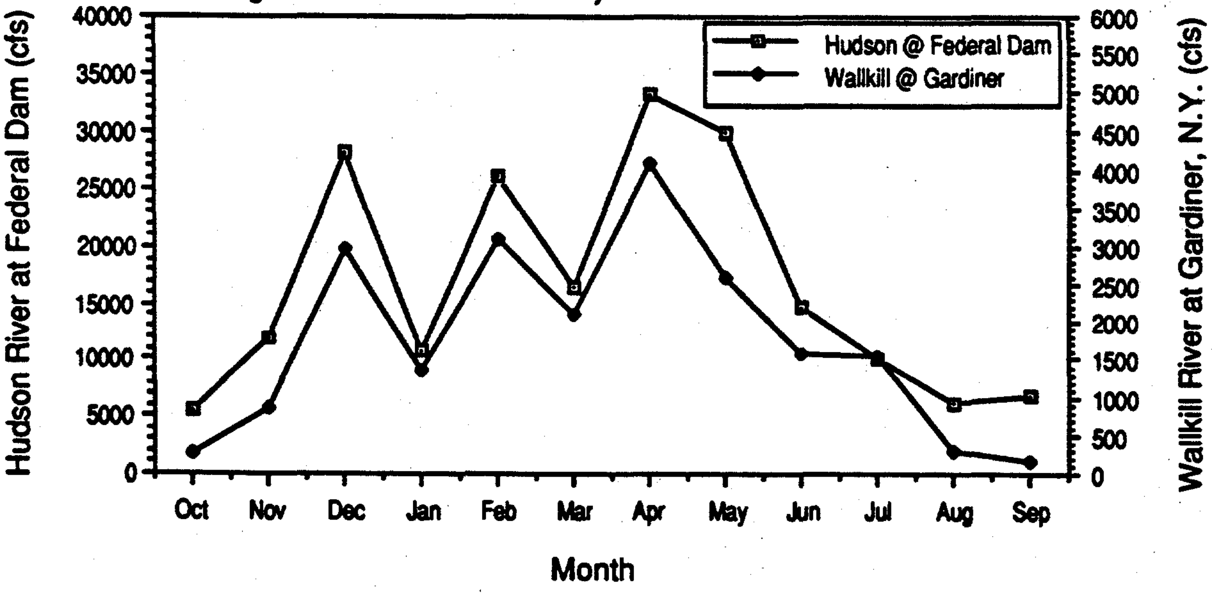


Figure A.1-3b: Mean Monthly Flow For Water Year 1984



Source: Garvey (1990).

Note: Hudson R. flow scale is given at left.
Wallkill R. flow scale is given at right.

Figure A.1-4

Fresh Water Contributions to the Lower Hudson River

Figure A.1-4a: Flow Contributions By Tributary

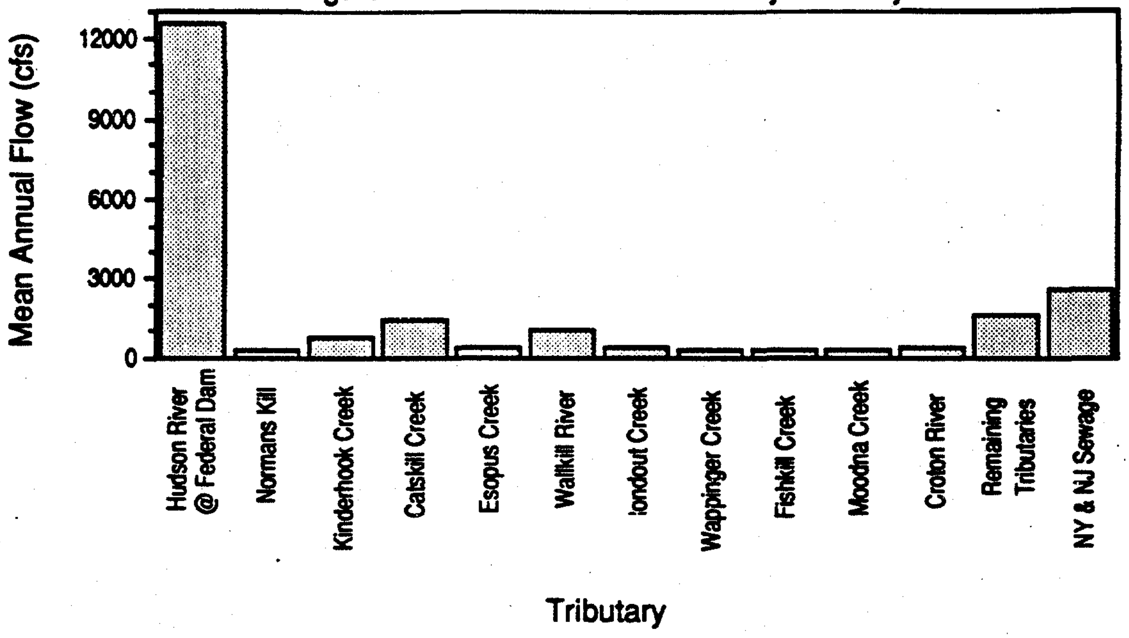
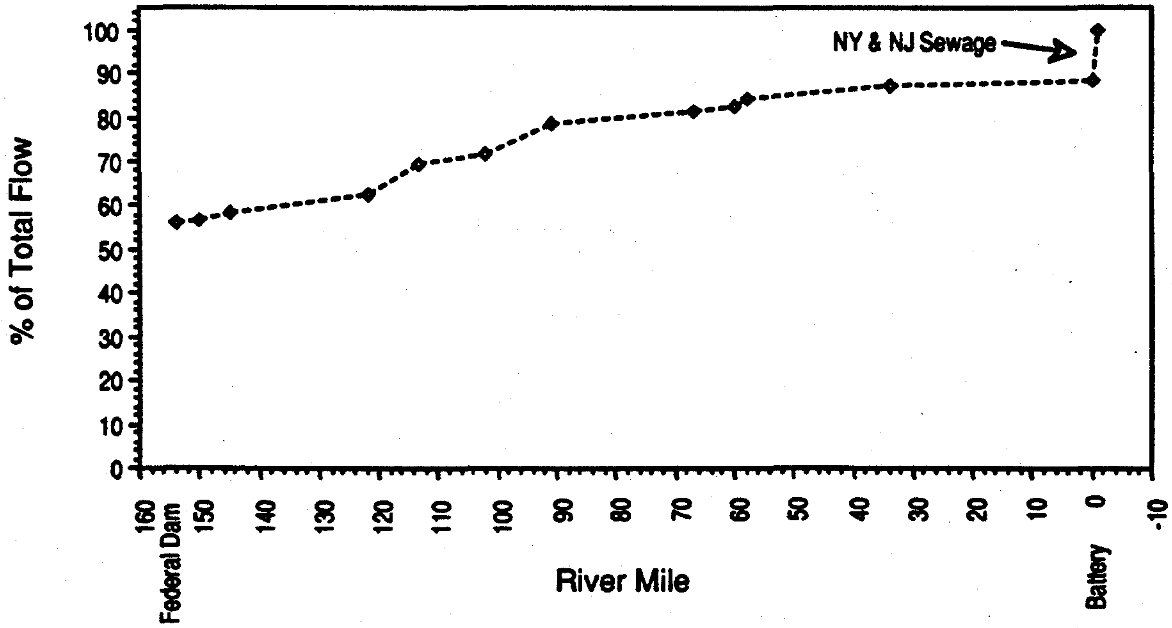


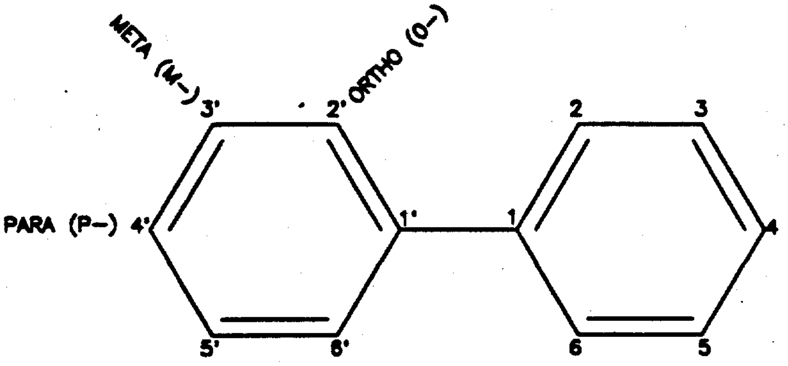
Figure A.1-4b: Flow Contributions by River Mile



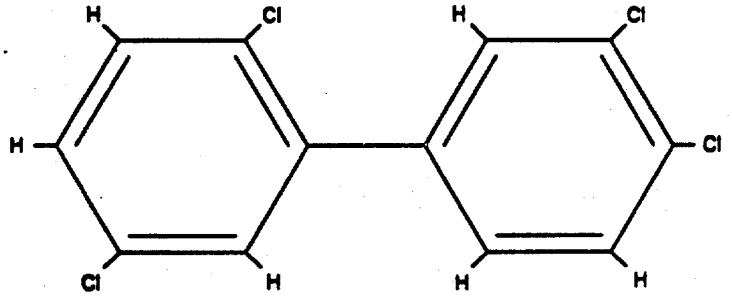
Source: Garvey (1990).

Figure A.2–1
PCB STRUCTURE AND GROUP

GENERIC STRUCTURE:



PCB CONGENER:



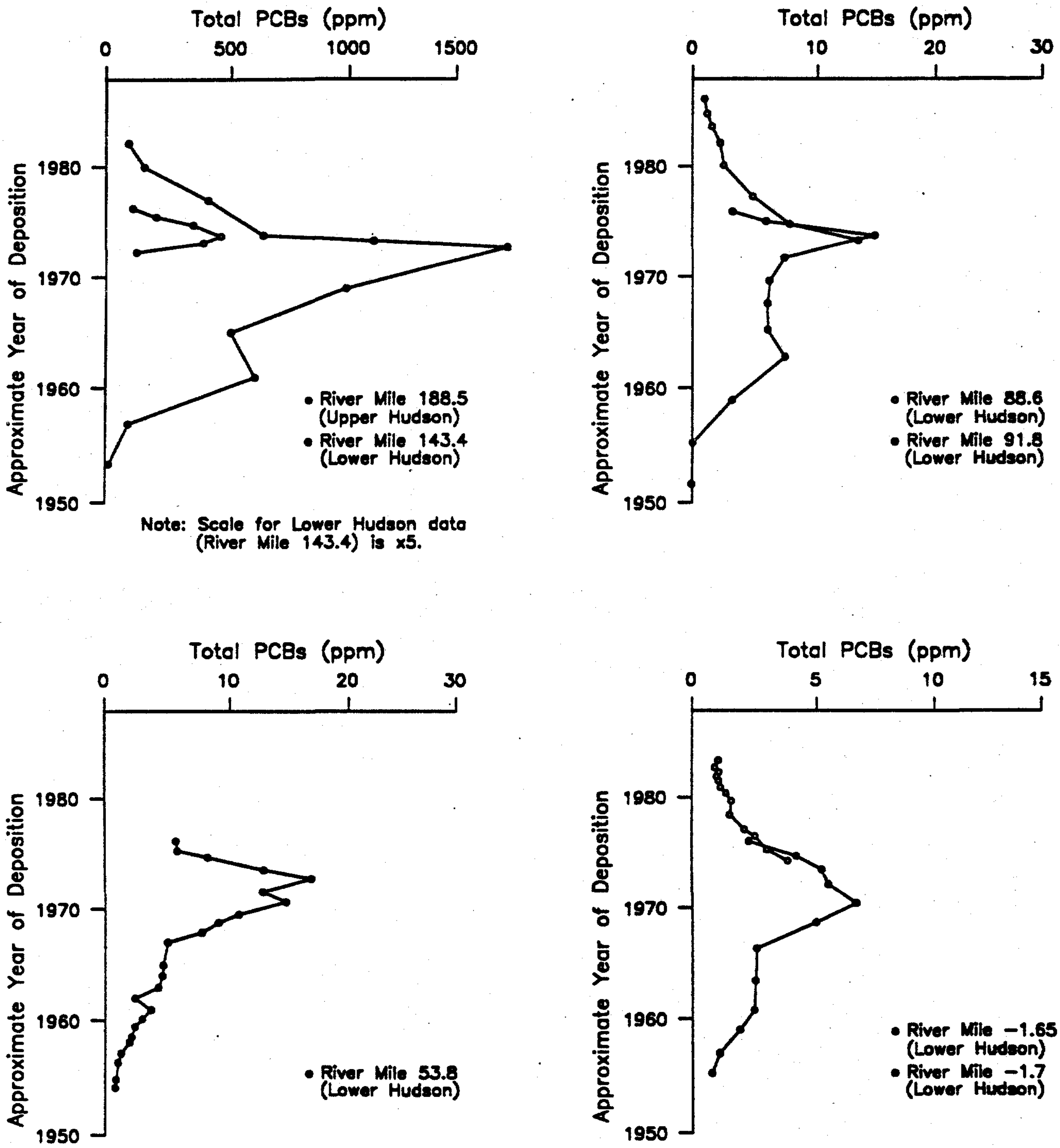
3,4,2',5' tetrachlorobiphenyl

PCB Homologue Group	Number of Congeners
Mono–	3
Di–	12
Tri–	24
Tetra–	42
Penta–	46
Hexa–	42
Hepta–	24
Octa–	12
Nona–	3
Deca–	1
Total Congeners	209

Source: Cairns et al. (1986).

Figure A.3-1

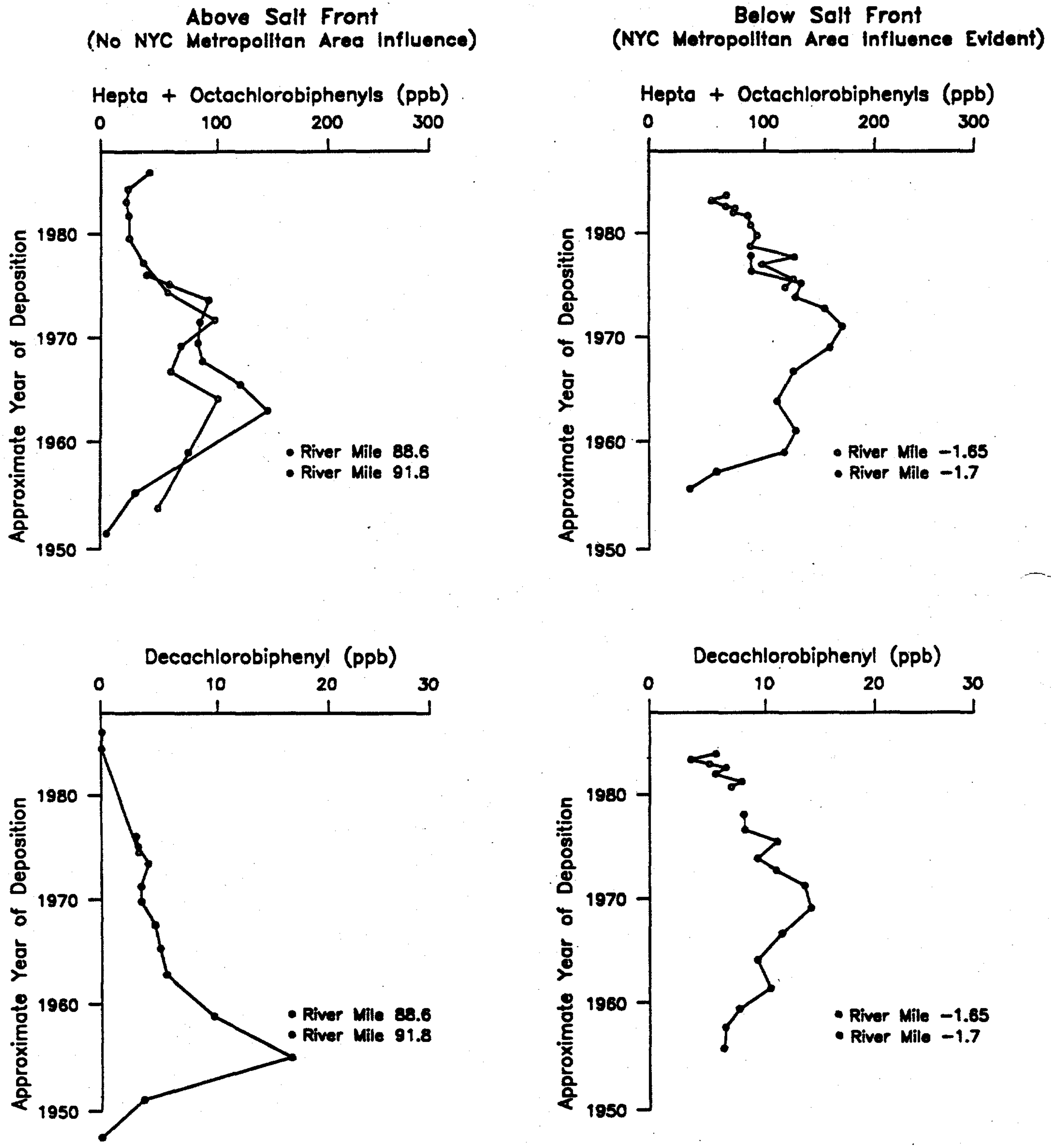
Total PCB Levels in Dated Hudson River Sediment Cores by River Mile



Note: Scale for Lower Hudson data (River Mile 143.4) is x5.

Source: Bopp and Simpson (1989).

Figure A.3-2
Highly Chlorinated PCB Homologues in Lower Hudson River Sediments



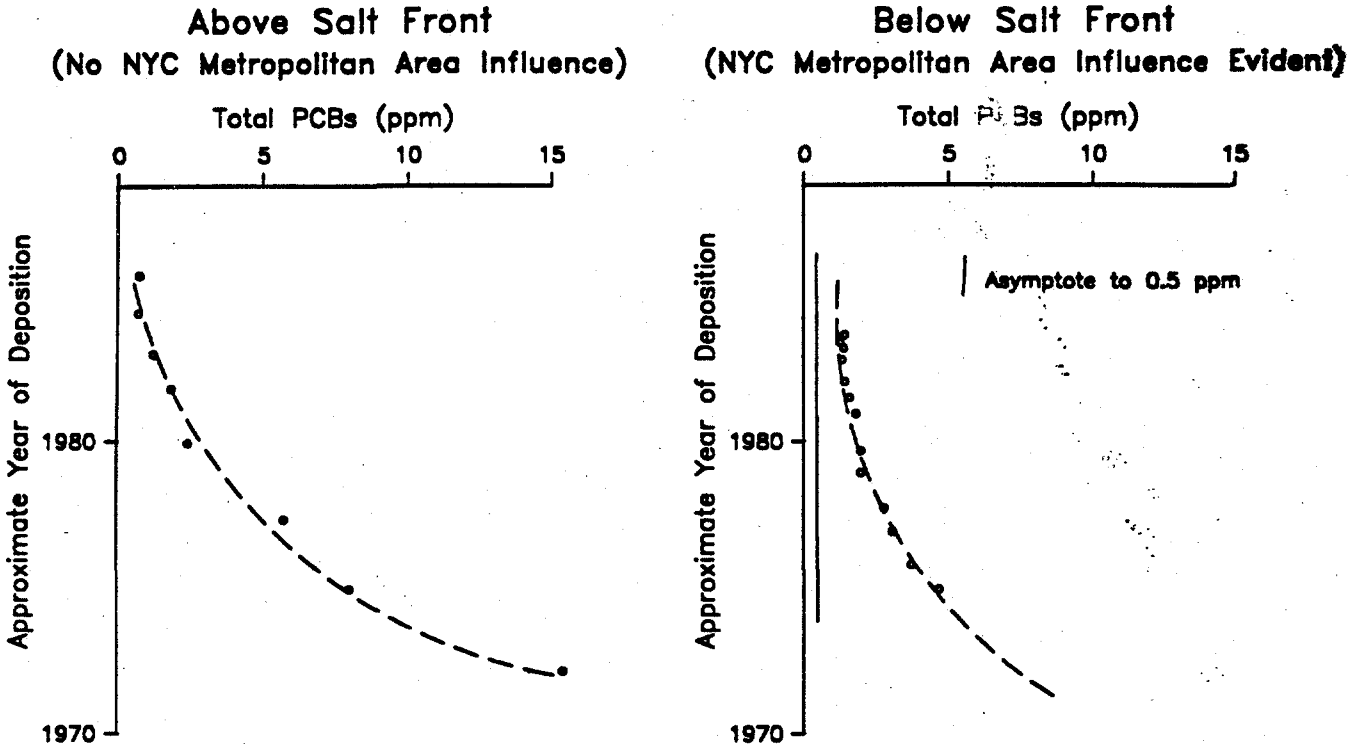
Above Salt Front
(No NYC Metropolitan Area Influence)

Below Salt Front
(NYC Metropolitan Area Influence Evident)

Source: Bopp and Simpson (1989).

Figure A.3-3

Decreasing PCB Levels in Hudson River Sediment over Time



Exponential decay curve for core at River Mile 88.6 (half-life of 3.5 years)

Exponential decay curve for core at River Mile −1.65 (half life of 3.5 years)

Source: Bopp and Simpson (1989).

Figure A.3-4
Lipid-Based Aroclor Concentration:
Striped Bass Lower Hudson

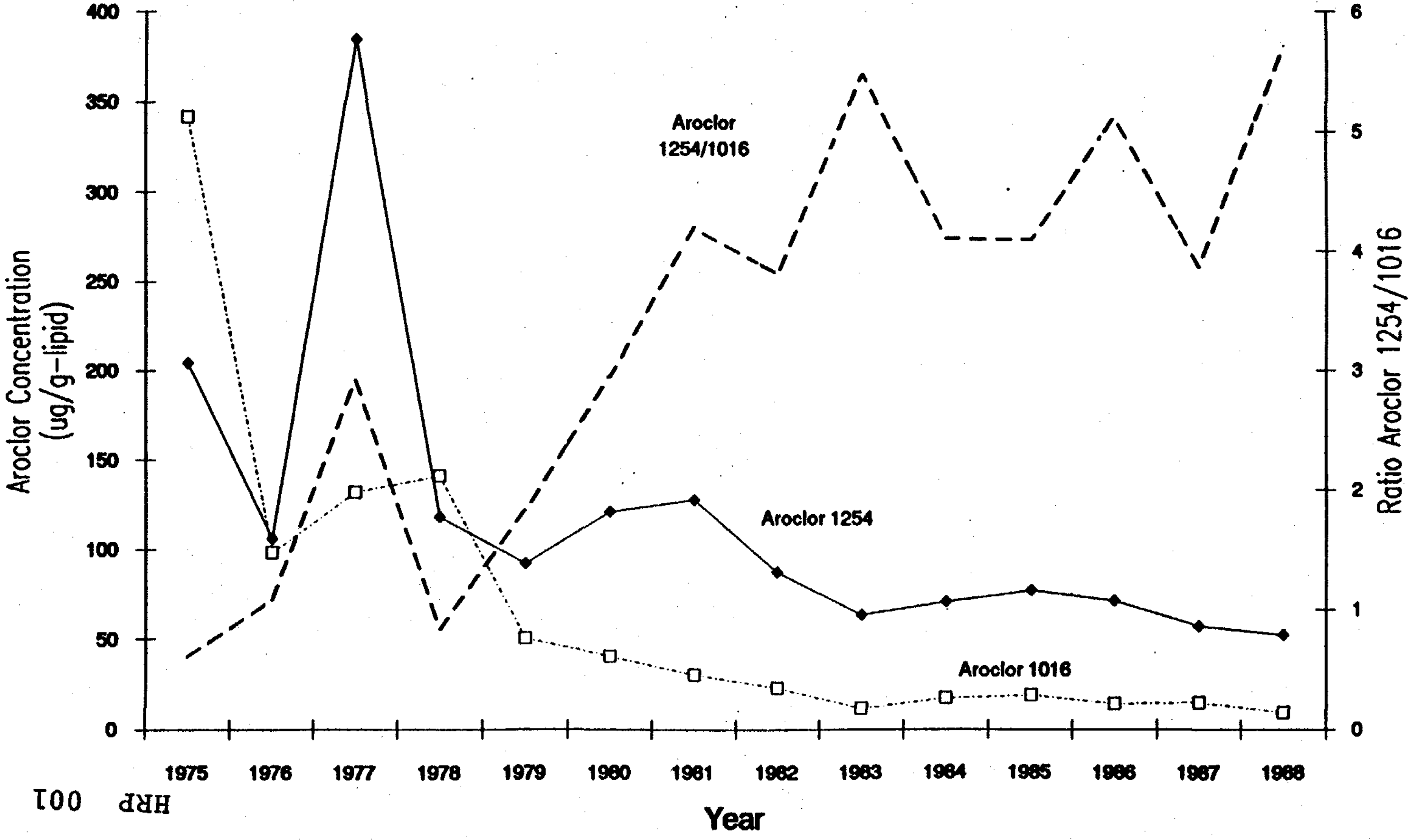
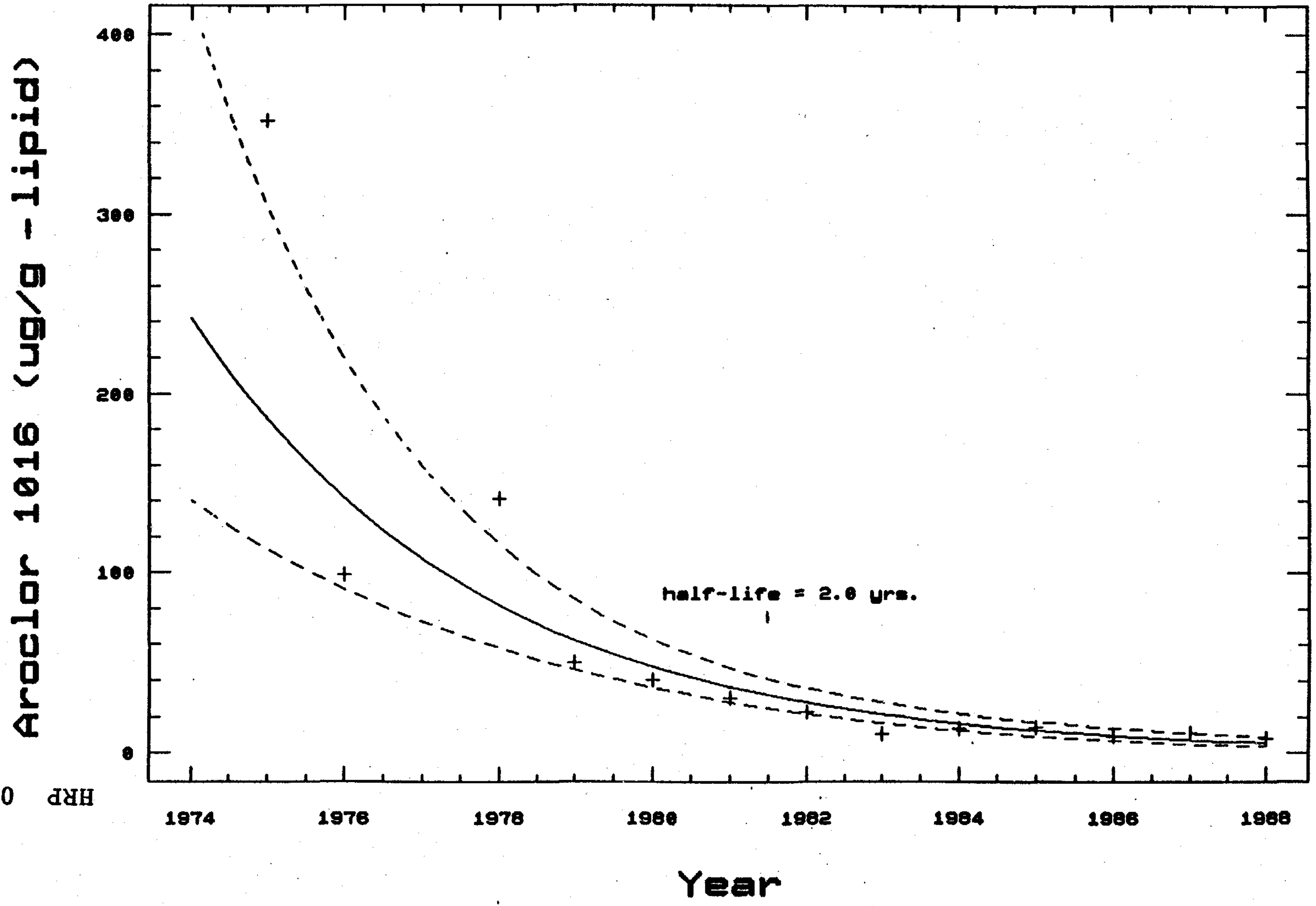


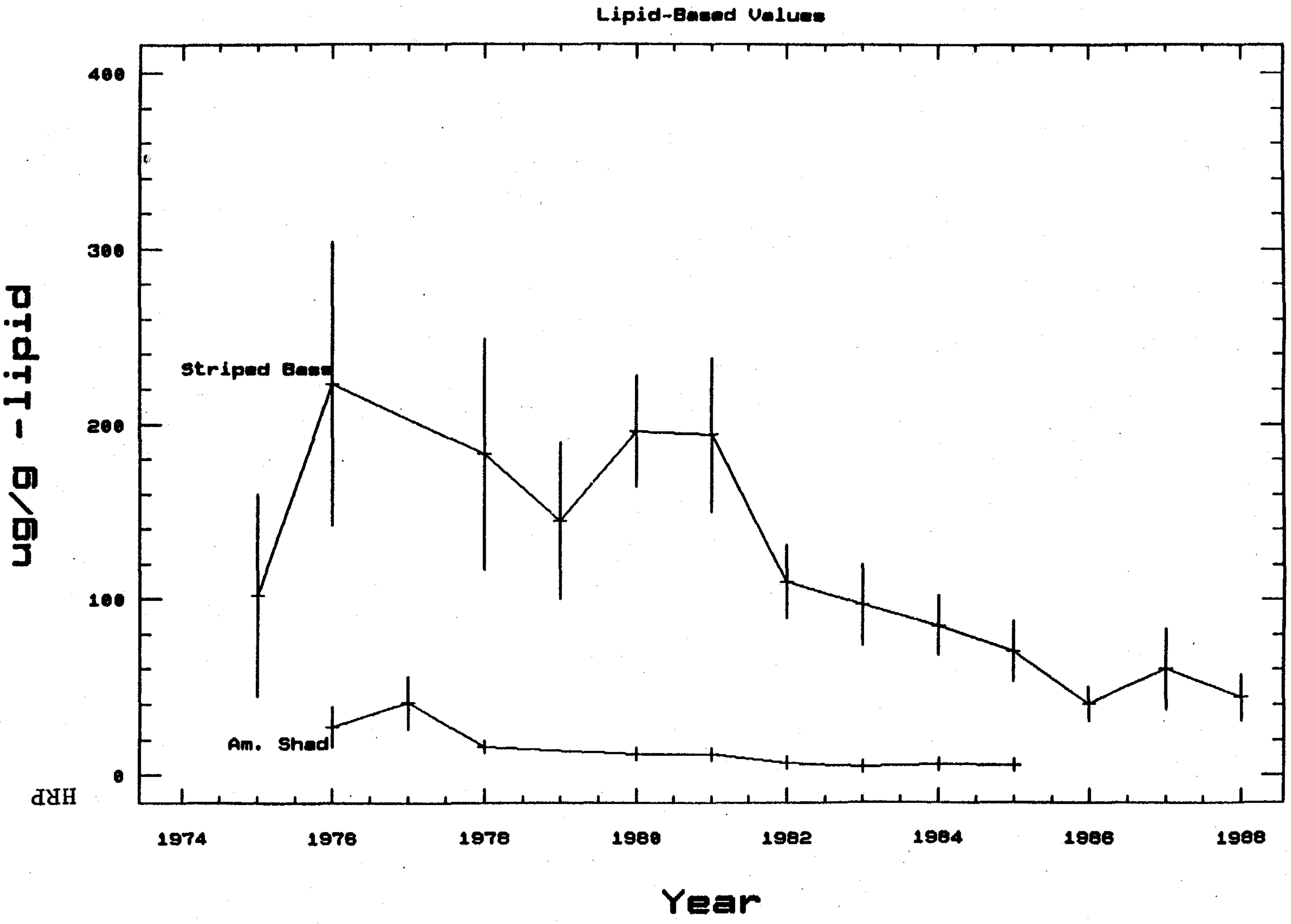
Figure A.3-5
Striped Bass (below River Mile 80)
Aroclor 1016, lipid-based



Exponential Regression, with 95% Confidence Bounds

Figure A.3-5

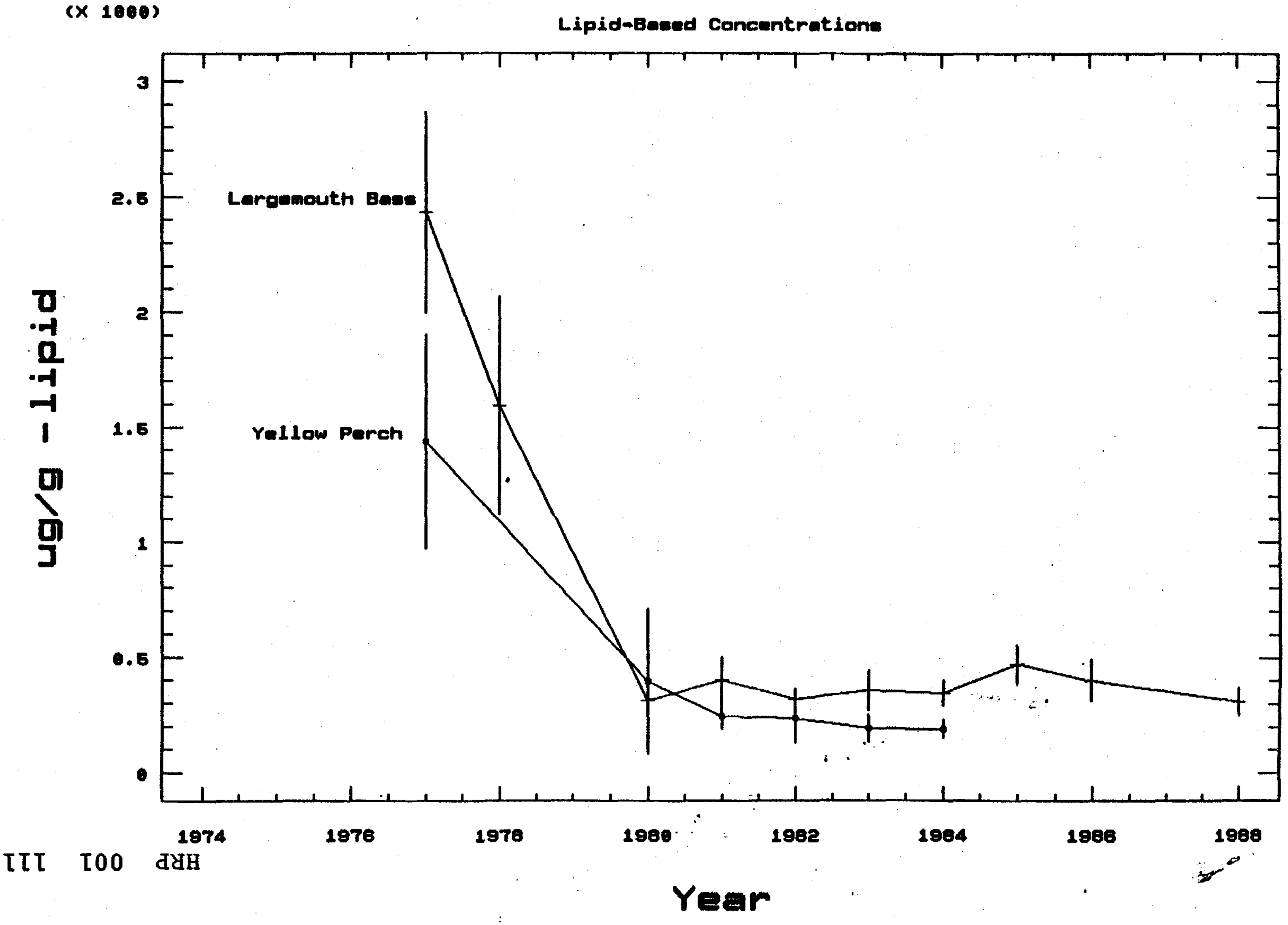
Figure A.3-6
Total PCBs in Fish, Tappan Zee Bridge



Means & 95% Confidence Intervals

Figure A.3-6

Figure A.3-7
Total PCBs in Fish at Catskill (R.M.114)



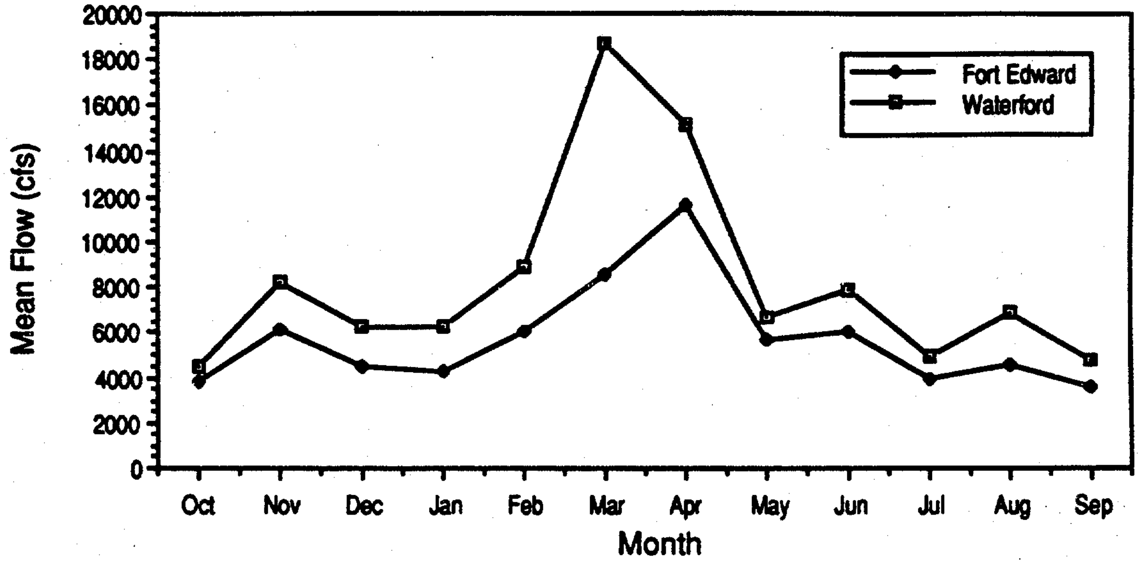
Means & 95% Confidence Intervals

Figure A.3-7

Figure B.1-1

Mean Monthly Flow in the Upper Hudson River

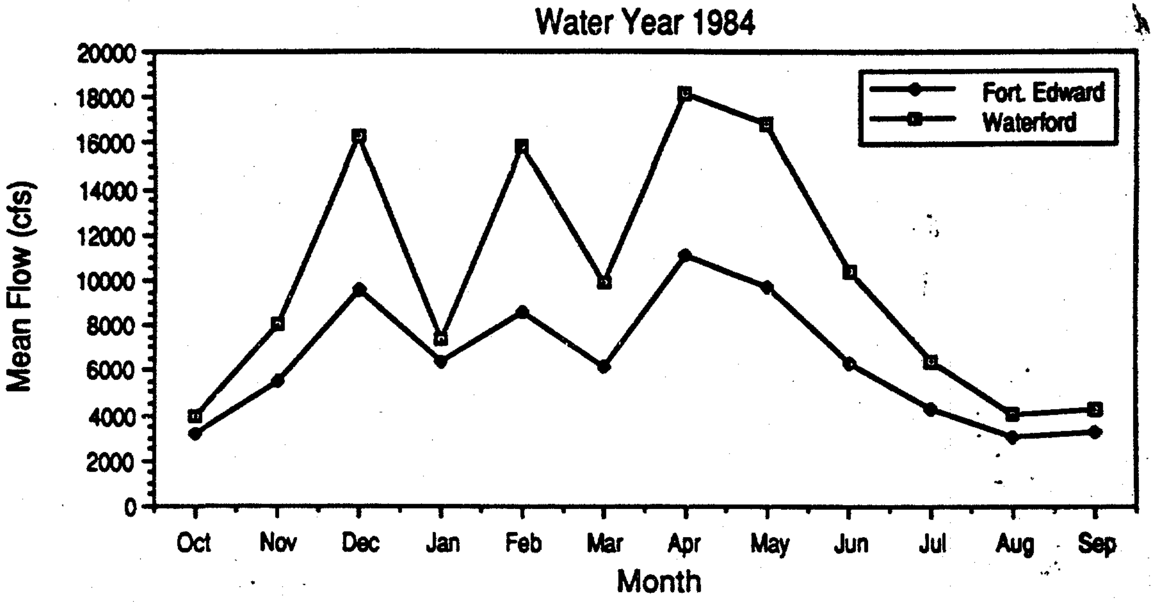
Water Year 1986



Source: USGS, Water Resources Data-New York Vol. 1, Water Year 1986 (1987).

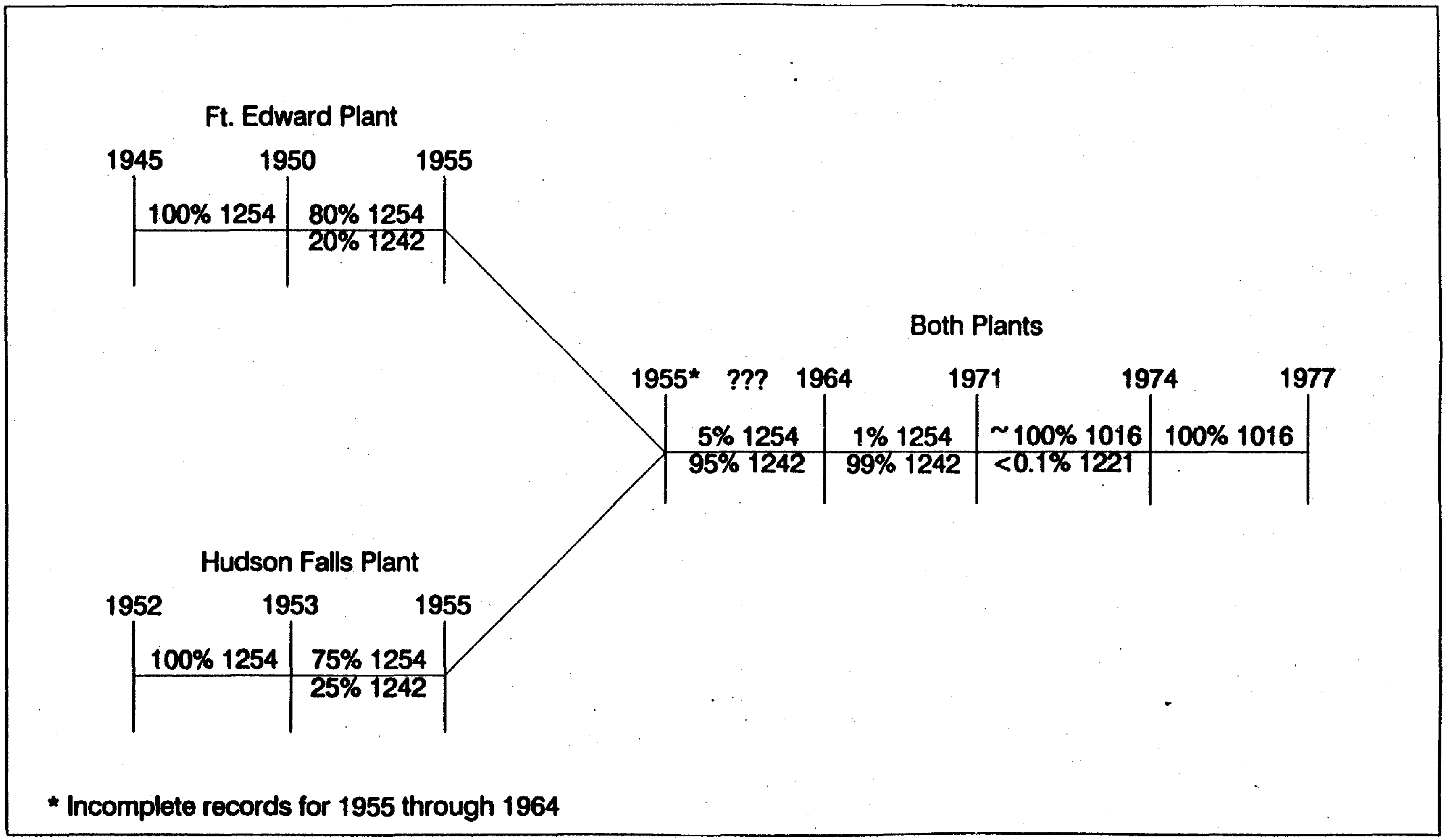
Figure B.1-2

Mean Monthly Flow in the Upper Hudson River



Source: USGS, Water Resources Data-New York Vol. 1, Water Year 1984 (1985).

Figure B.2-1
Reported General Electric PCB Usage

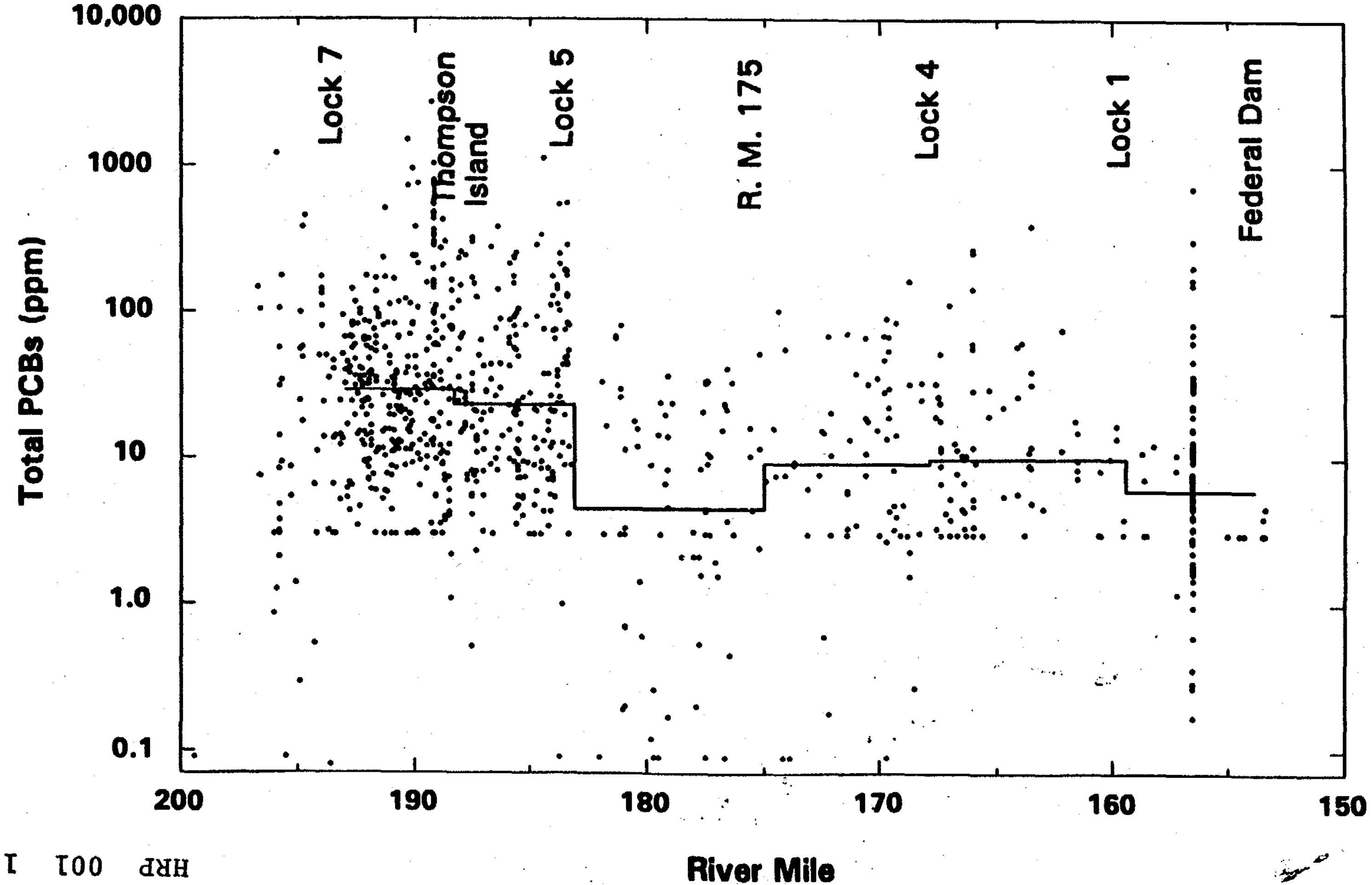


* Incomplete records for 1955 through 1964

Source: Brown, Jr. et al. (1984).

Figure B.3-1

Total PCBs in Surface Sediments, 1976-78



Solid line shows median by river reach.

Figure B.3-1

Figure B.3-2
PCB Concentration vs. Texture Relationship
Gravel

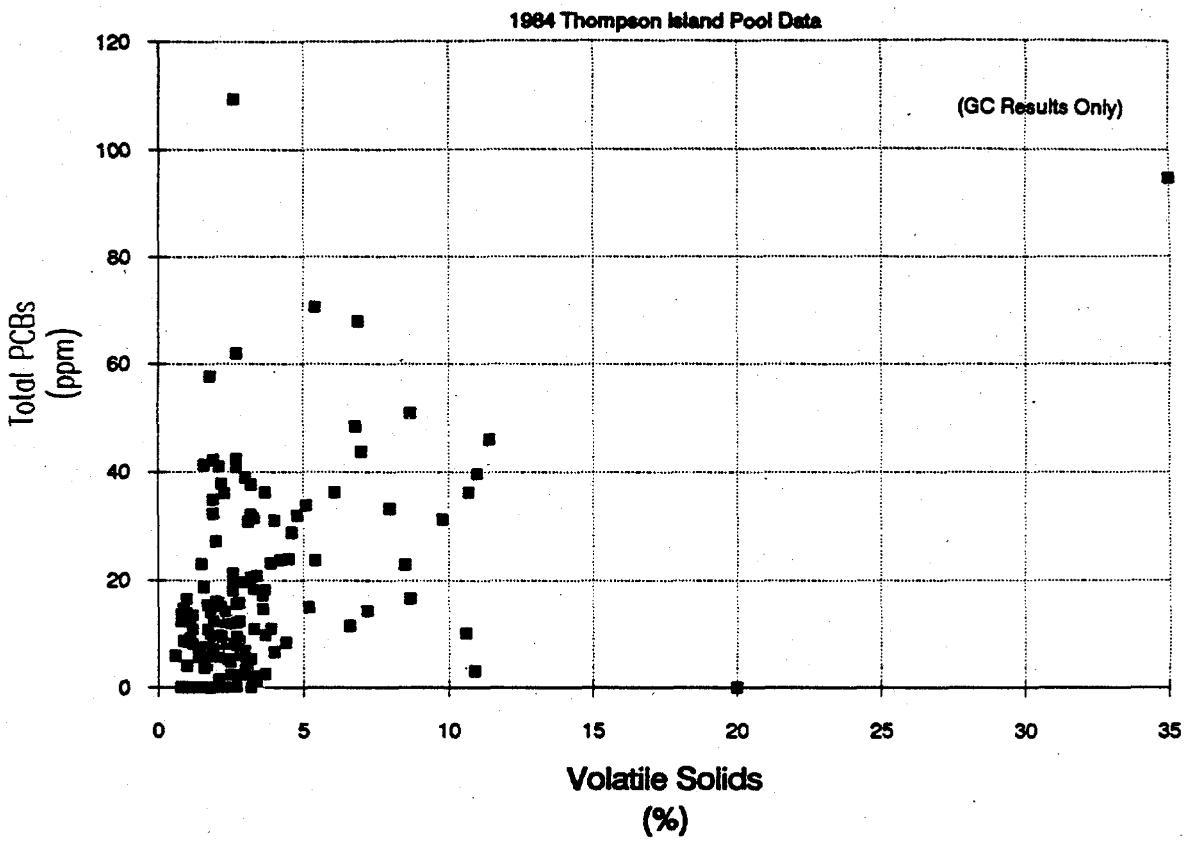


Figure B.3-3
PCB Concentration vs. Texture Relationship
Fine Sand

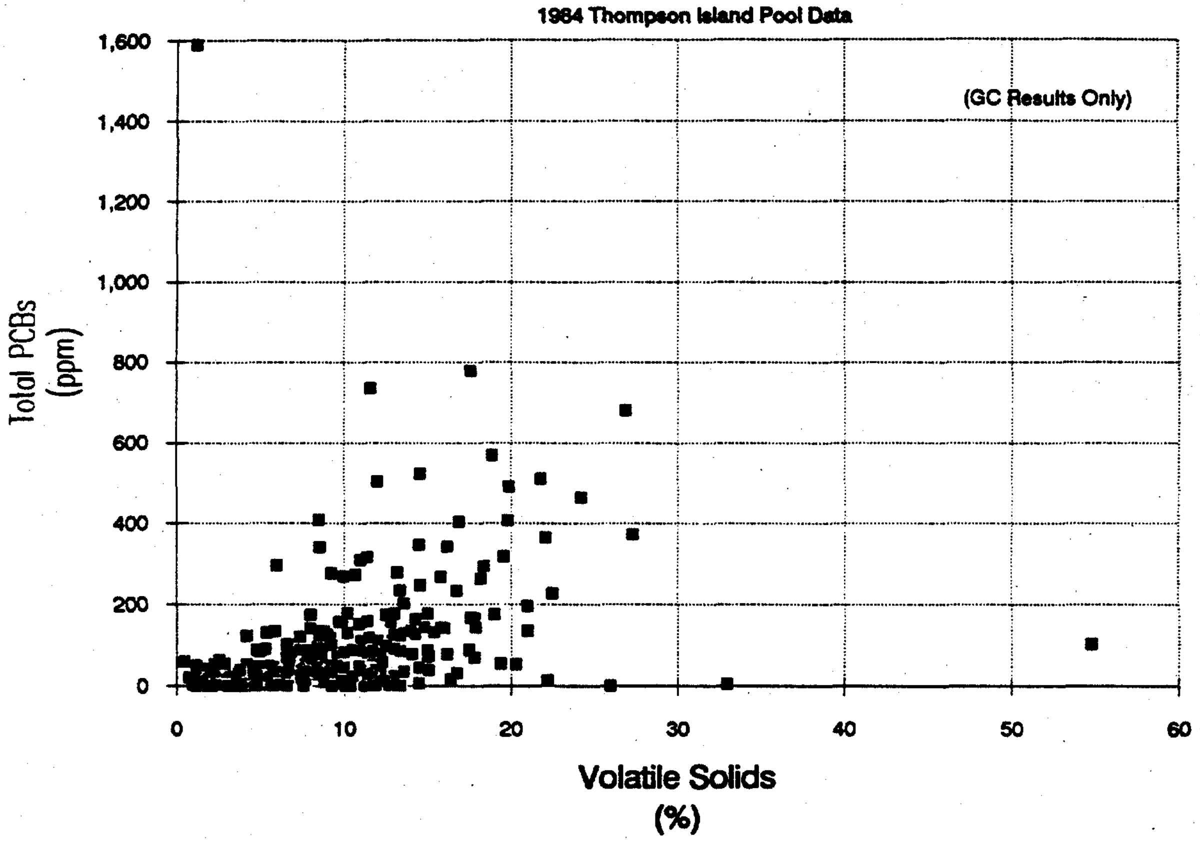


Figure B.3-4
PCB Concentration vs. Texture Relationship
Fine Sand/Wood Chips

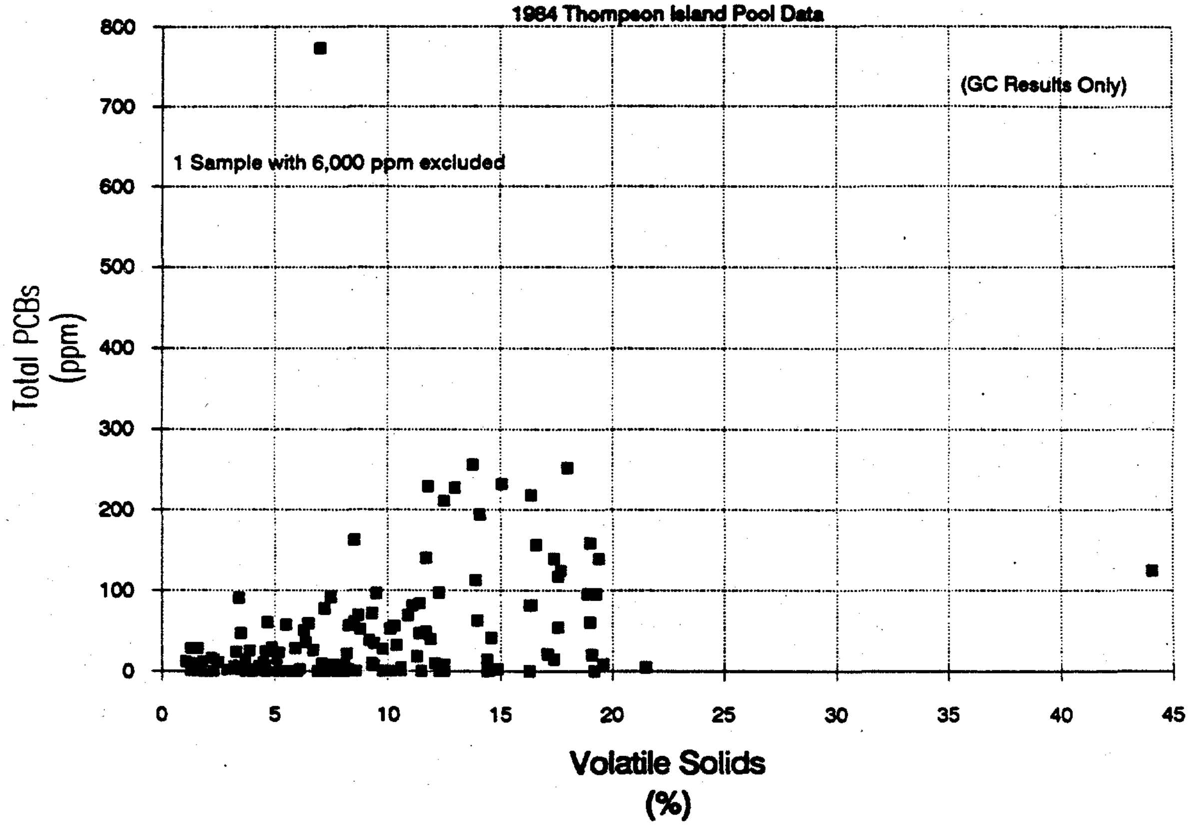


Figure B.3-5
PCB Concentration Frequency Comparison

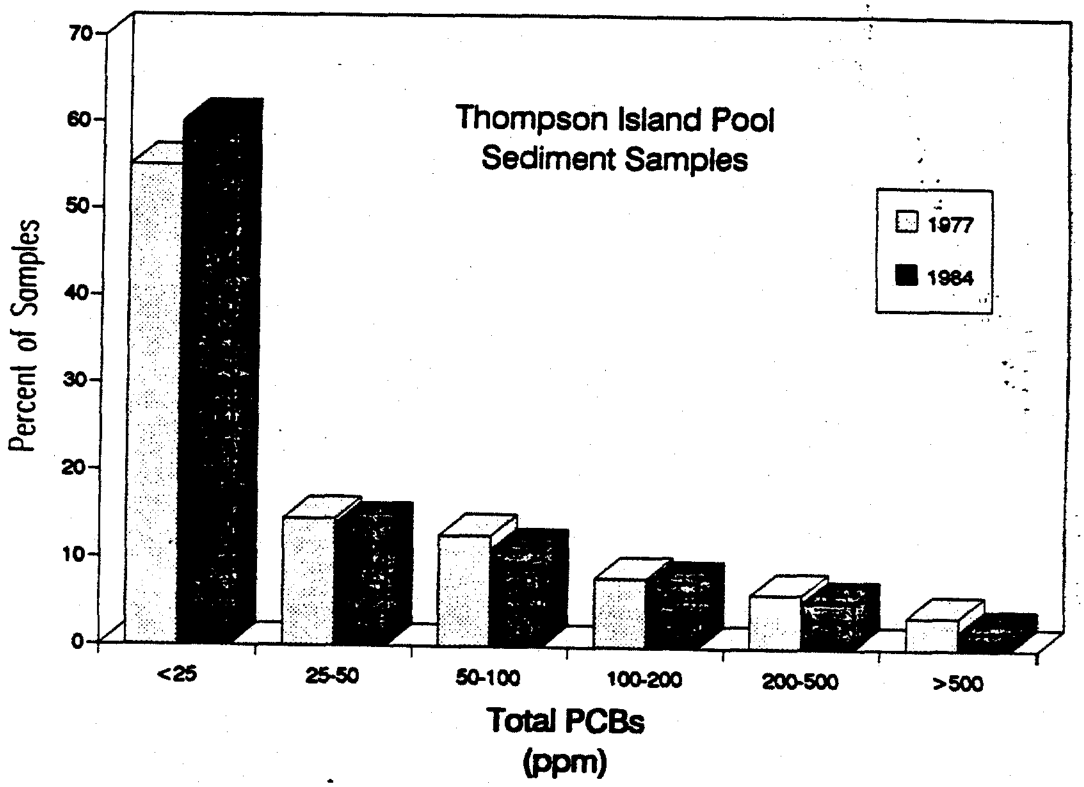
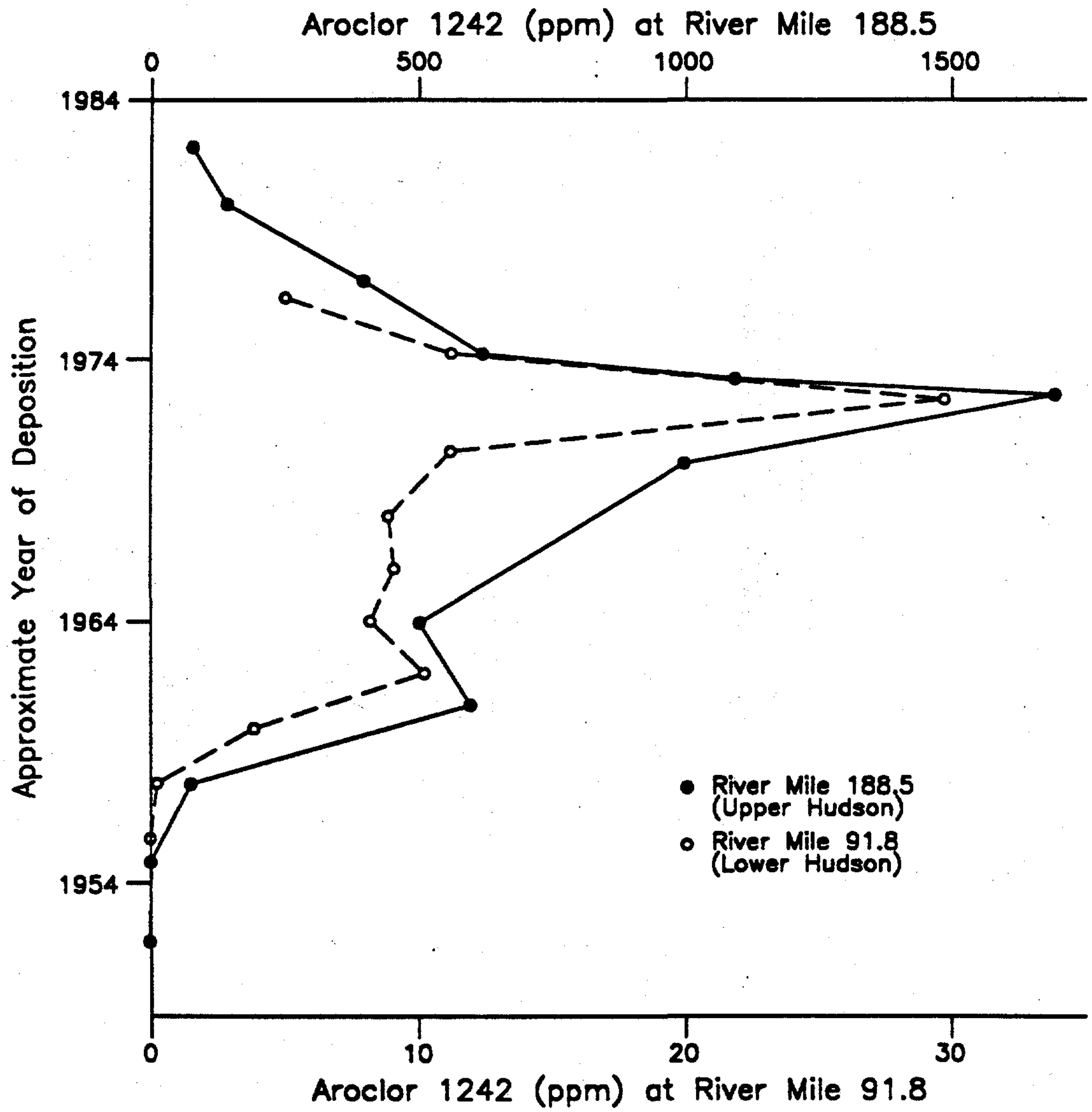


Figure B.3–6

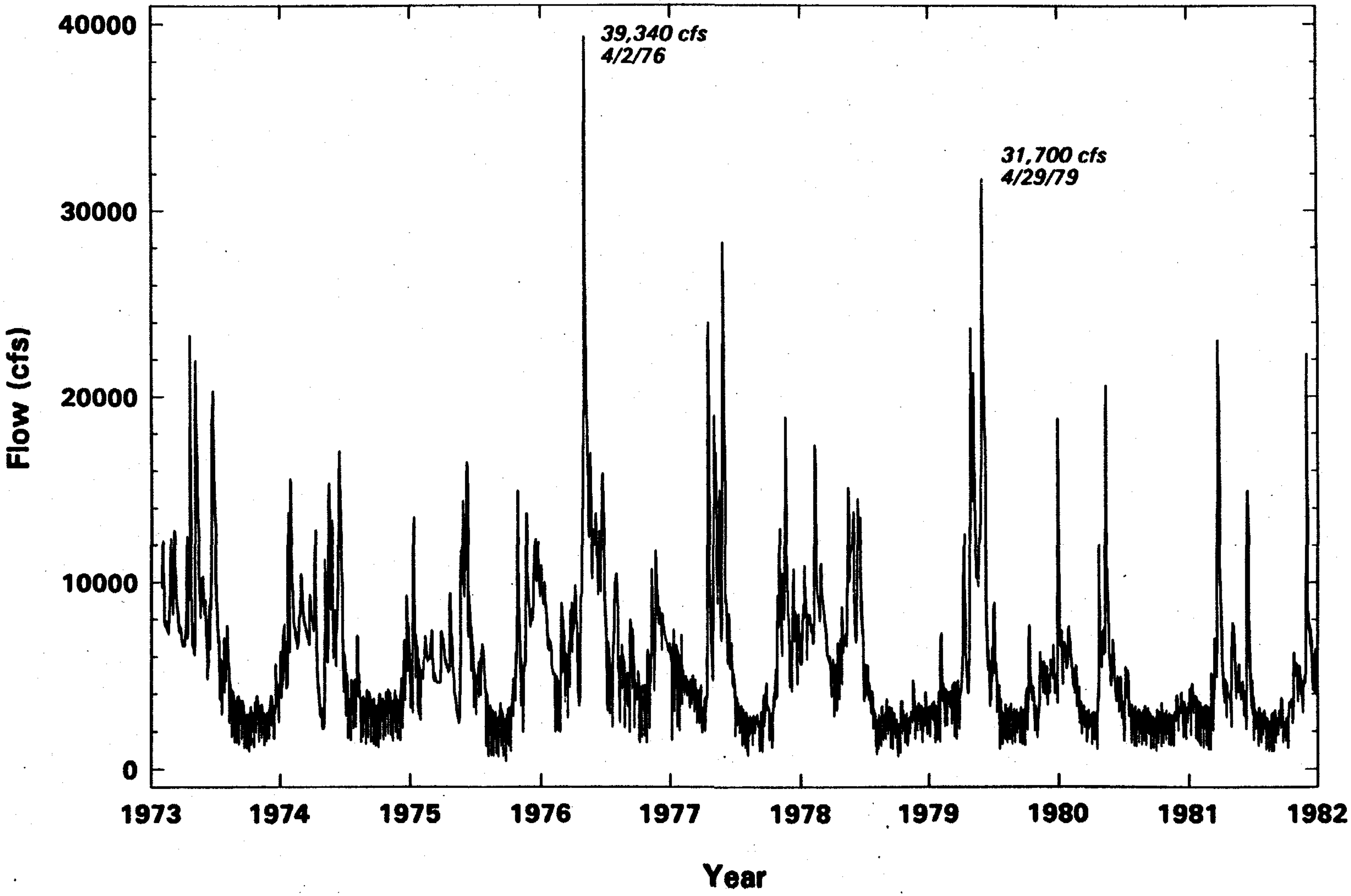
Correlation of Sediment Aroclor 1242 Levels in Upper and Lower Hudson Sediment Cores



Source: Bopp et al. (1985).

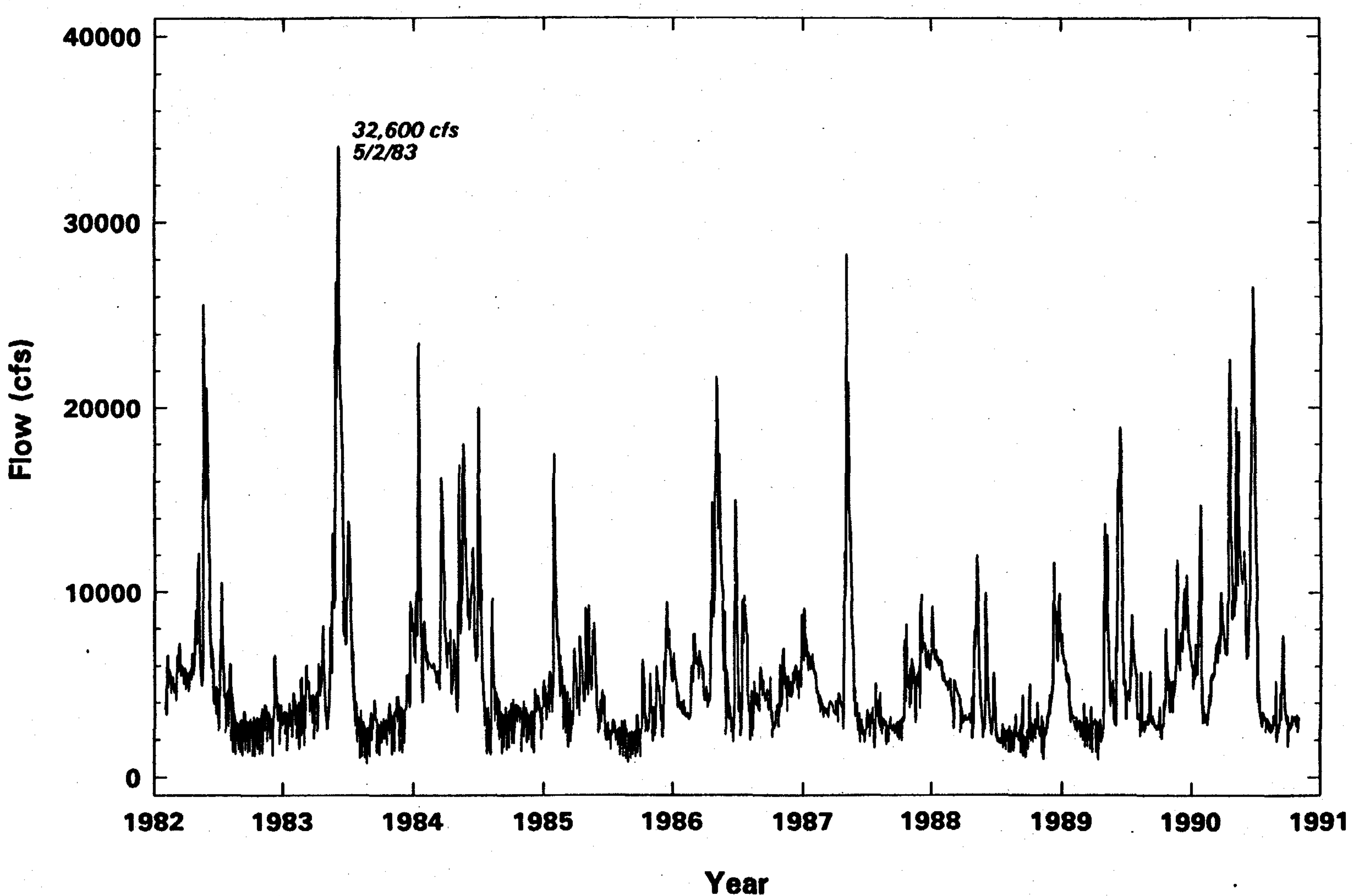
Figure B.3-7a

Upper Hudson Daily Average Flows, 1973-1981



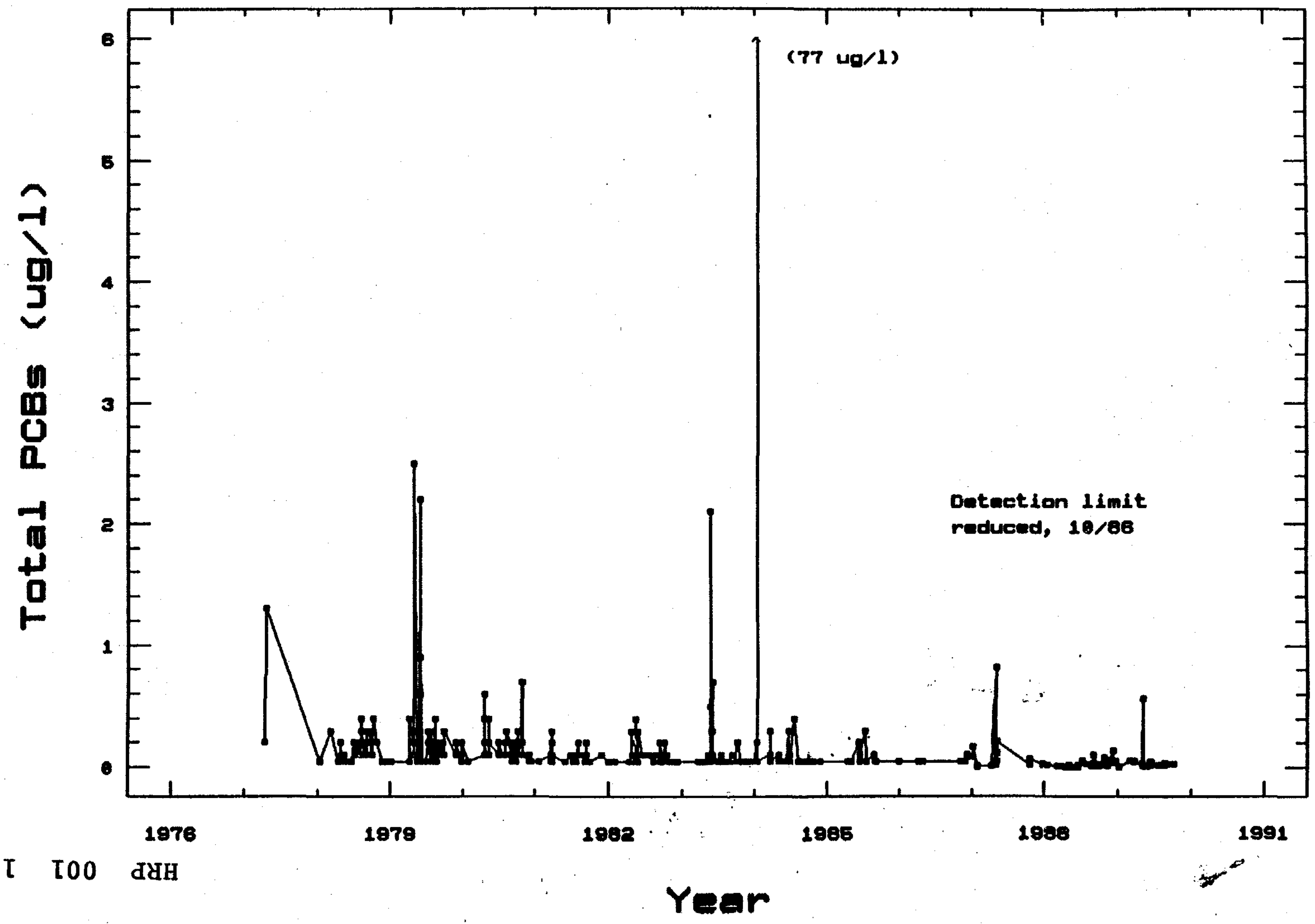
Source: USGS Monitoring ; 1973-1976 below Sacandaga River; 1977-1981 at Fort Edward.

Figure B.3-7b
Upper Hudson Daily Average Flow, 1982-1990



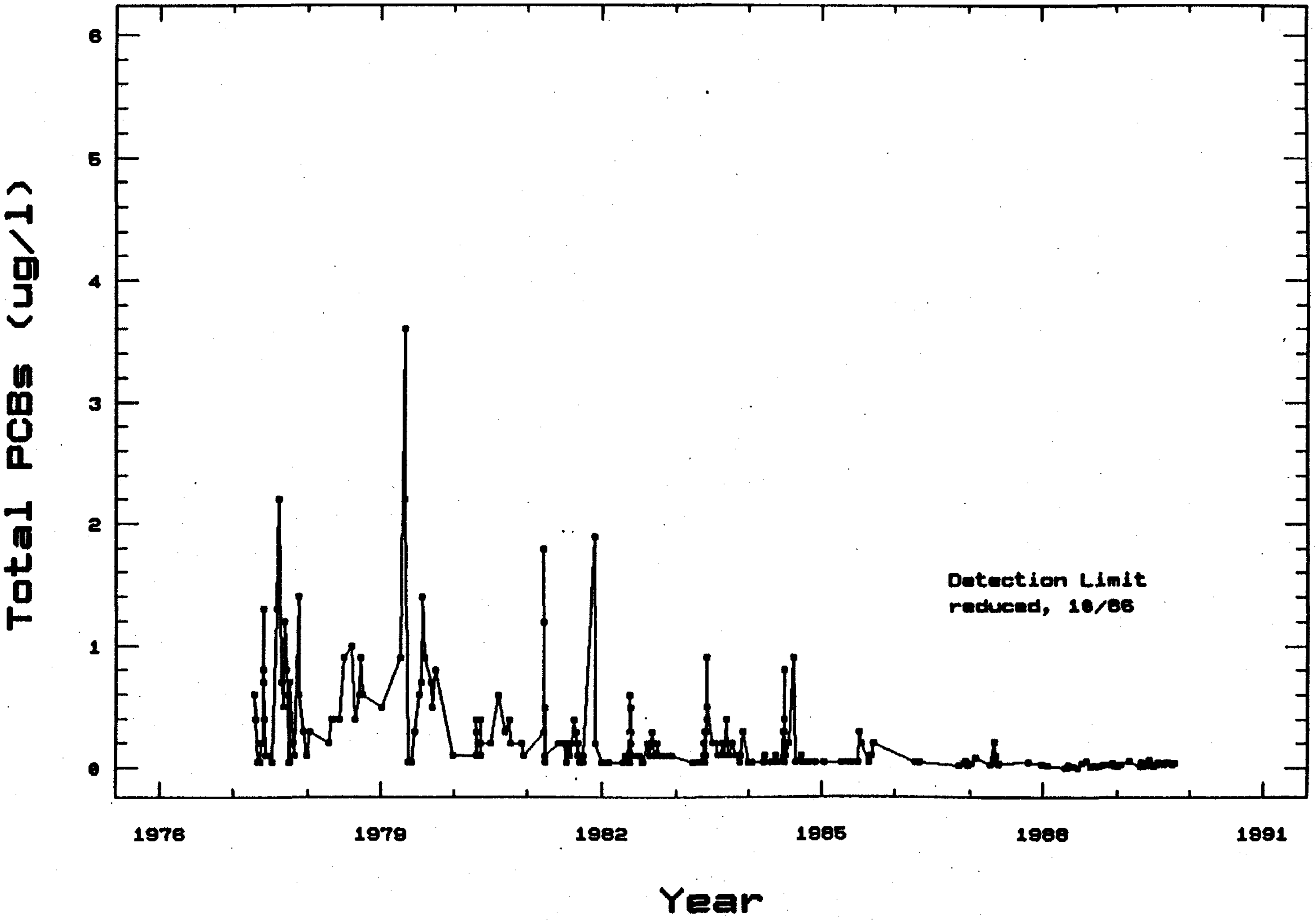
Source: USGS Monitoring at Fort Edward.

Figure B.3-8
Total PCBs in Water Column: Fort Edward



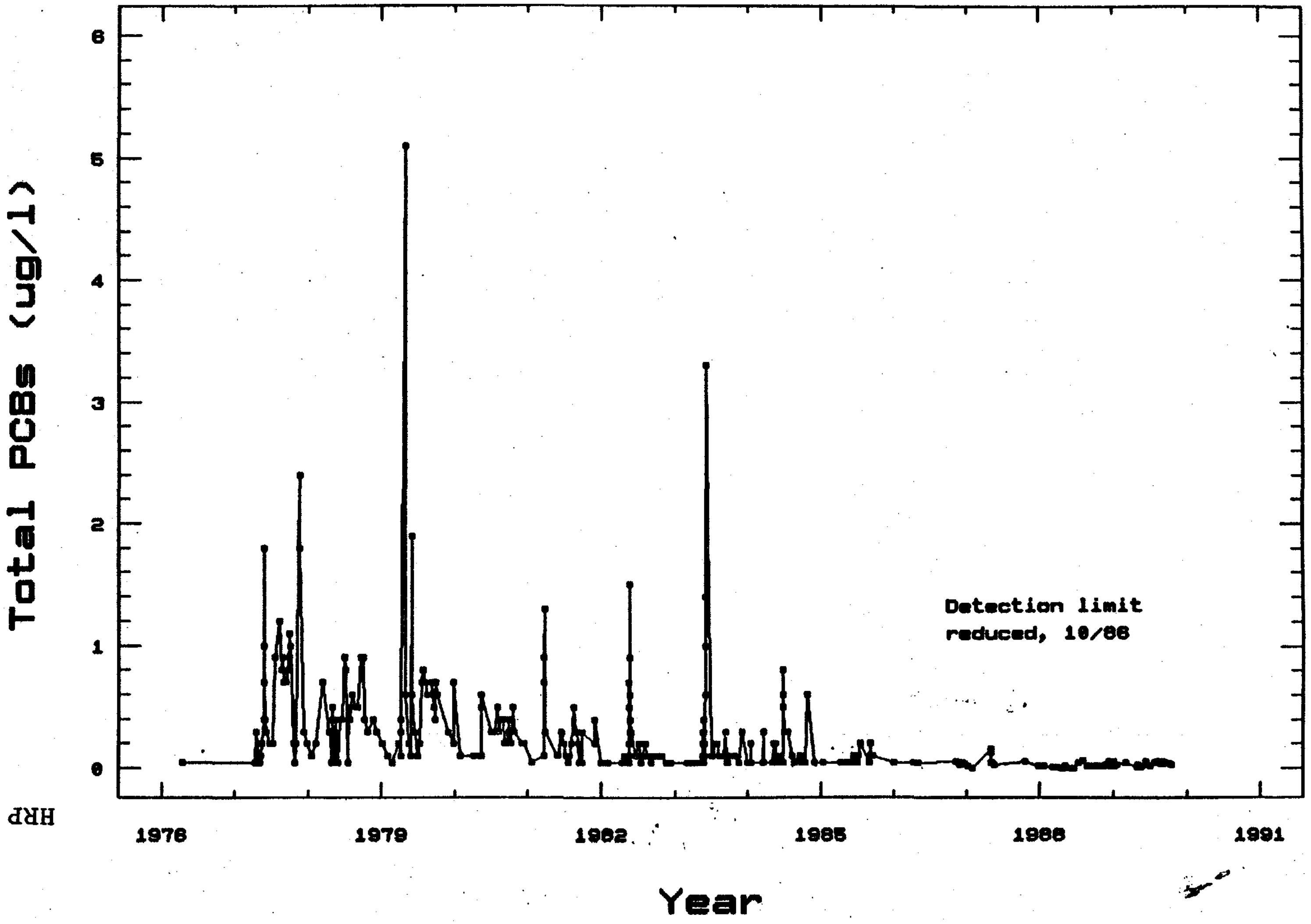
USGS Monitoring

Figure B.3-9
Total PCBs in Water Column: Schuylerville



USGS Monitoring

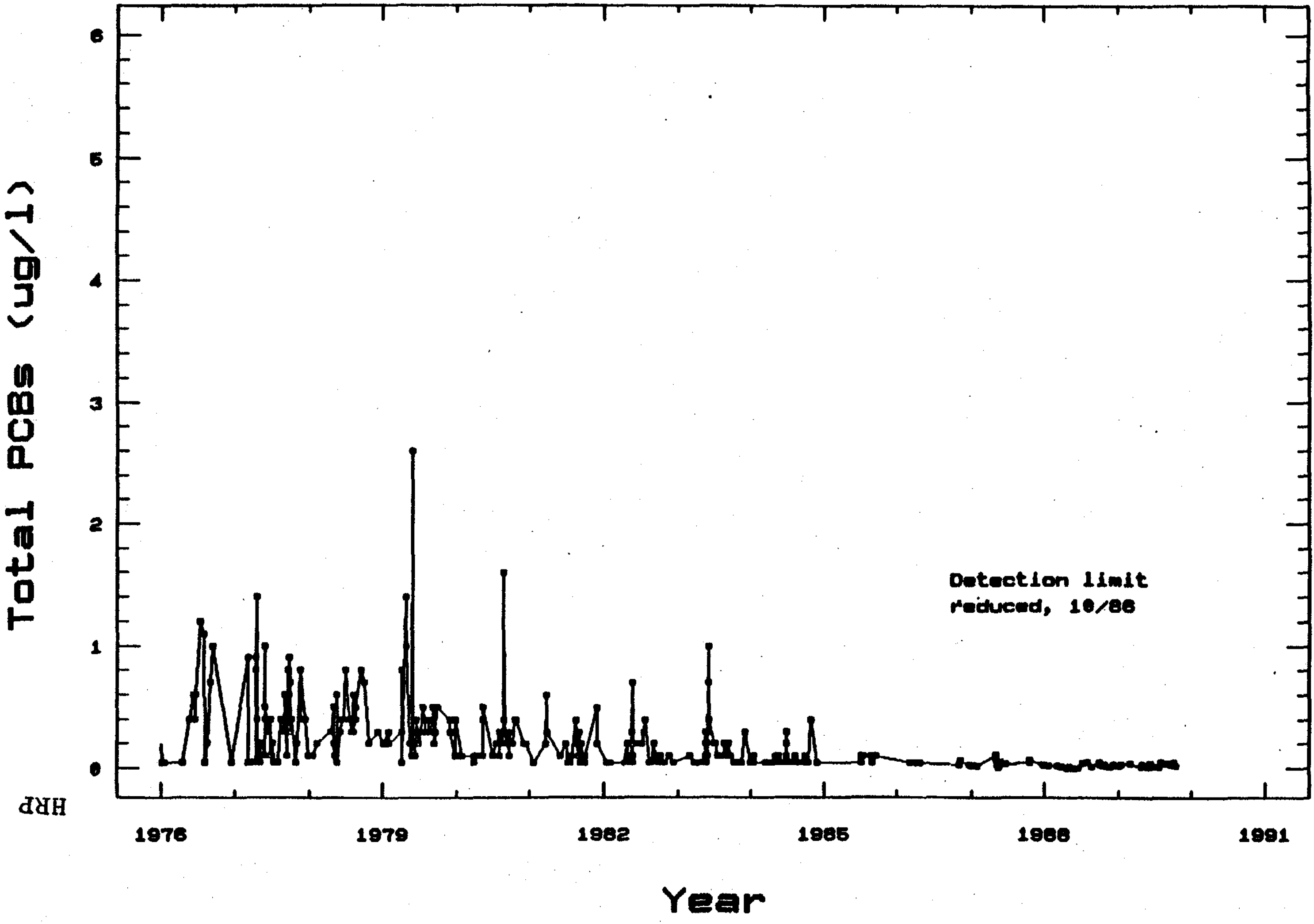
Figure B.3-10
Total PCBs in Water Column: Stillwater



USGS Monitoring

Figure B.3-10

Figure B.3-11
Total PCBs in Water Column: Waterford



USGS Monitoring

Figure B.3-12
Summer (June - September) Average PCB Concentrations in Water

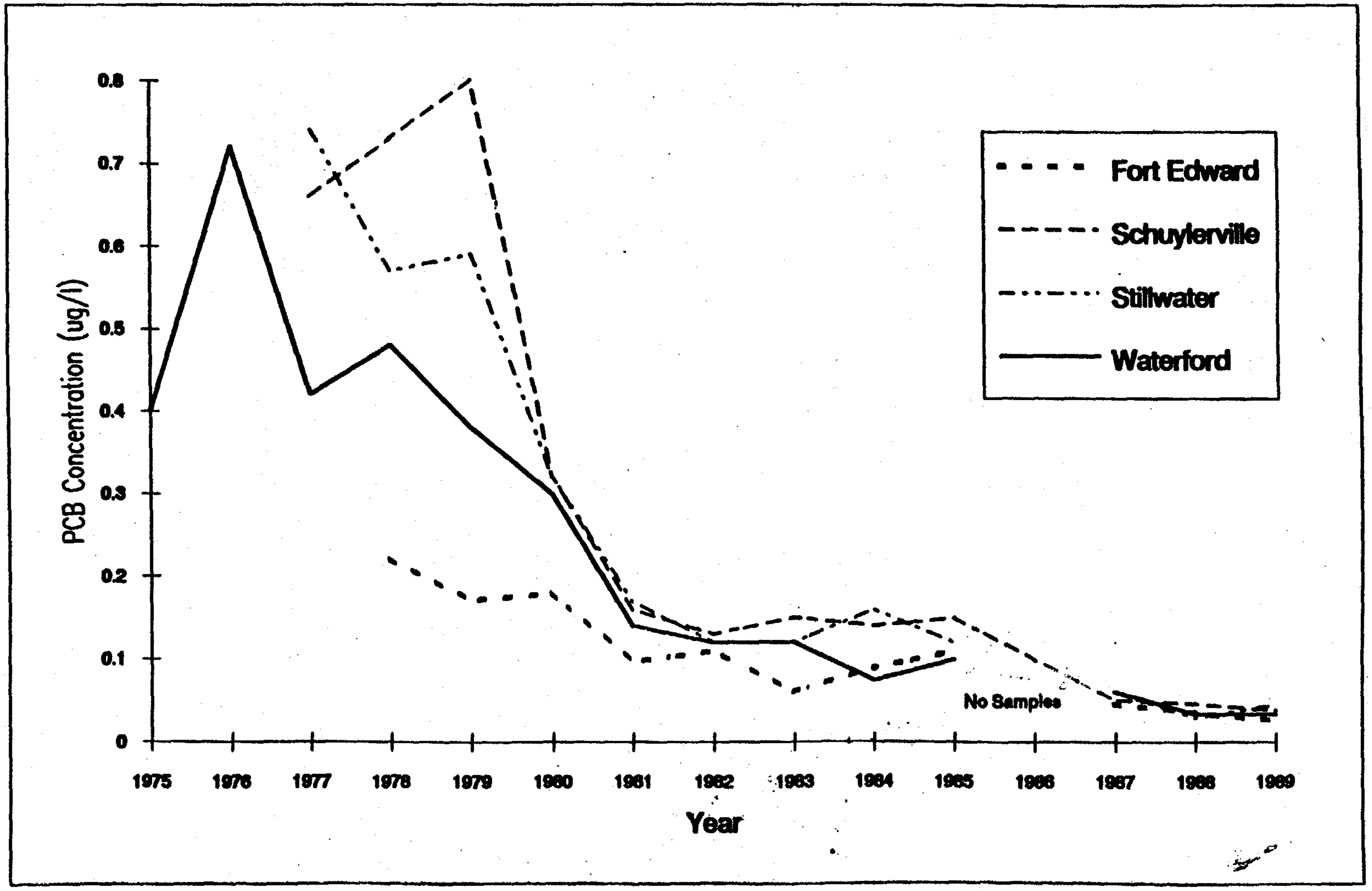


Figure B.3-12

Figure B.3-13
Mean Total PCBs in Brown Bullhead

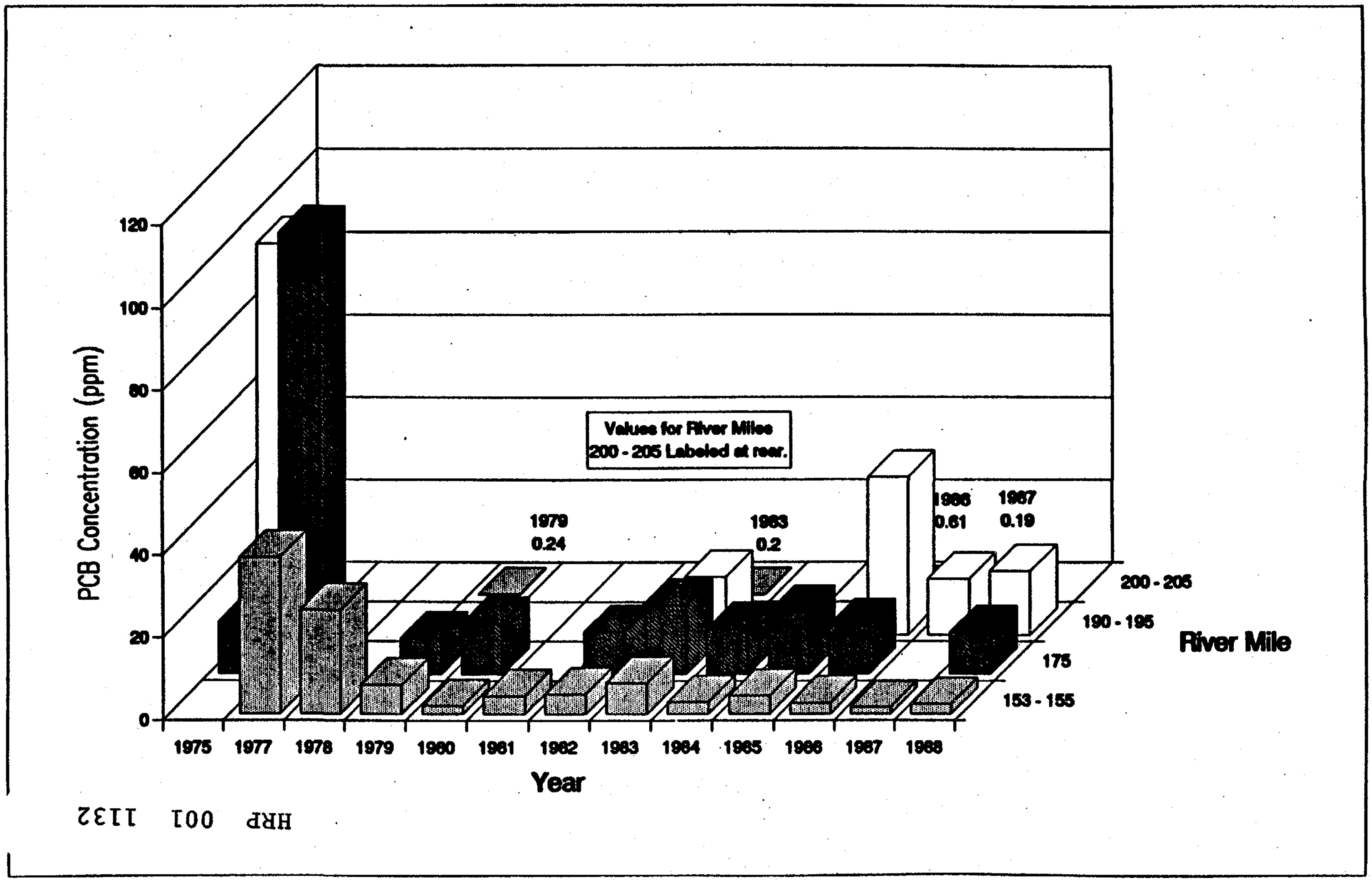
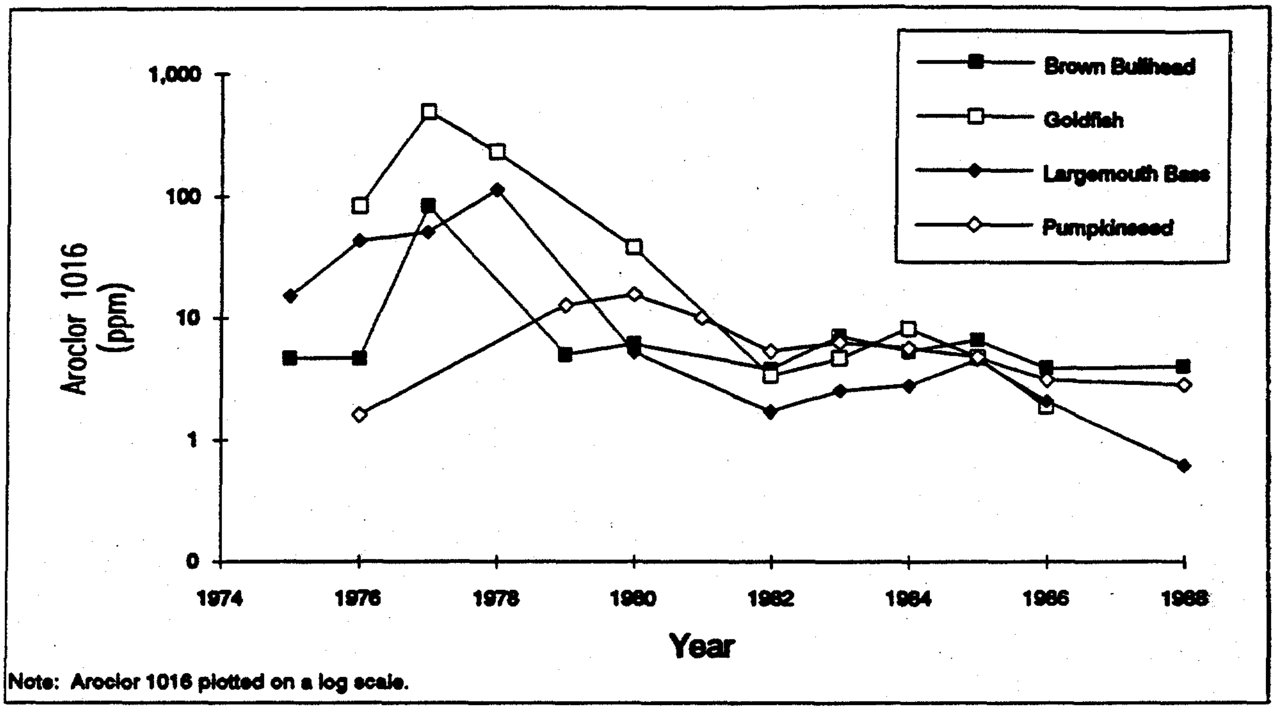


Figure B.3-13

Figure B.3-14
Mean Aroclor Trends in Fish
(River Mile 175)



Note: Aroclor 1016 plotted on a log scale.

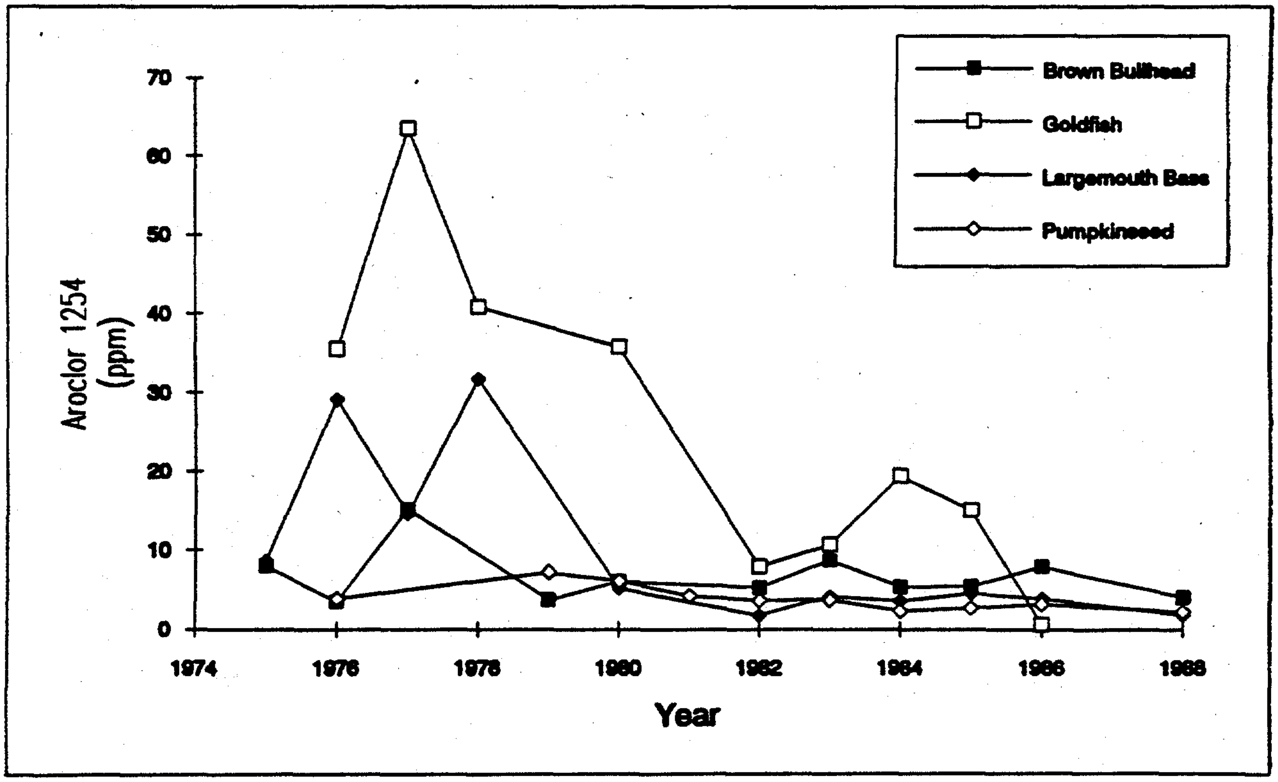


Figure B.3-15
Trends in Mean Lipid-Based Aroclor Levels in Fish
(River Mile 175)

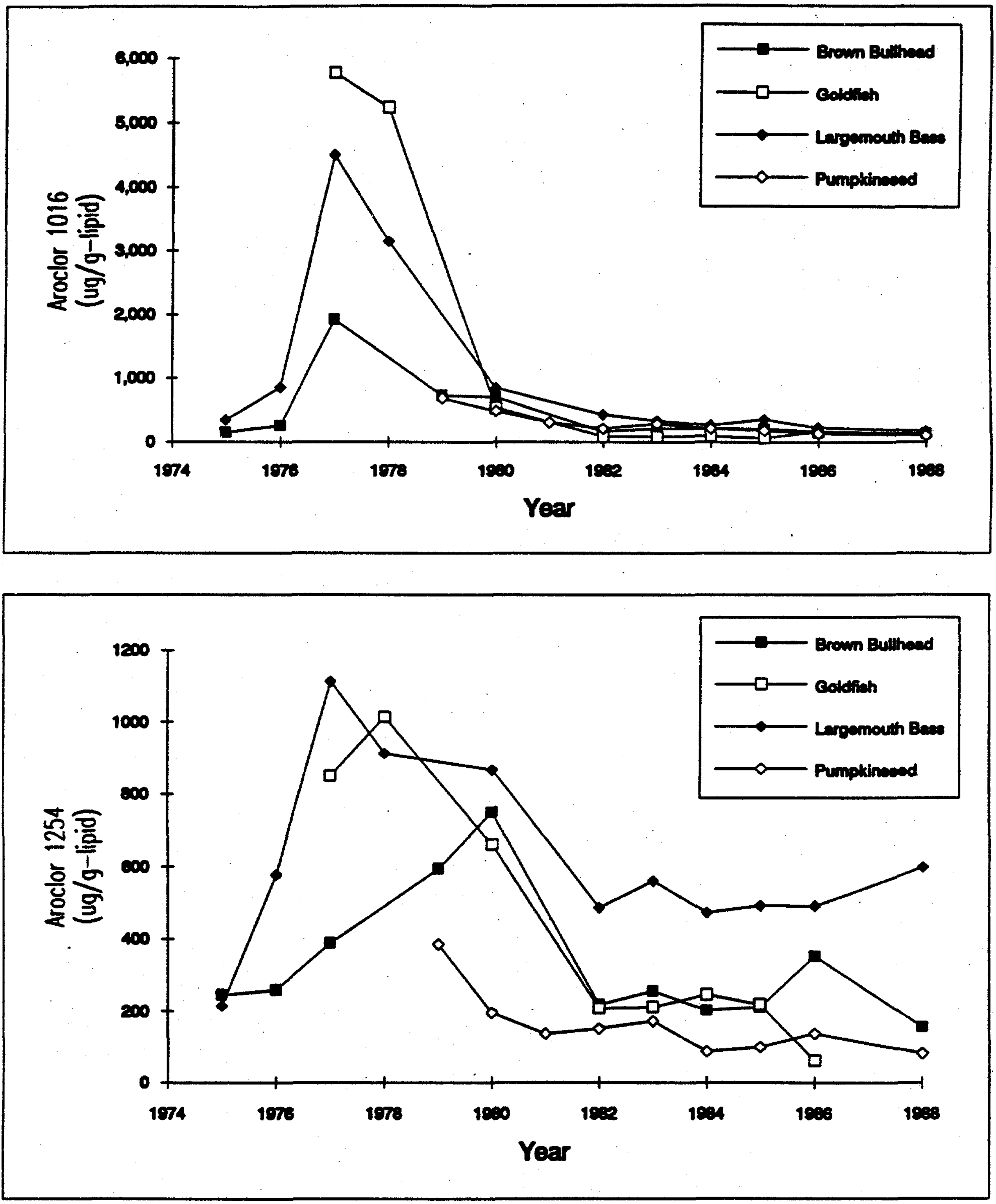
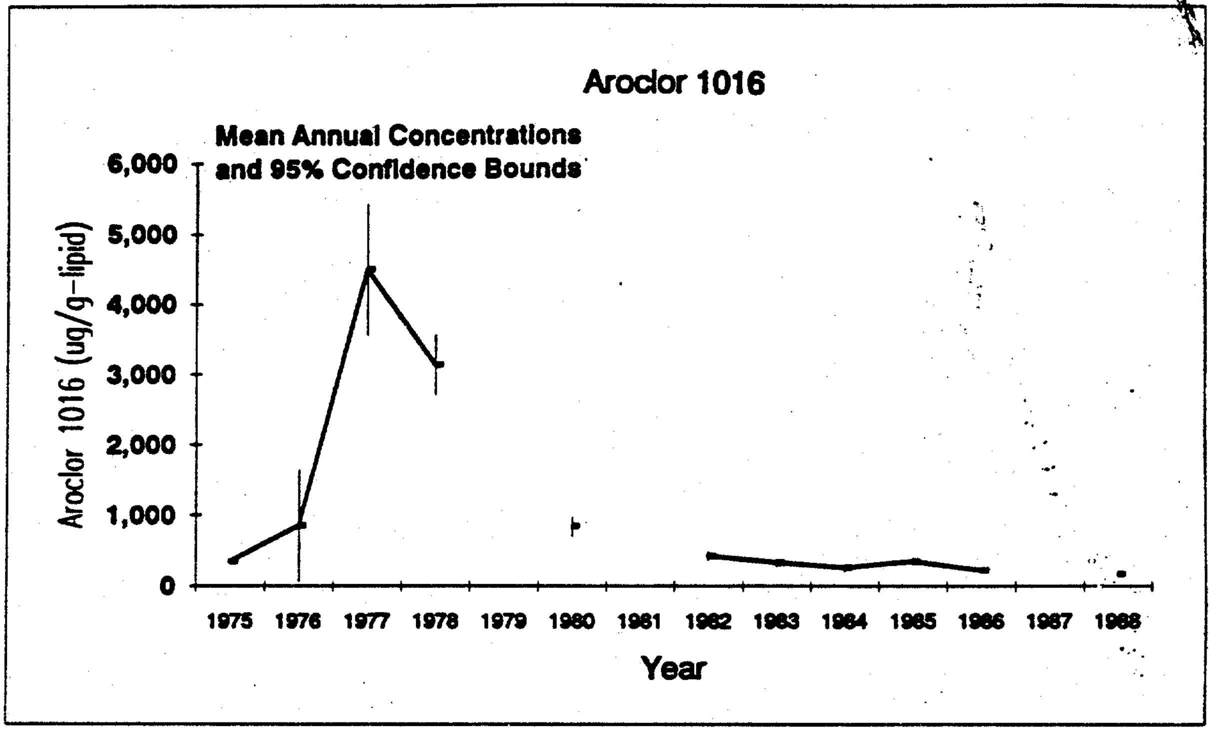


Figure B.3-16
Lipid-Based Aroclor Trends: Largemouth Bass
River Mile 175



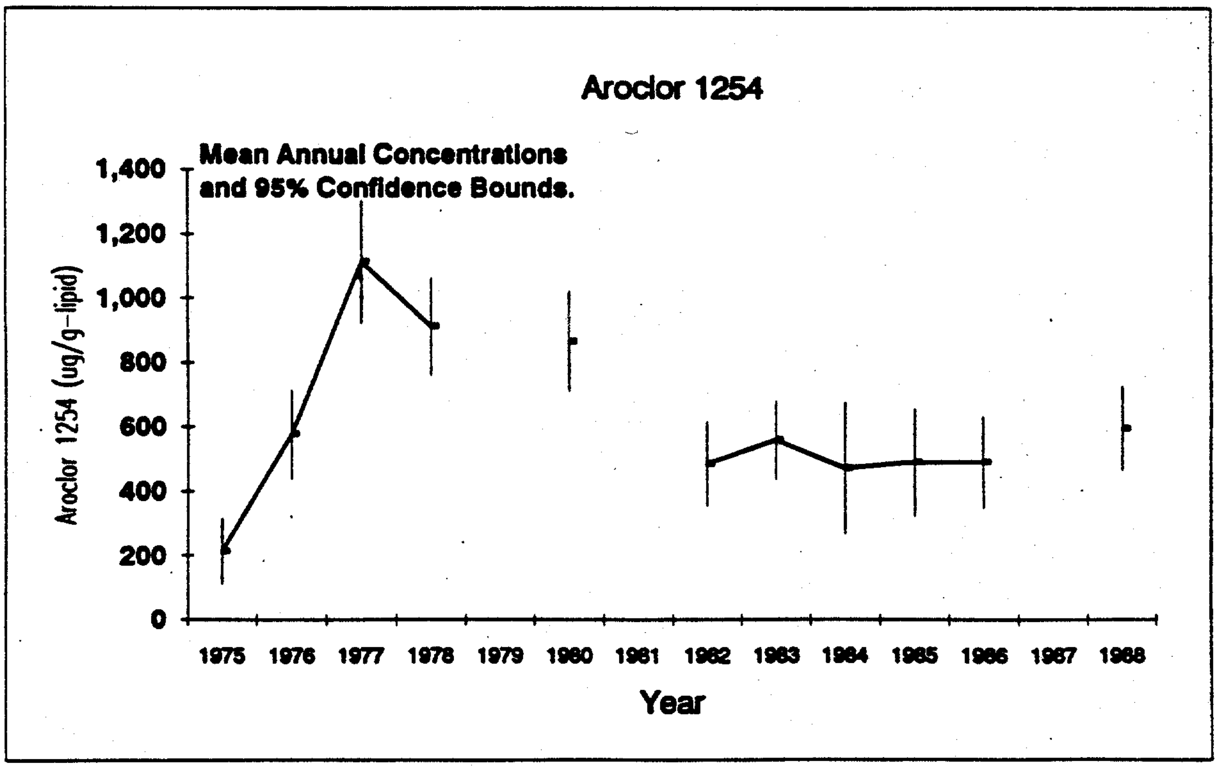
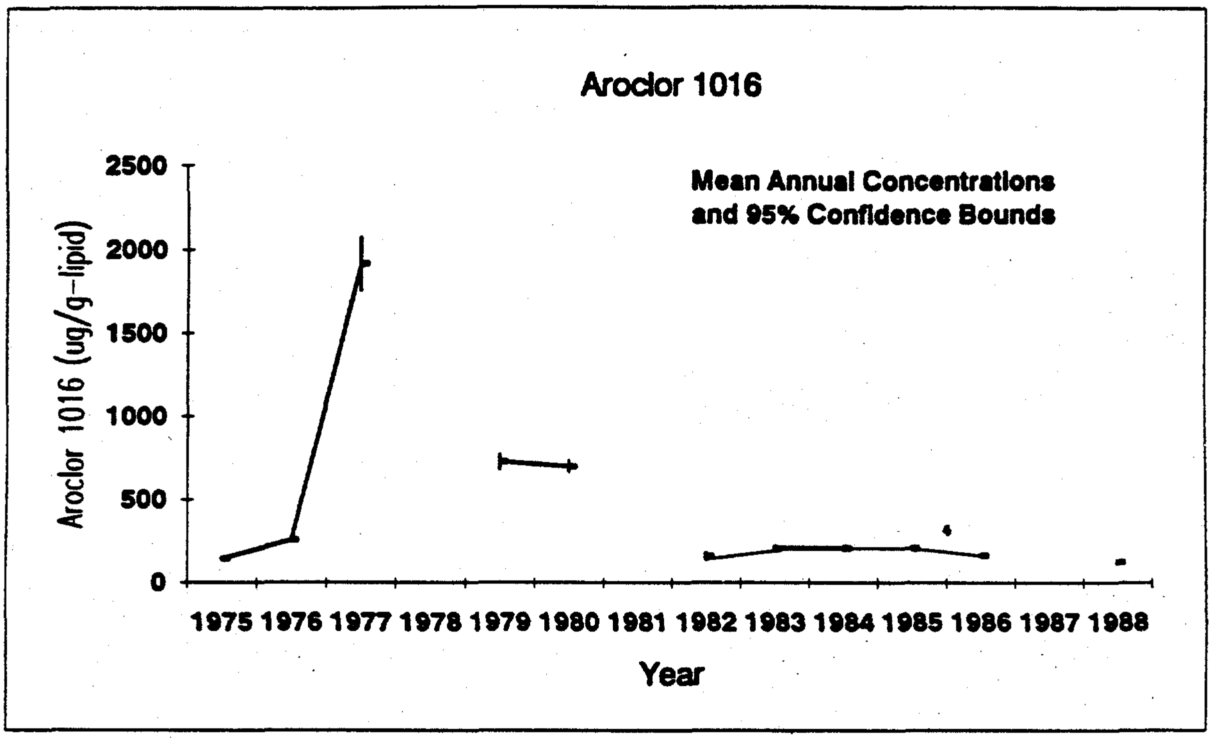


Figure B.3-17

Lipid-Based Aroclor Trends: Brown Bullhead

River Mile 153



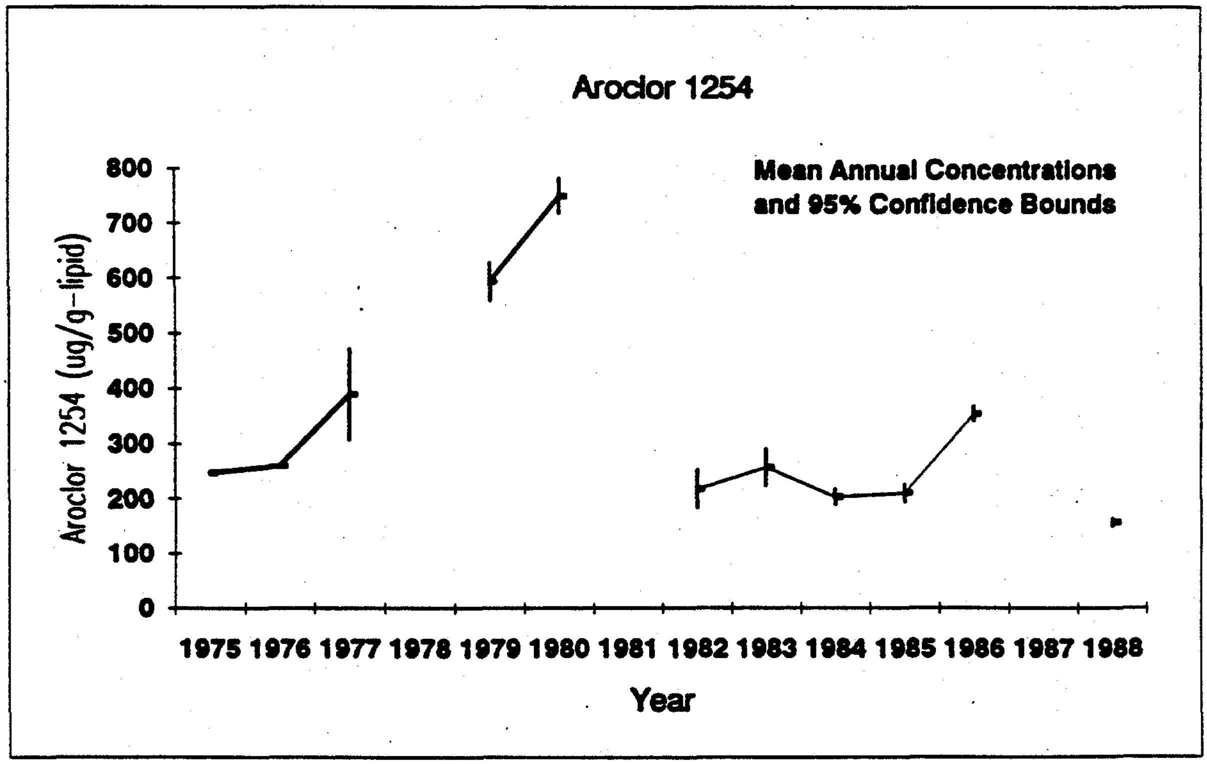
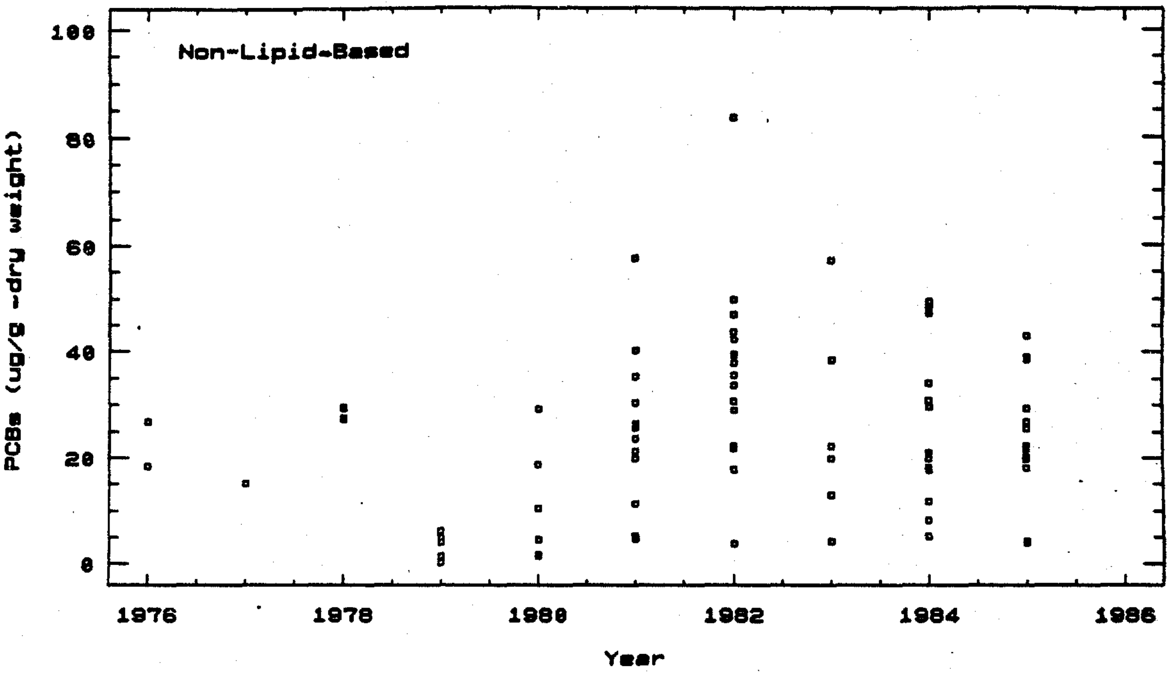


Figure B.3-18
Total PCBs in Multiplate/Caddisfly
Fort Miller



Total PCBs in Multiplate/Caddisfly
Fort Miller

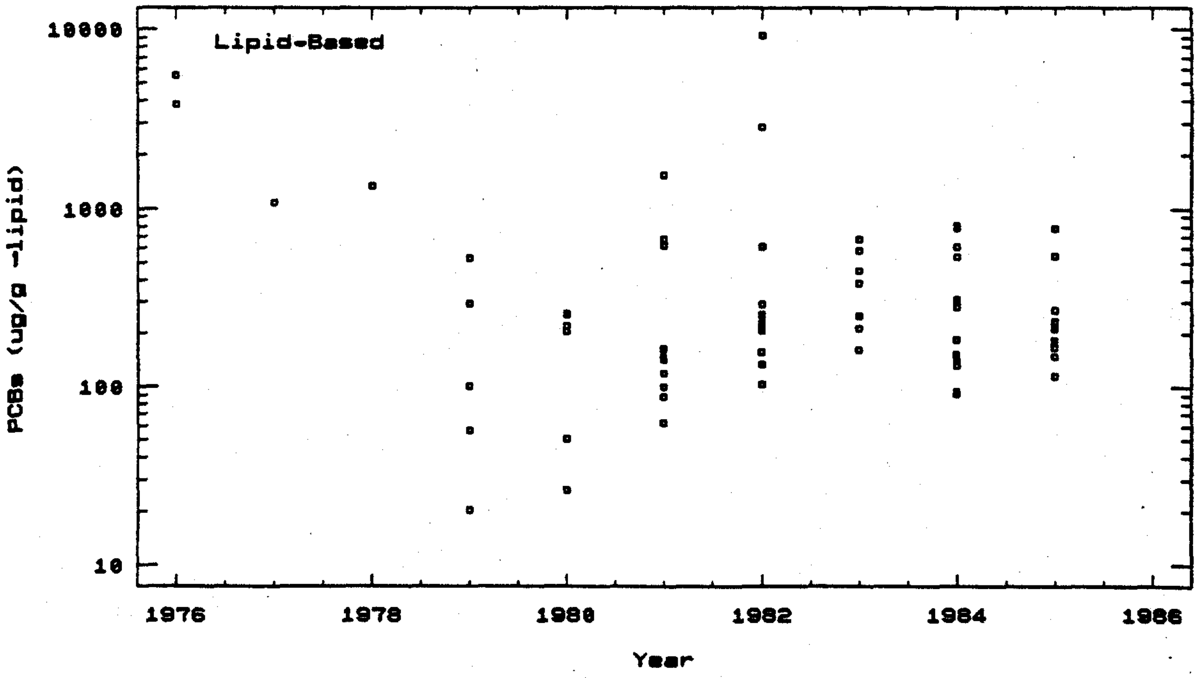
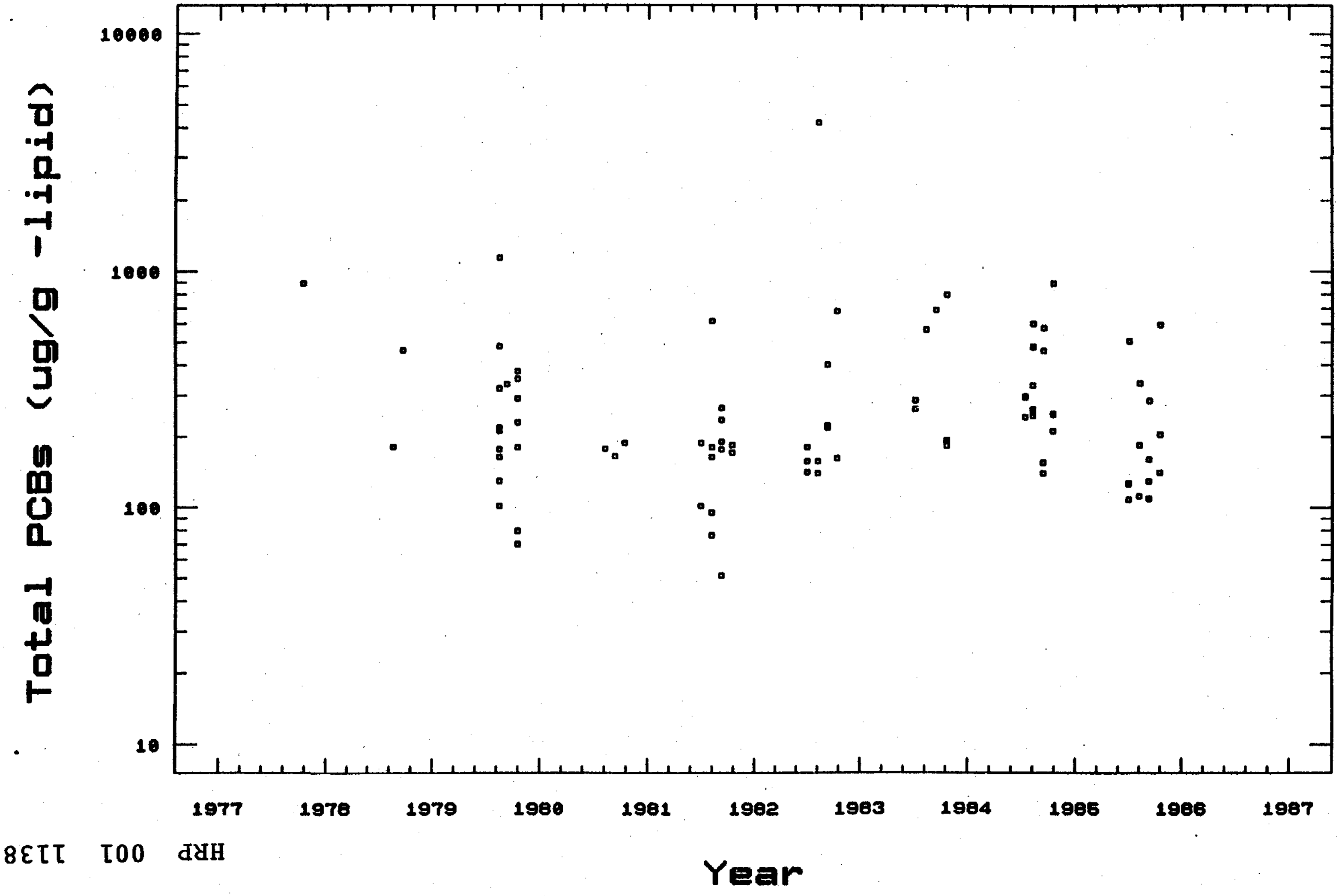


Figure B.3-18

Figure B.3-19
Total PCBs in Multiplate/Caddisfly Data
PCB-7, Stillwater



Lipid-Basis Total PCBs

Figure B.3-20
PCBs in Multiplate/Caddisfly, All Stns.

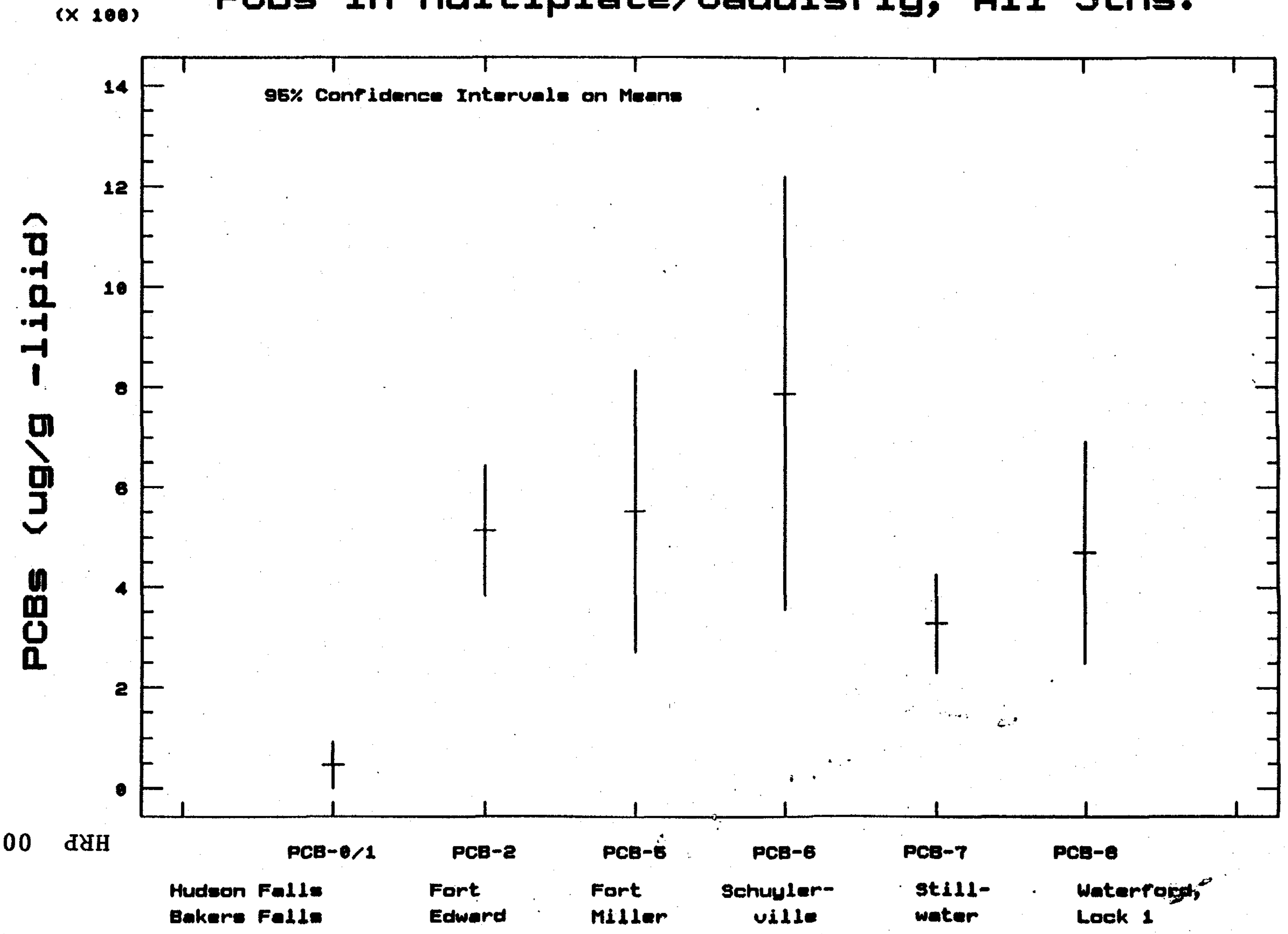
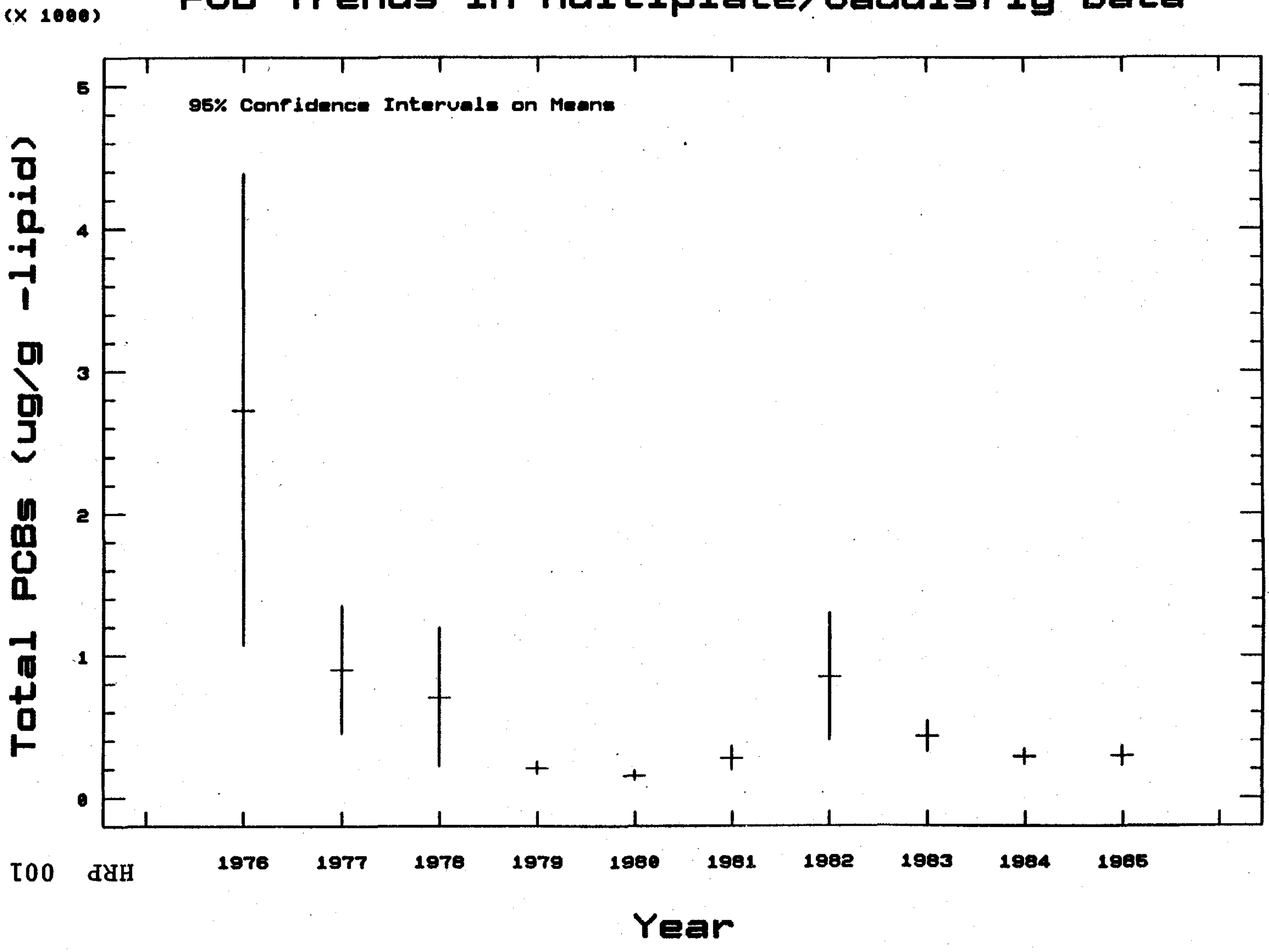


Figure B.3-21

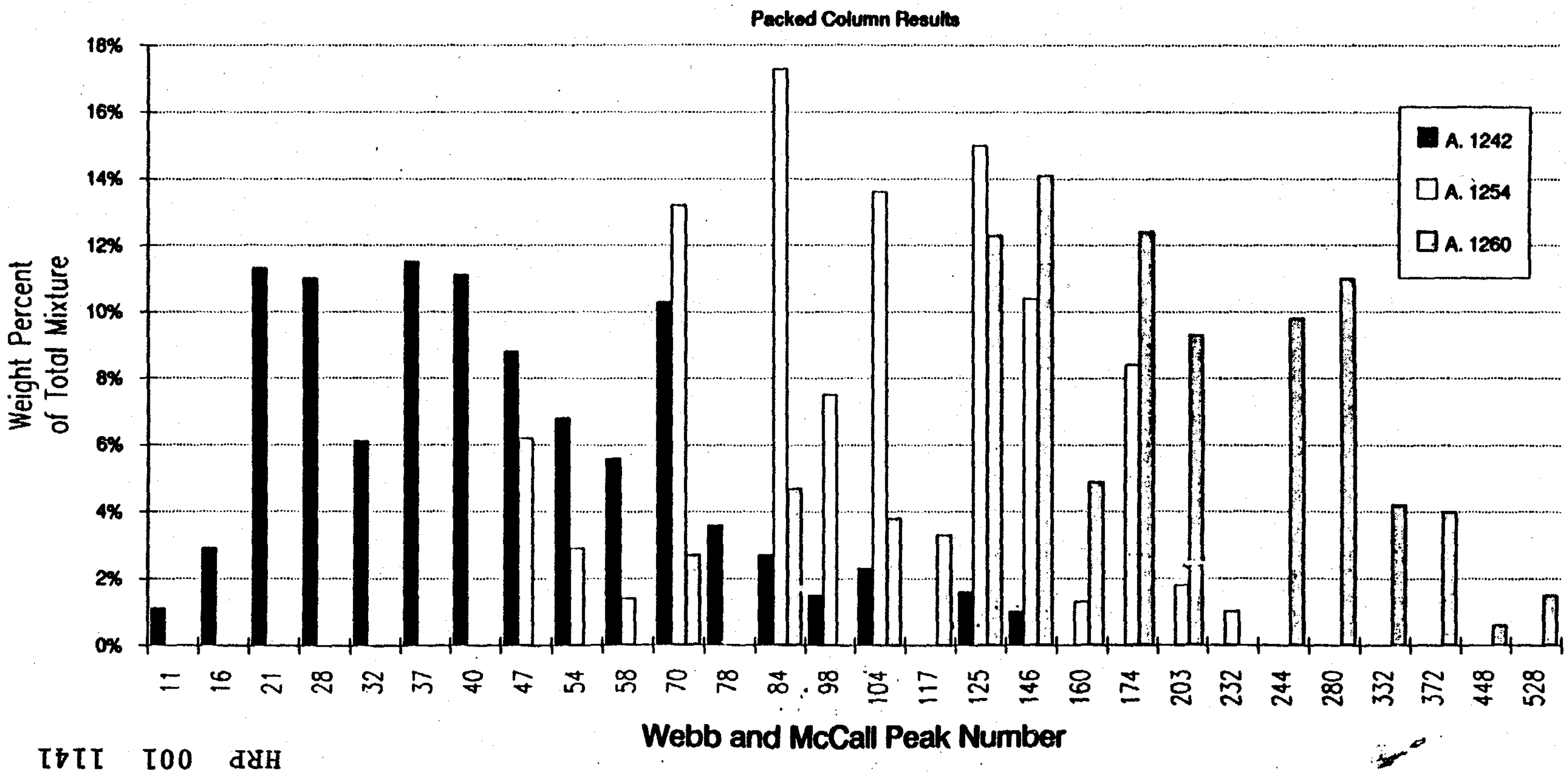
PCB Trends in Multiplate/Caddisfly Data



Lipid-Basis Total PCBs

Figure B.3-21

Figure B.3-22
Gas Chromatogram Peaks for Three Aroclor Standards



Source: Webb and McCall (1973).

Figure B.4.1
Conceptual Reassessment Framework

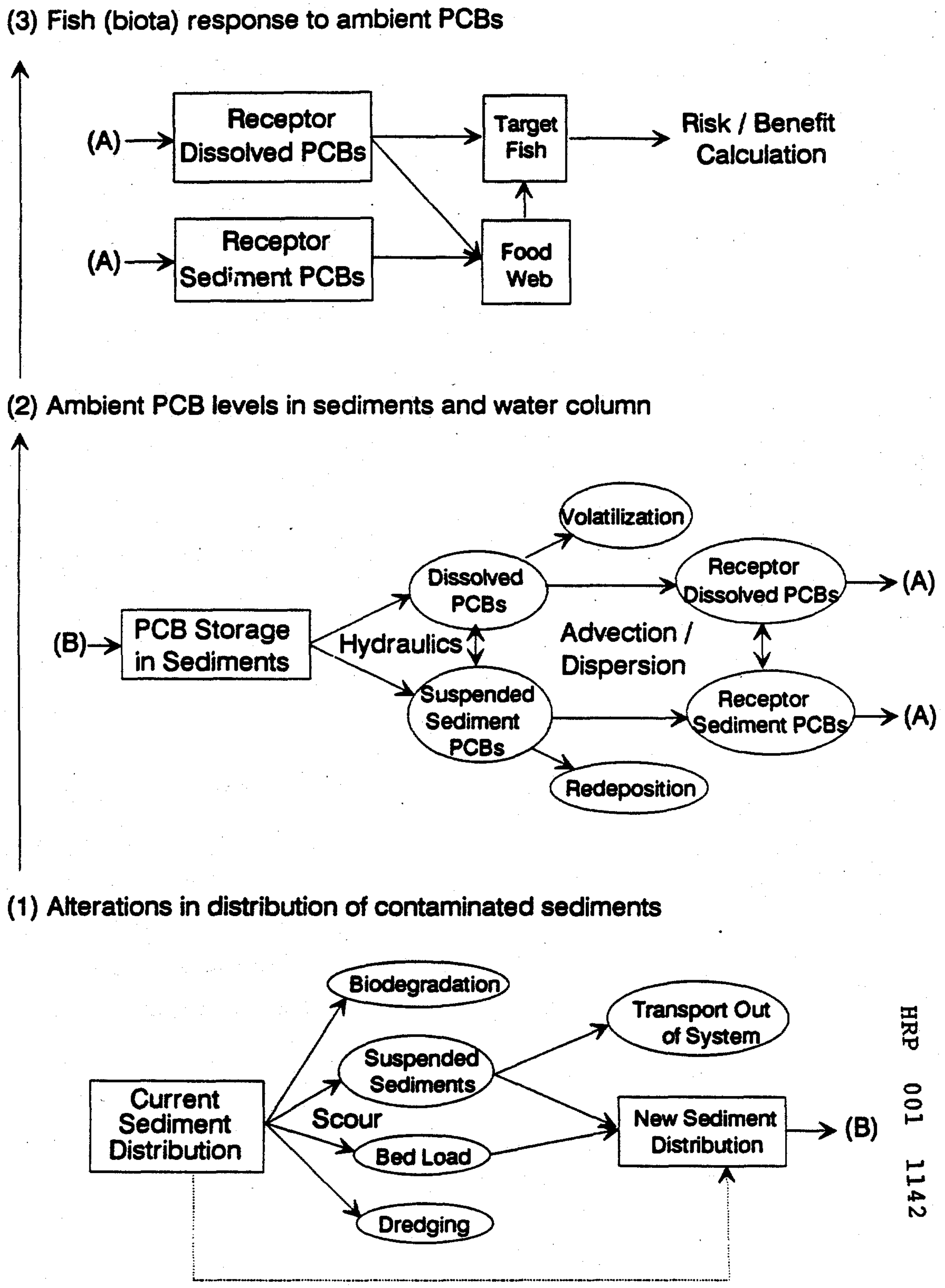


Figure B.4-2
Upper Hudson Flow Duration Curve

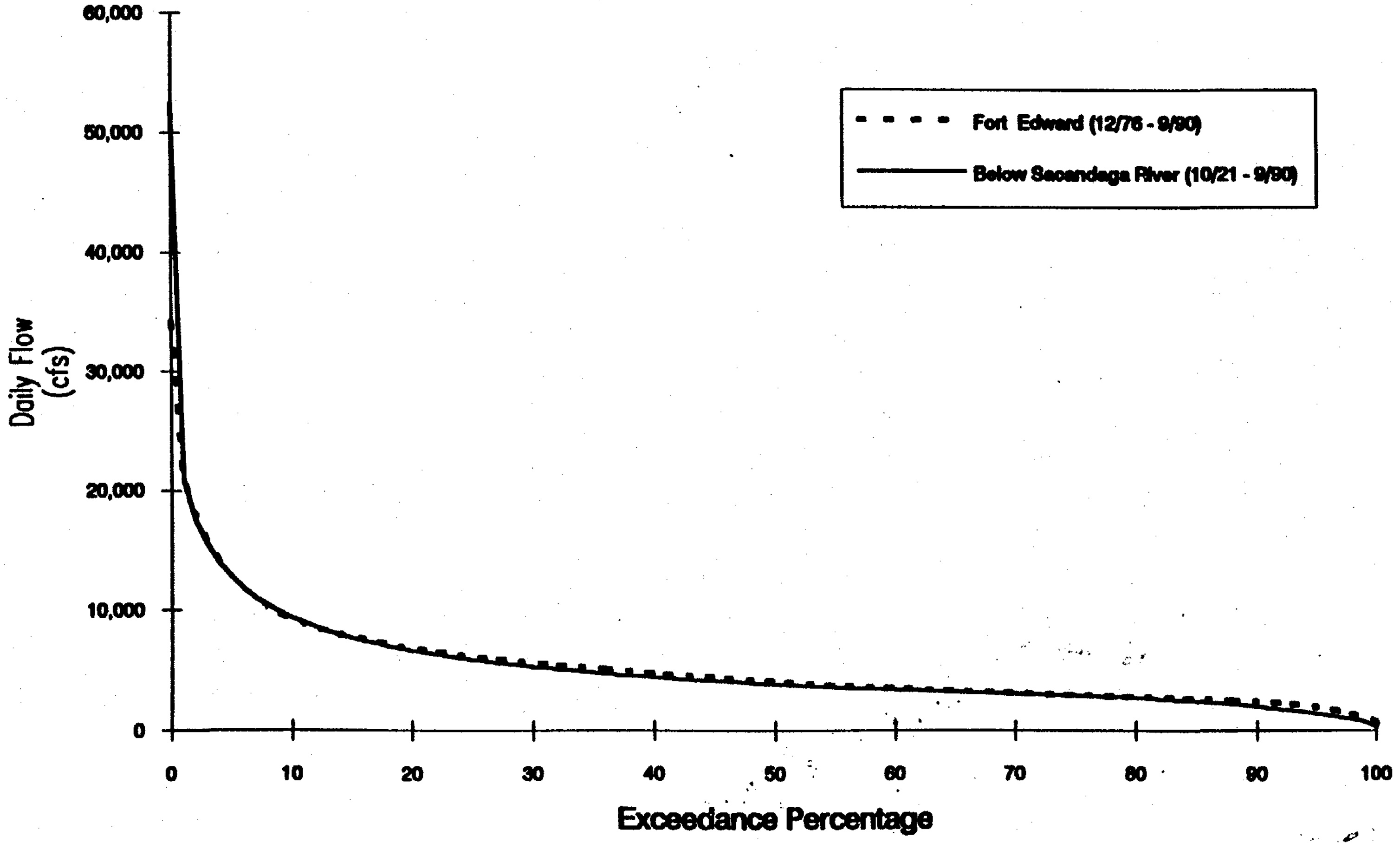
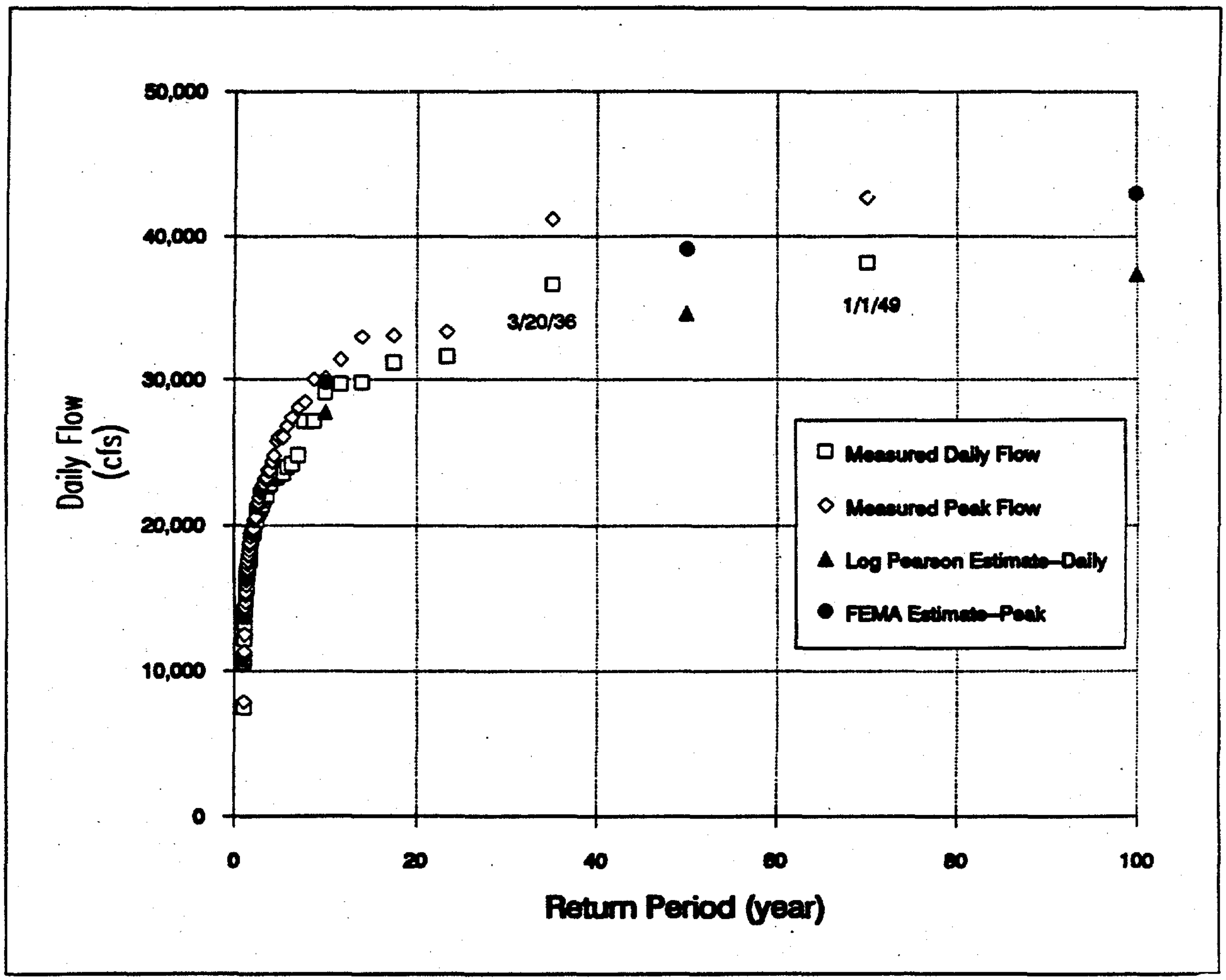


Figure B.4-2

Figure B.4-3a
Comparison of Estimated and
Measured Flows at Hadley



NOTE: Excludes 49,000 cfs reported in published file for 3/27 in 1913.

Figure B.4-3b
Annual Maximum Daily Flows Below Sacandaga River

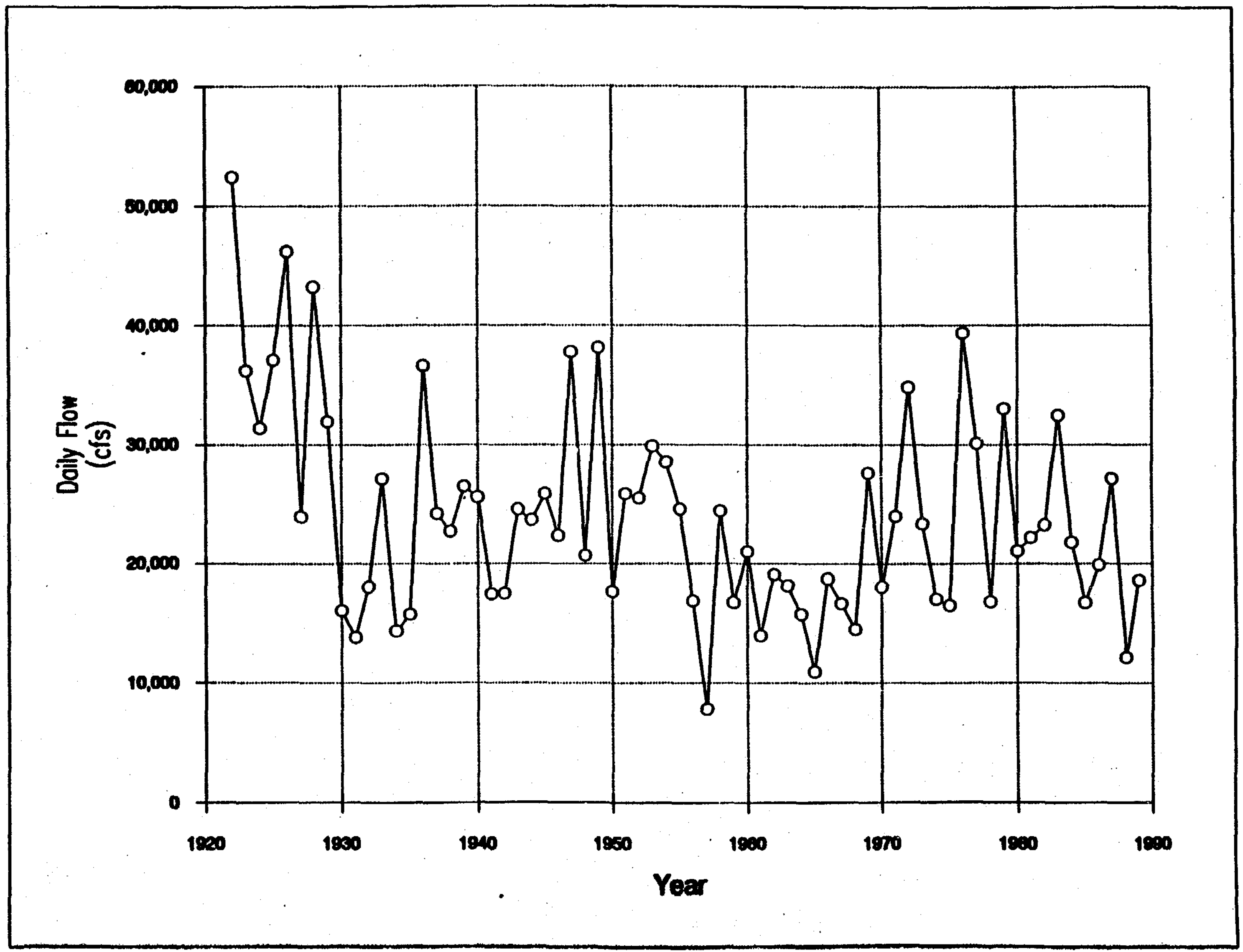


Figure B.4-3b

Figure B.4-4

Suspended Sediment Rating Curve

Fort Edward at Rogers Island, 1975-1989

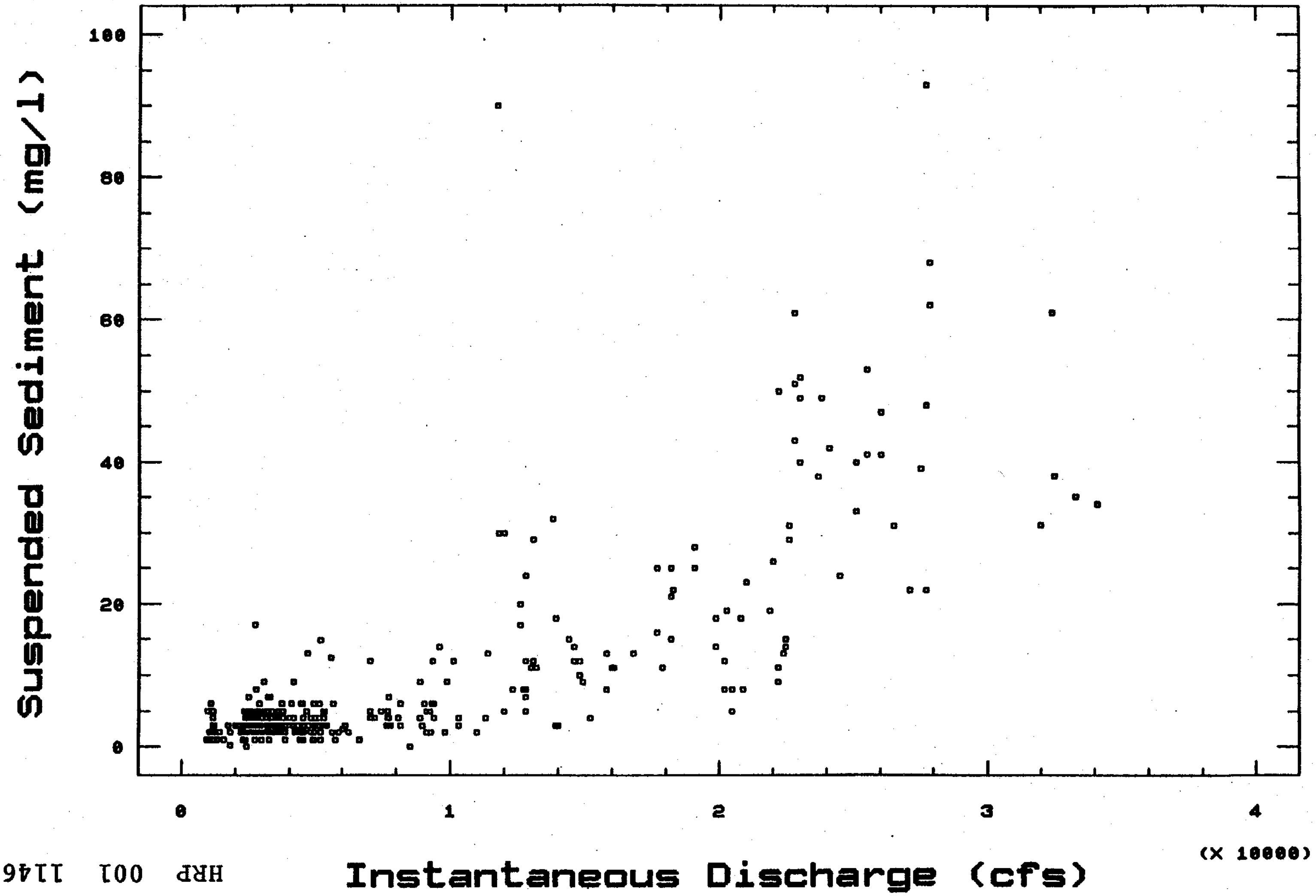


Figure B.4-5
Suspended Sediment Rating Curve
Hudson River at Schuylerville

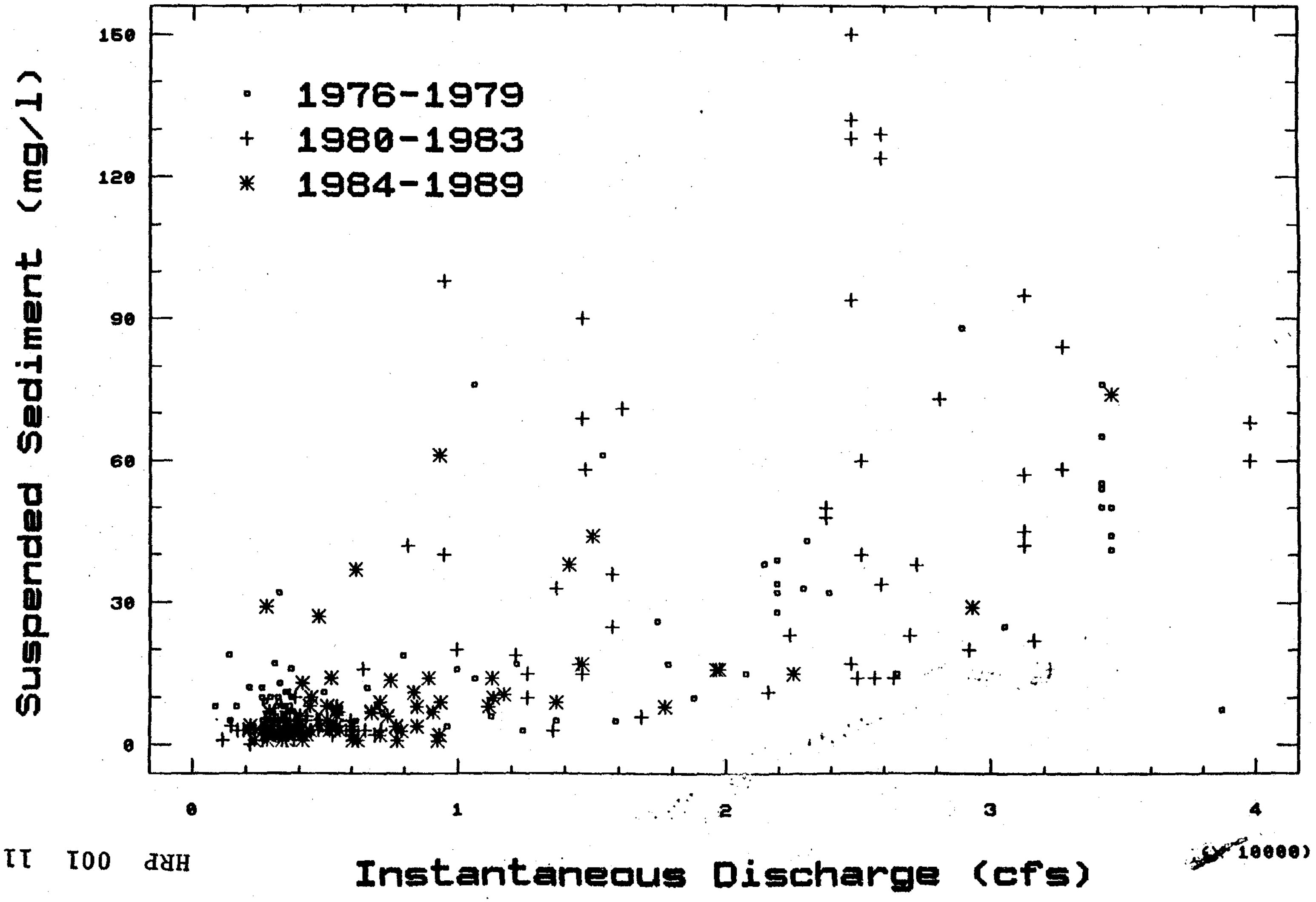


Figure B.4-6
Suspended Sediment Rating Curve
Hudson River at Stillwater

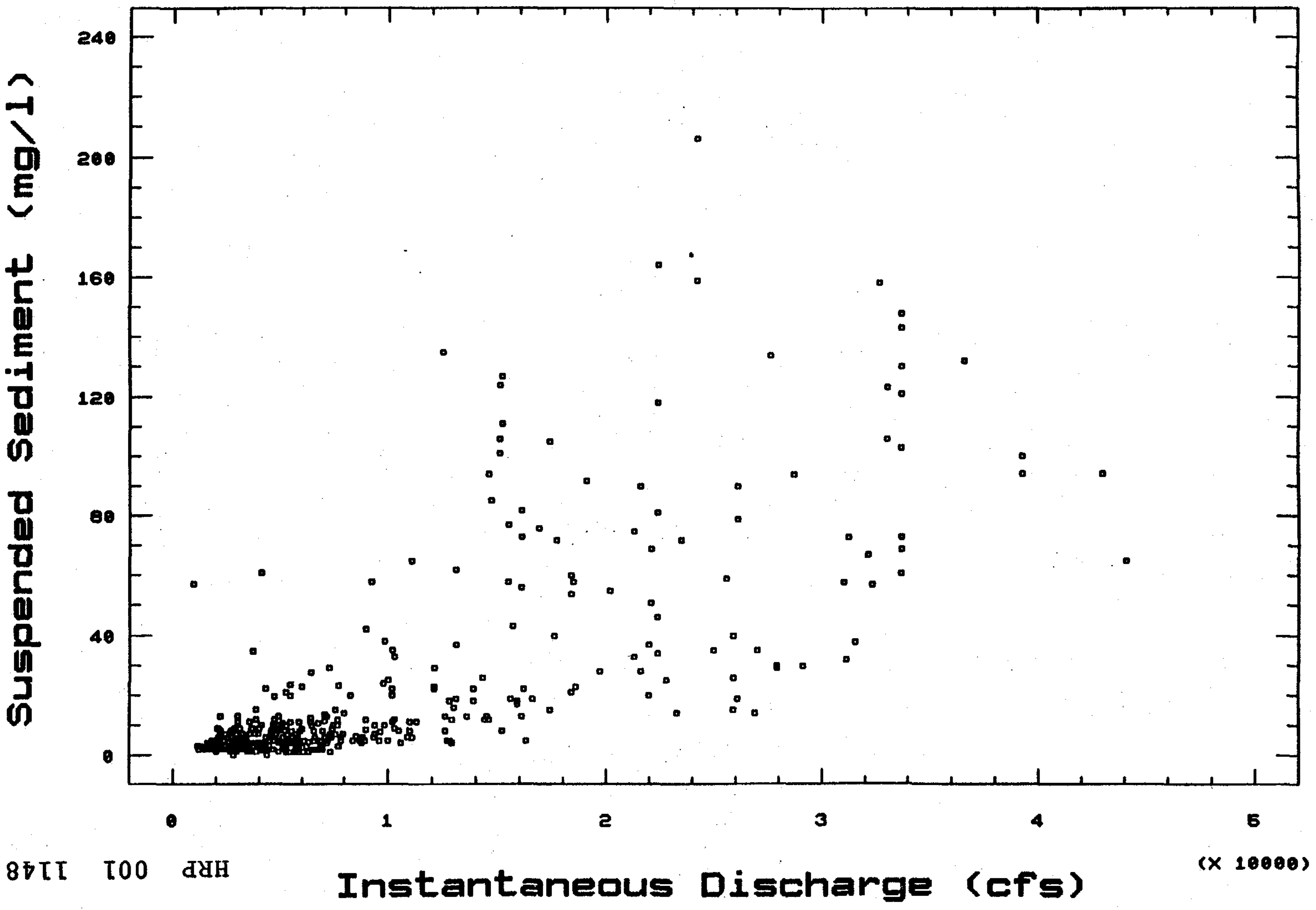


Figure B.4-7
Suspended Sediment Rating Curve
Hudson River at Waterford

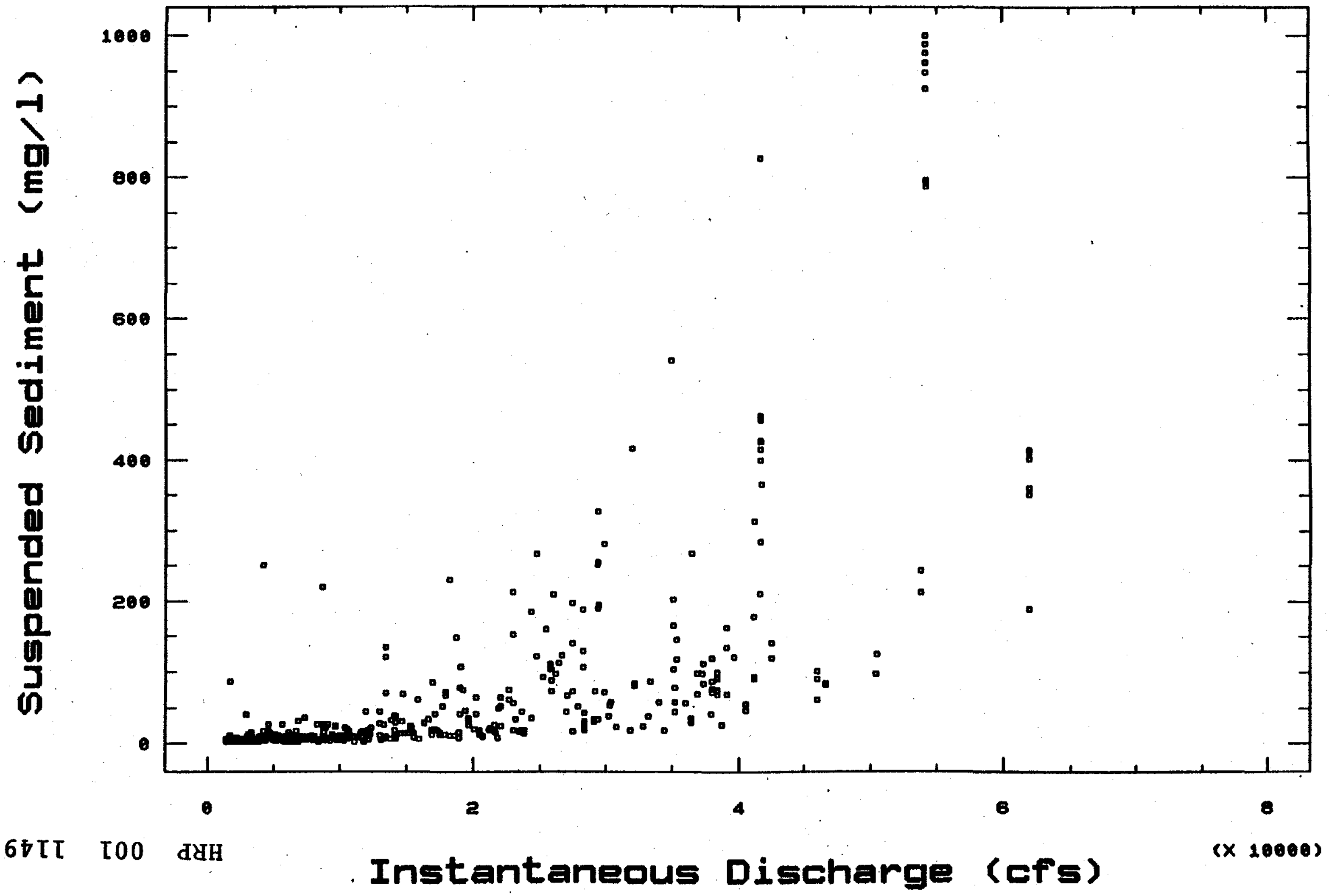
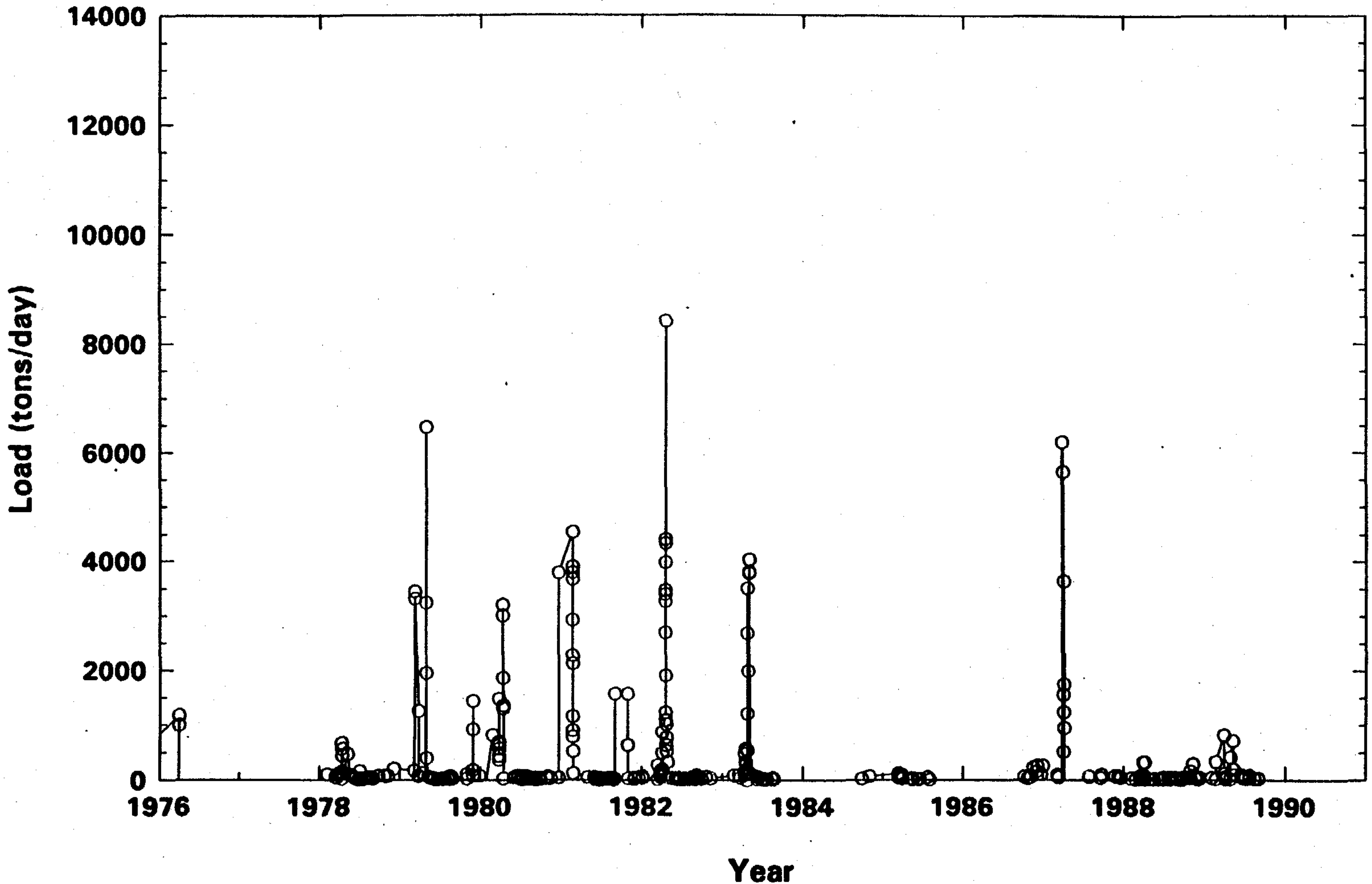


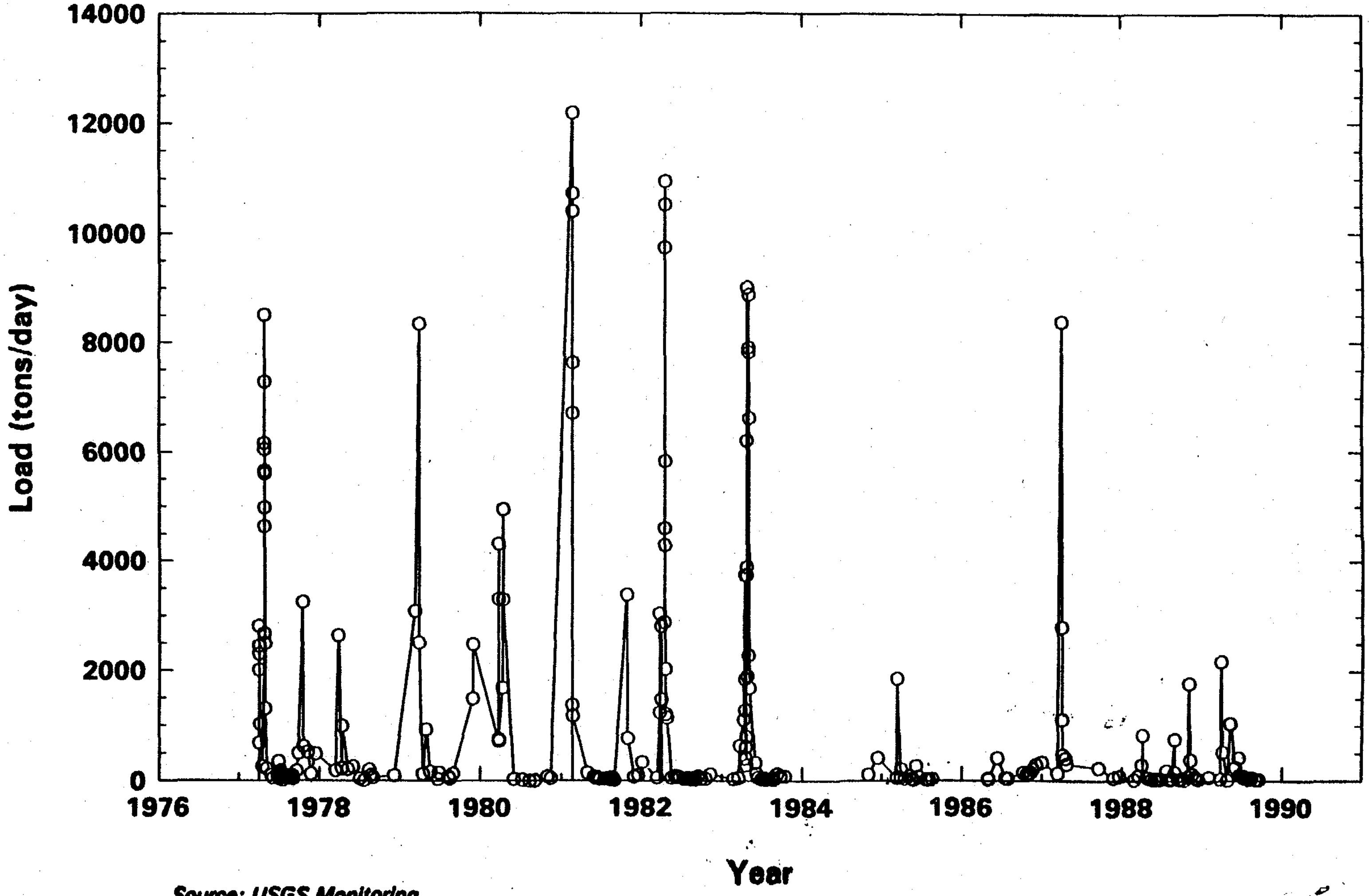
Figure B.4-7

Figure B.4-8
Sediment Load, Hudson River at Fort Edward



Source: USGS Monitoring

Figure B.4-9
Sediment Load, Hudson River at Schuylerville

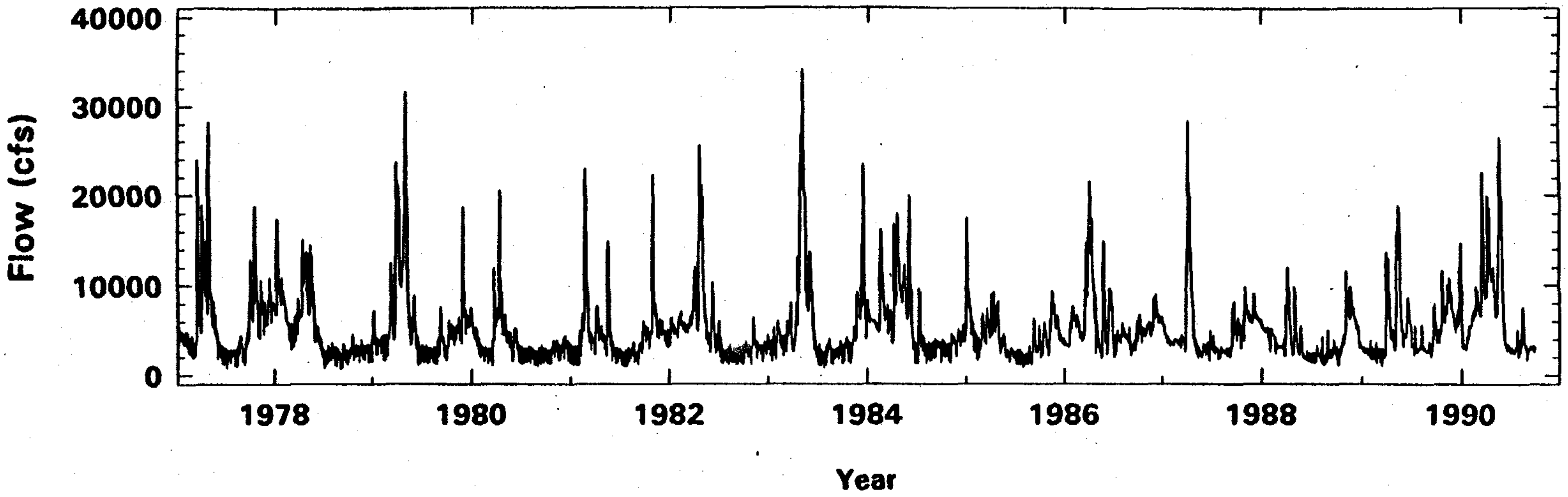


Source: USGS Monitoring

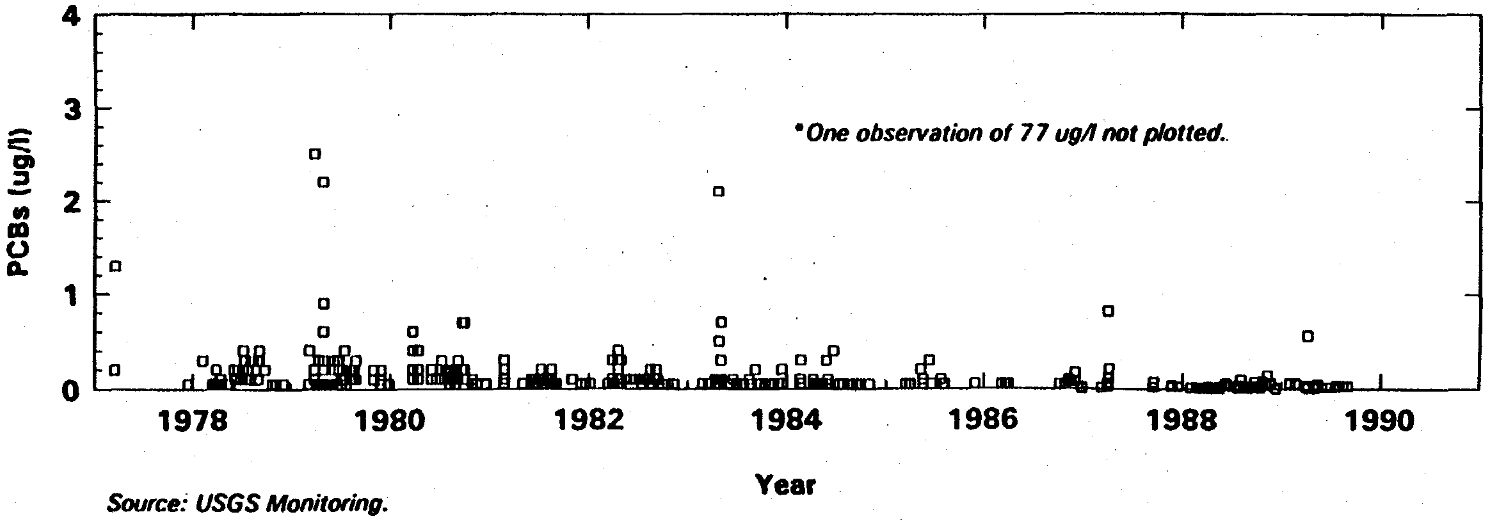
Figure B.4-10

Flows at Fort Edward and PCBs at Fort Edward

Daily Average Flows at Fort Edward



PCB Concentrations at Fort Edward

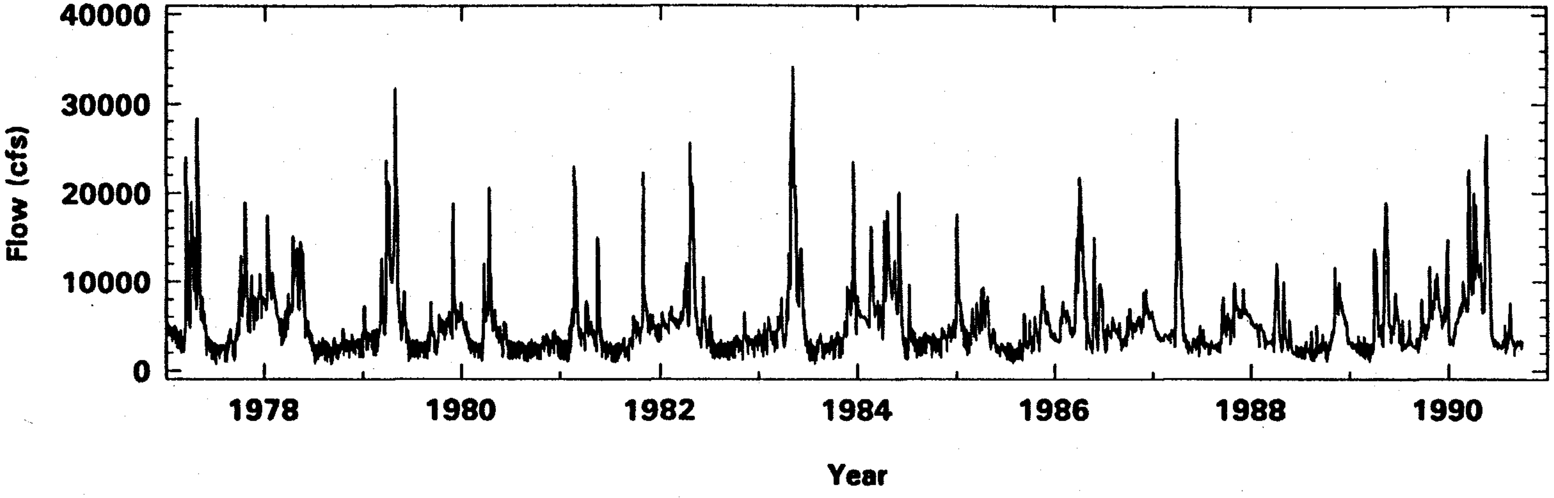


*One observation of 77 ug/l not plotted.

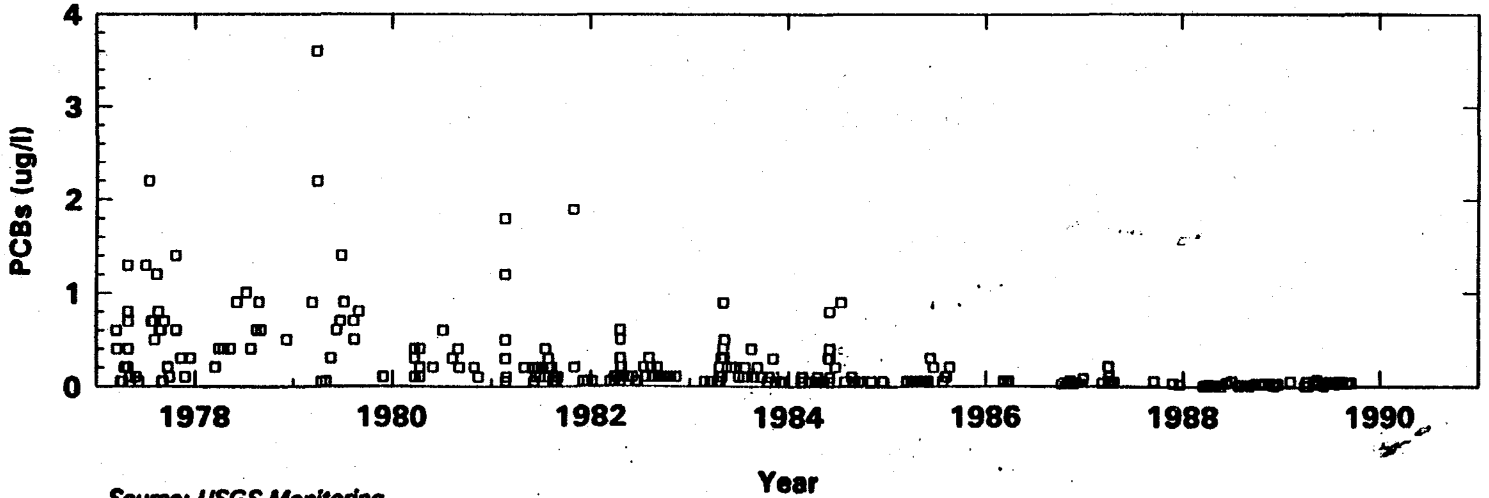
Source: USGS Monitoring.

Figure B.4-11
Flow at Fort Edward and PCBs at Schuylerville

Daily Average Flows at Fort Edward



PCB Concentrations at Schuylerville



Source: USGS Monitoring.

Figure B.4-12
Total PCBs in Water vs. Flow

Fort Edward

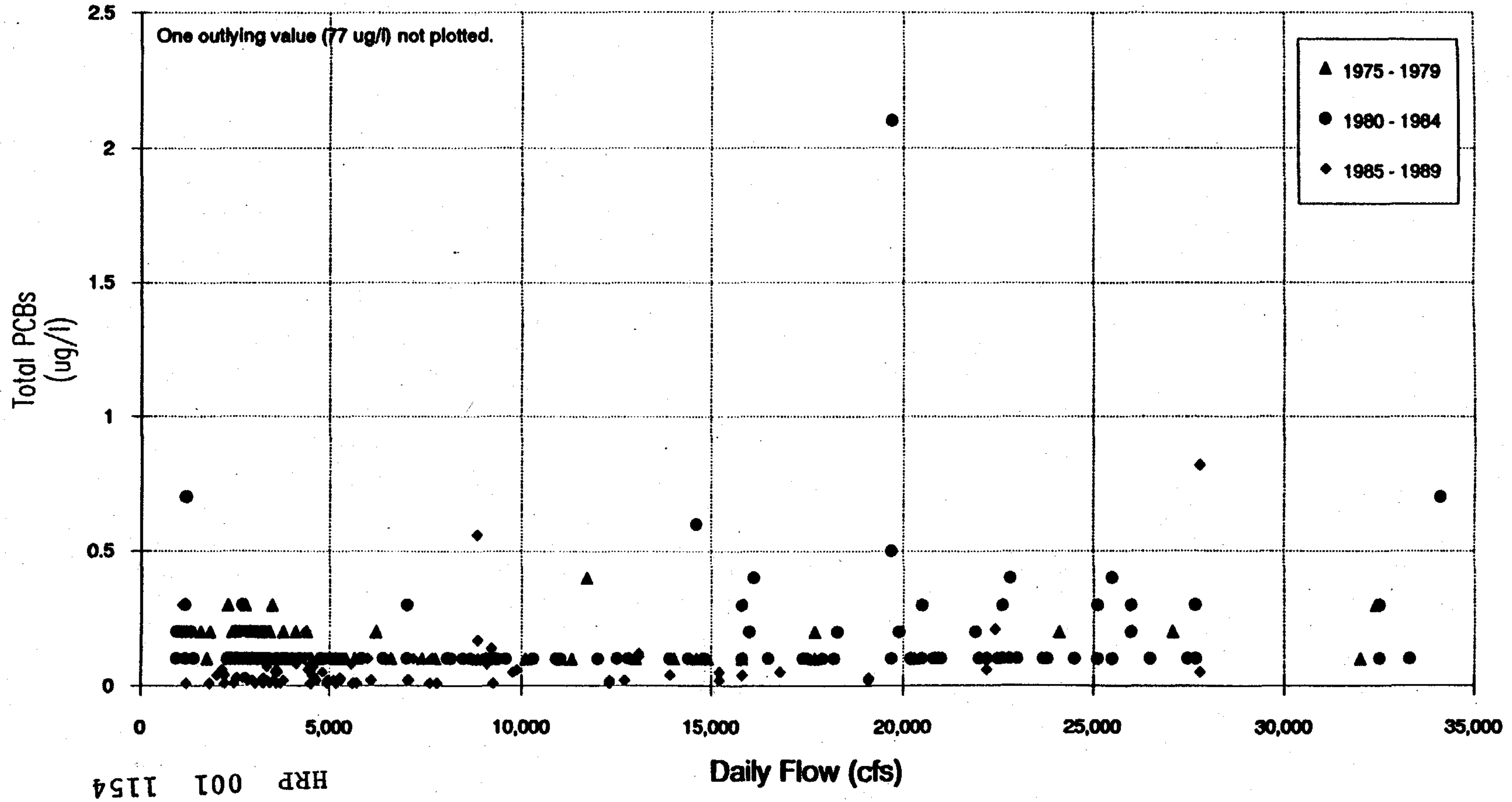


Figure B.4-13
Total PCBs in Water vs. Flow

Schuylerville

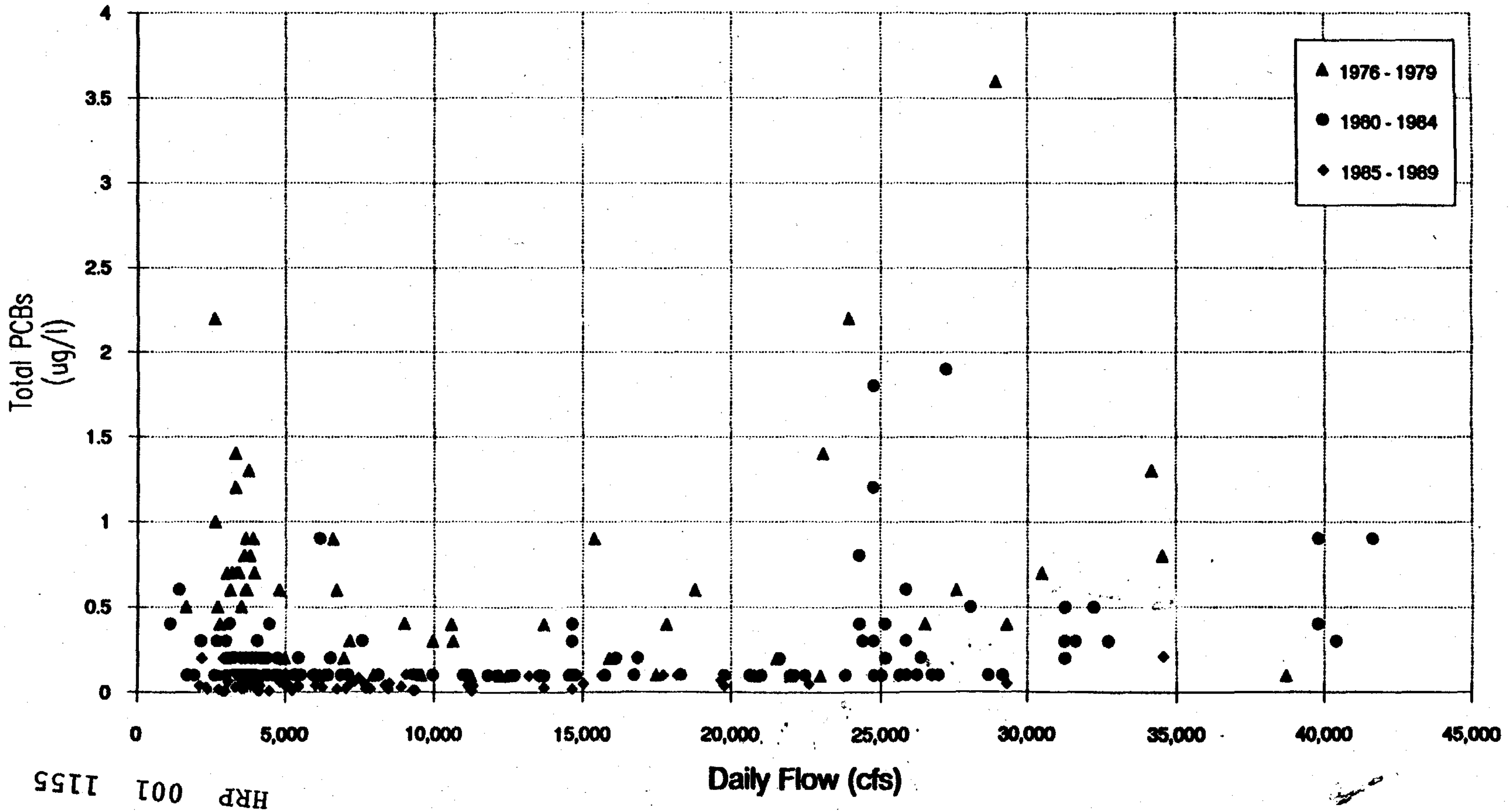


Figure B.4-14
Total PCBs in Water vs. Flow

Stillwater

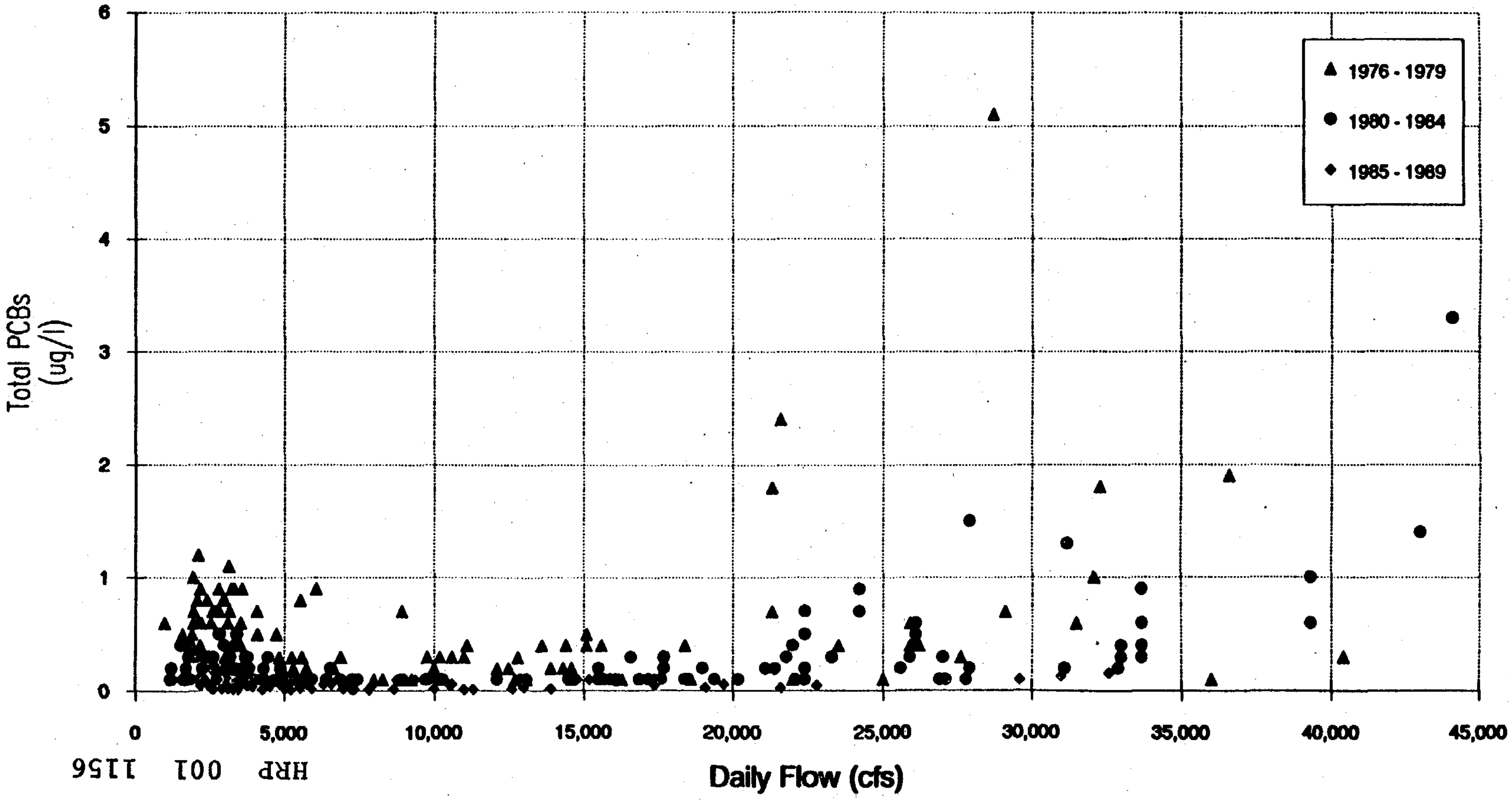


Figure B.4-15
Total PCBs in Water vs. Flow

Waterford

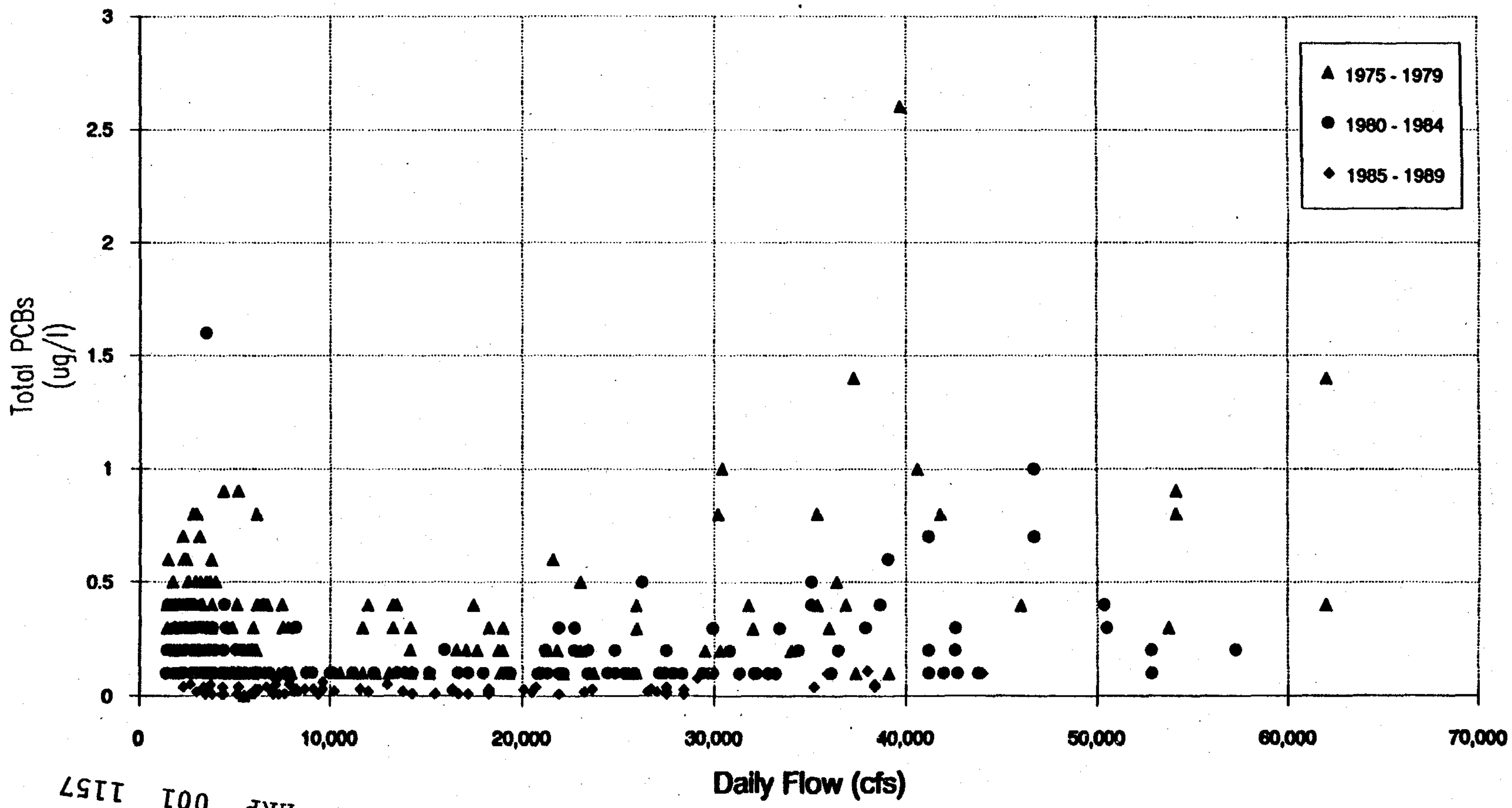


Figure B.4-16
Suspended Solids vs. Total PCBs

Stillwater

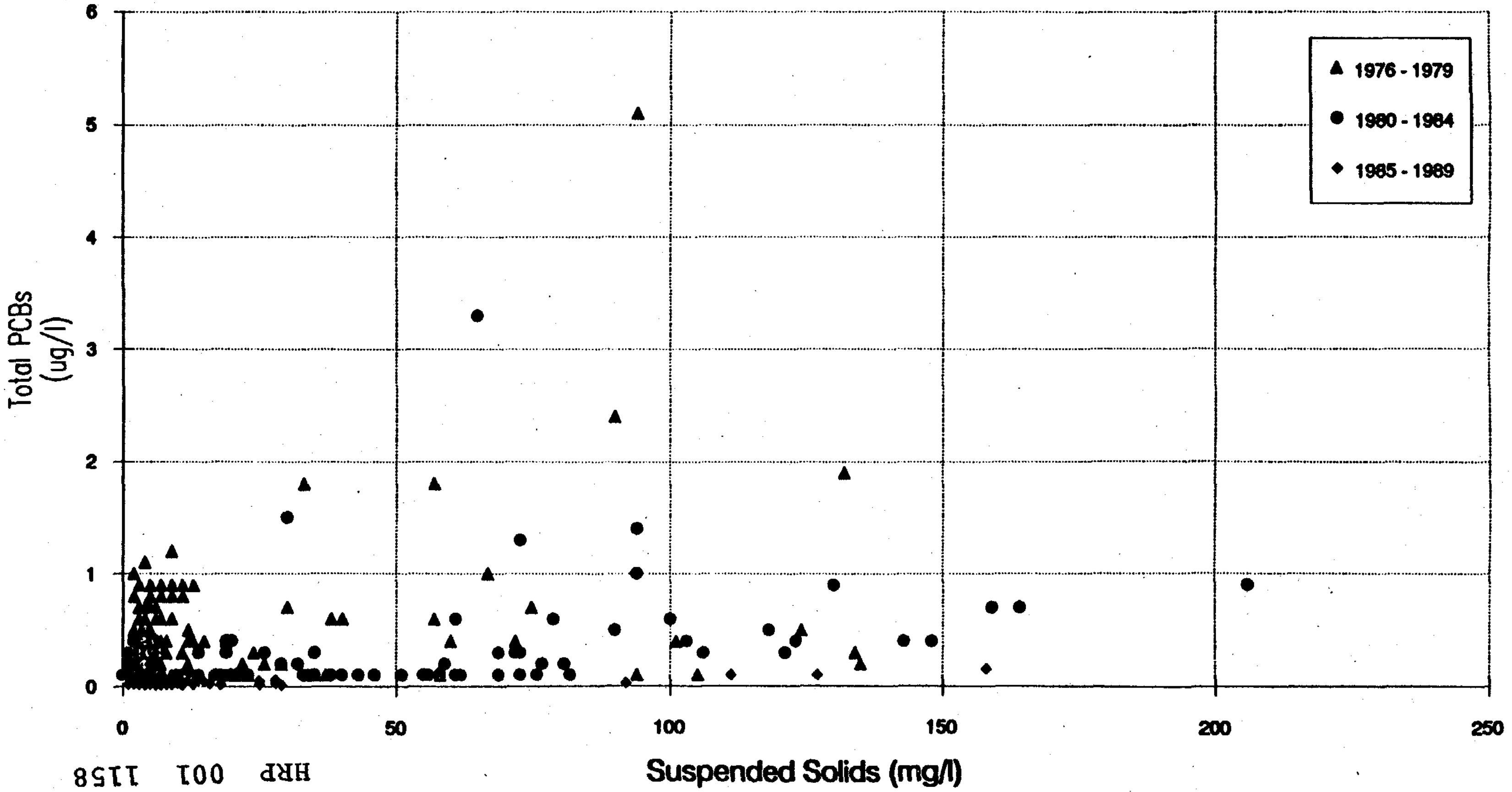
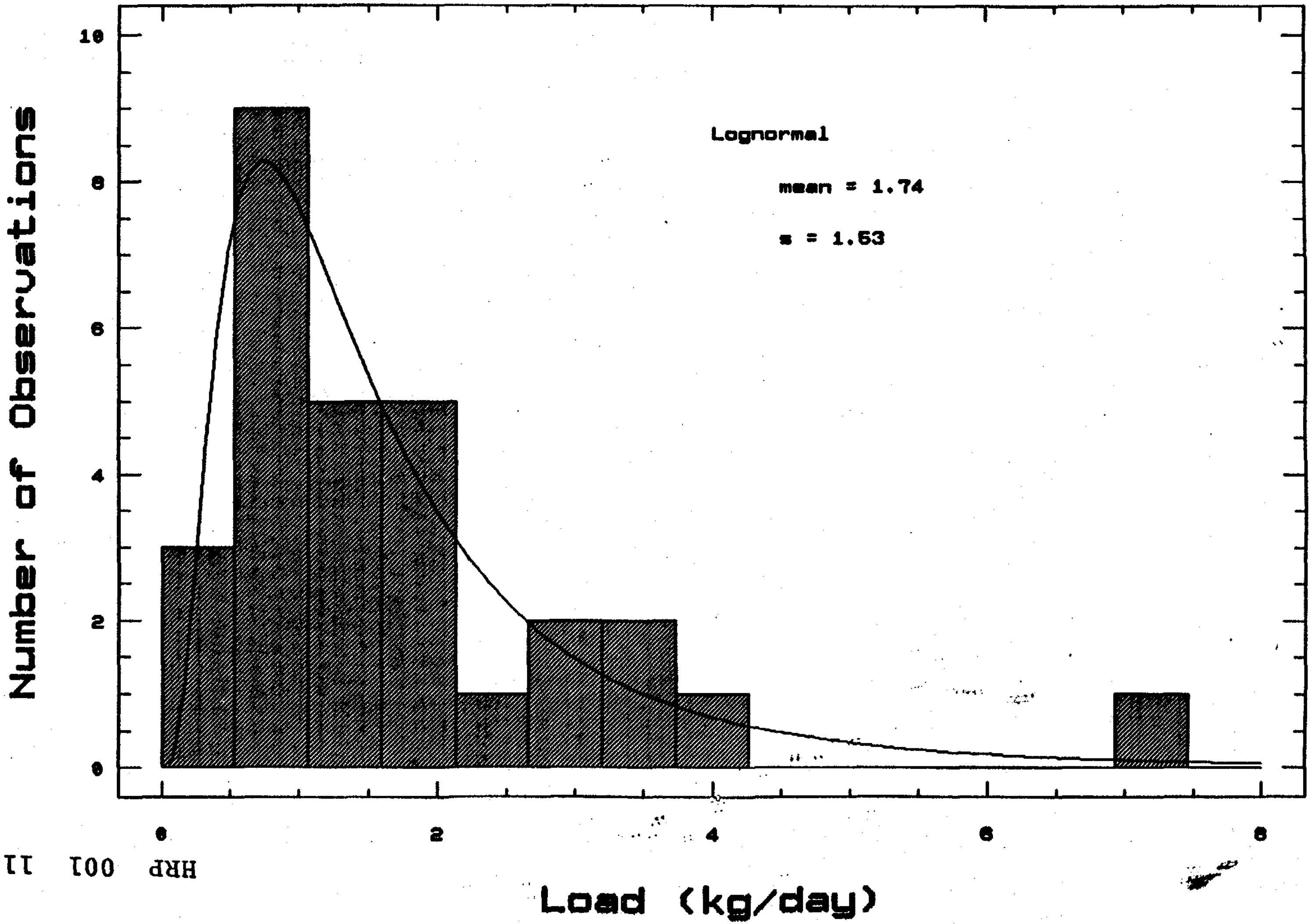


Figure B.4-17
PCB Load at Non-Scouring Flows, Stillwater, 1983

Calendar Year Data. Flows 49-490 cu.m/s (1730-17300 cfs)



Concentration nondetects treated as one-half of detection limit.

Figure B.4-17

Figure B.4-18
Flow - PCB Observation Pairs
Stillwater

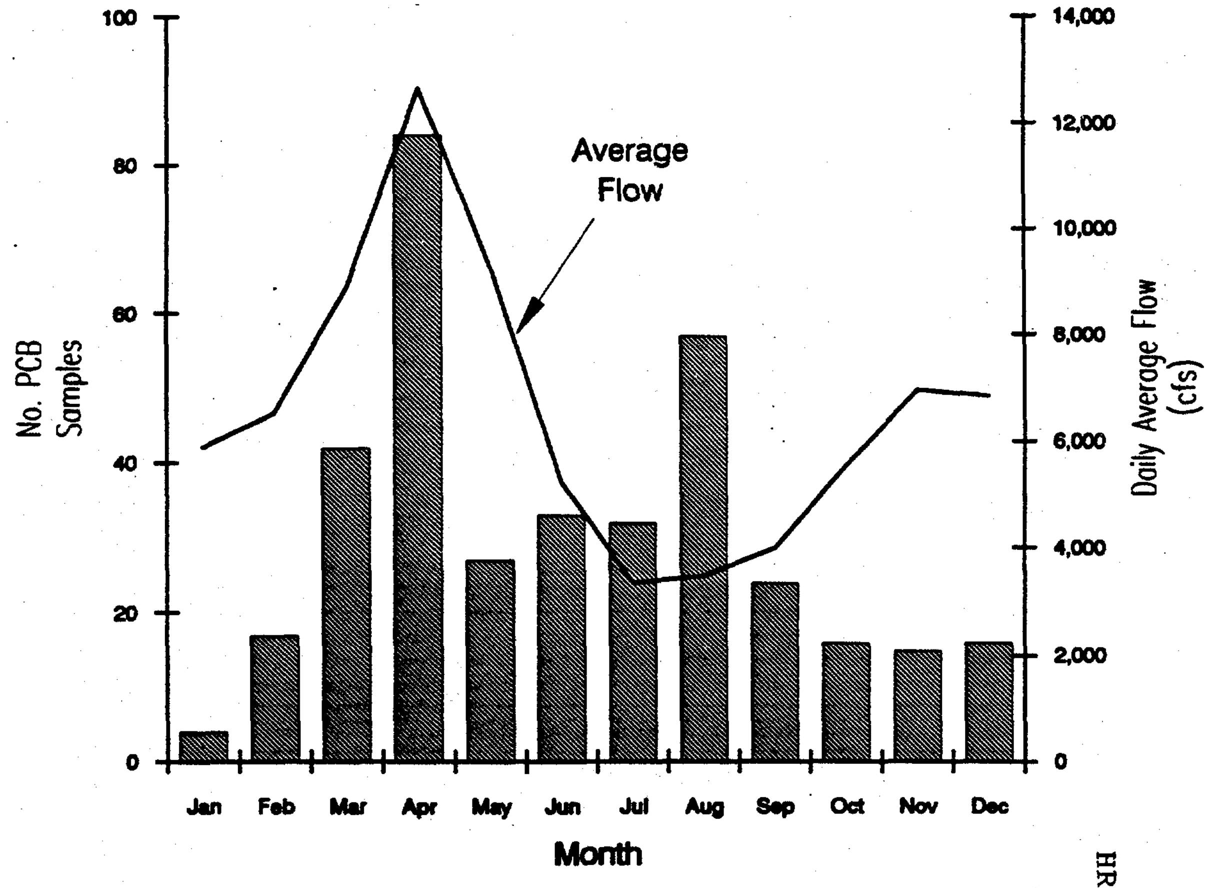
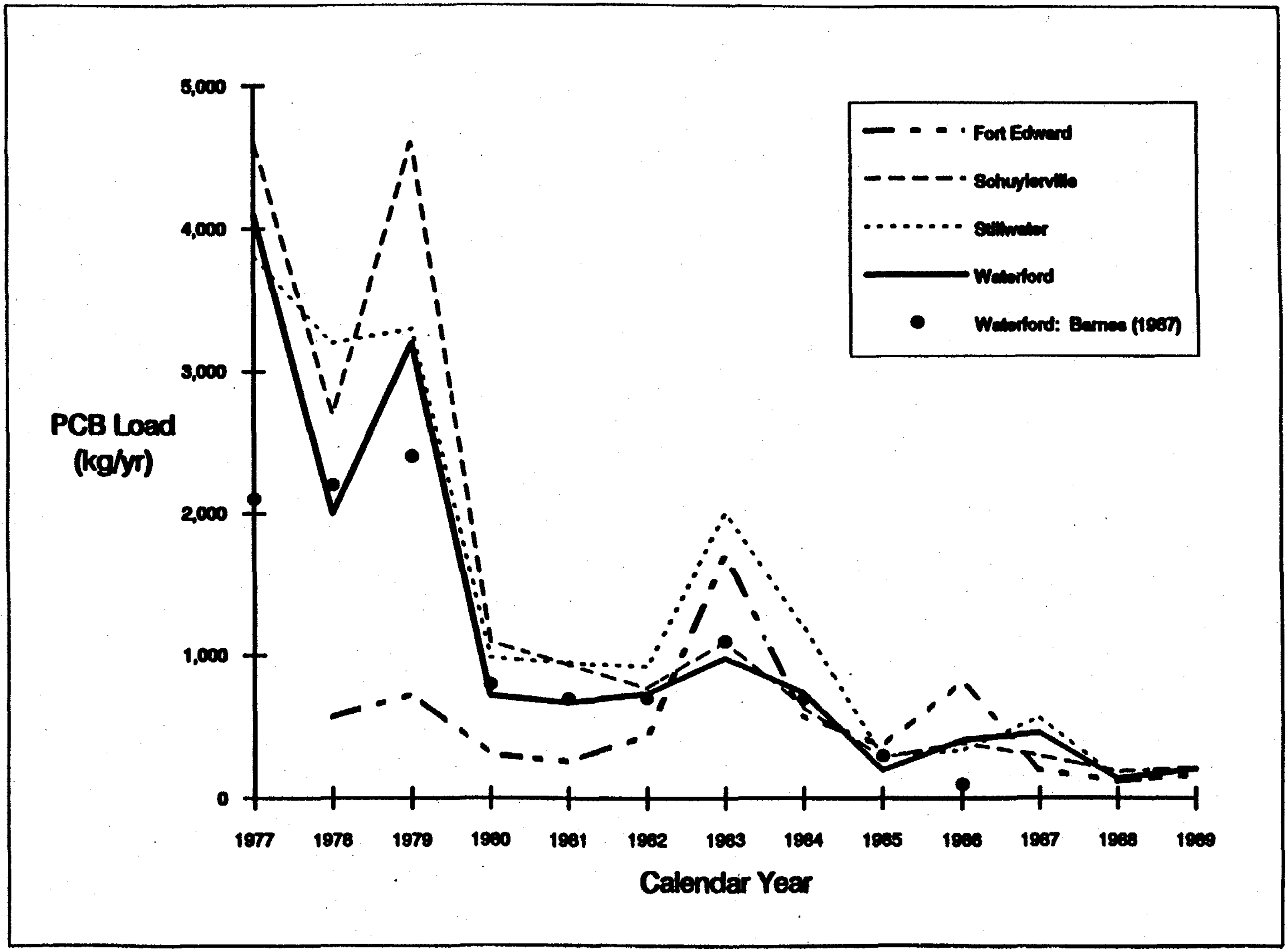
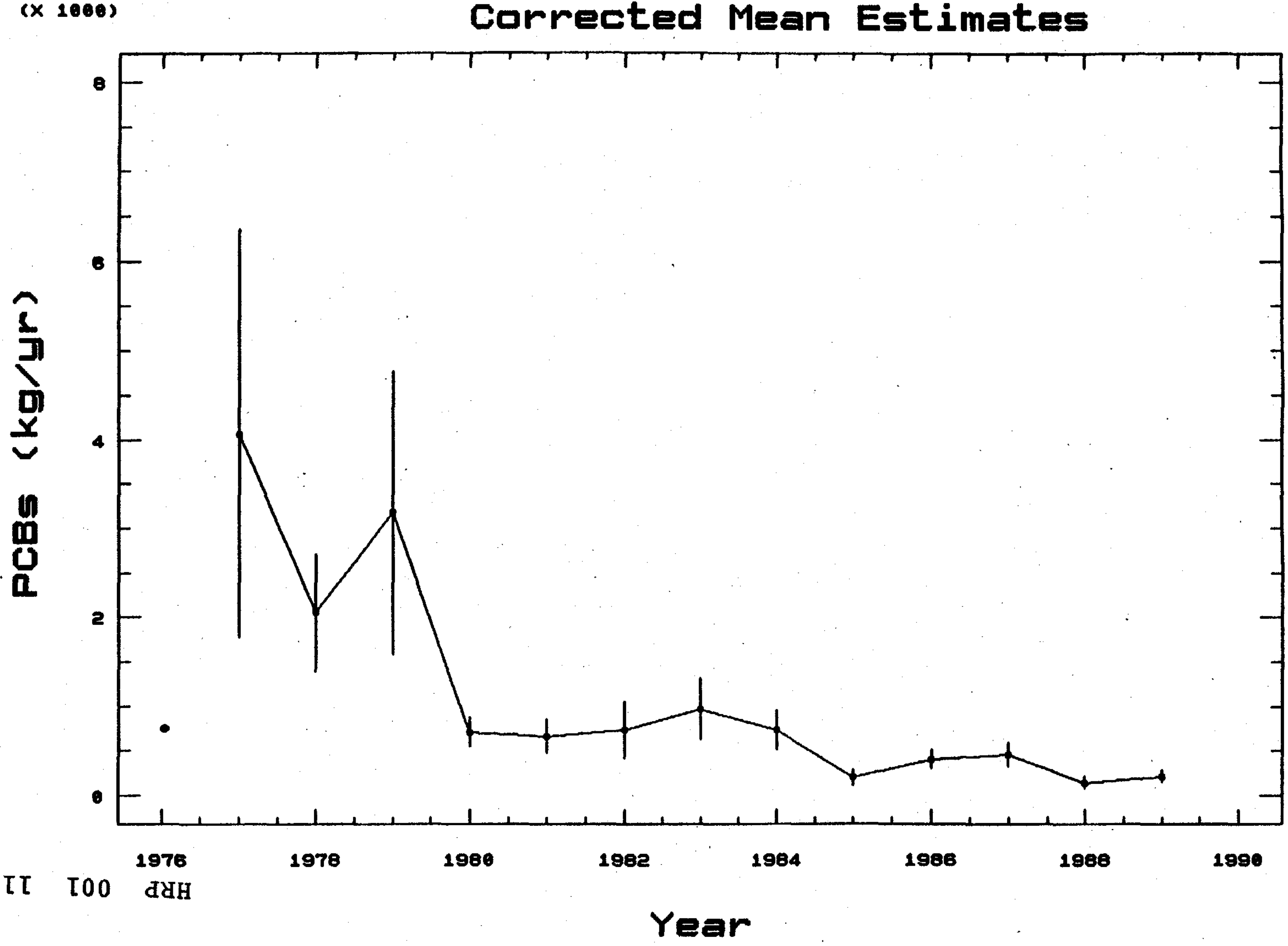


Figure B.4-19
PCB Mass Transport Corrected Mean Method Estimates



NOTE: Barnes (1987) values are water-year estimates not using the corrected mean method.

Figure B.4-20
PCB Mass Transport Past Waterford
Corrected Mean Estimates



95% Confidence Intervals on Means

Figure B.4-20

Figure B.4-21

PCB Mass Transport, Ft. Edward & Stillwater

Corrected Mean Estimates

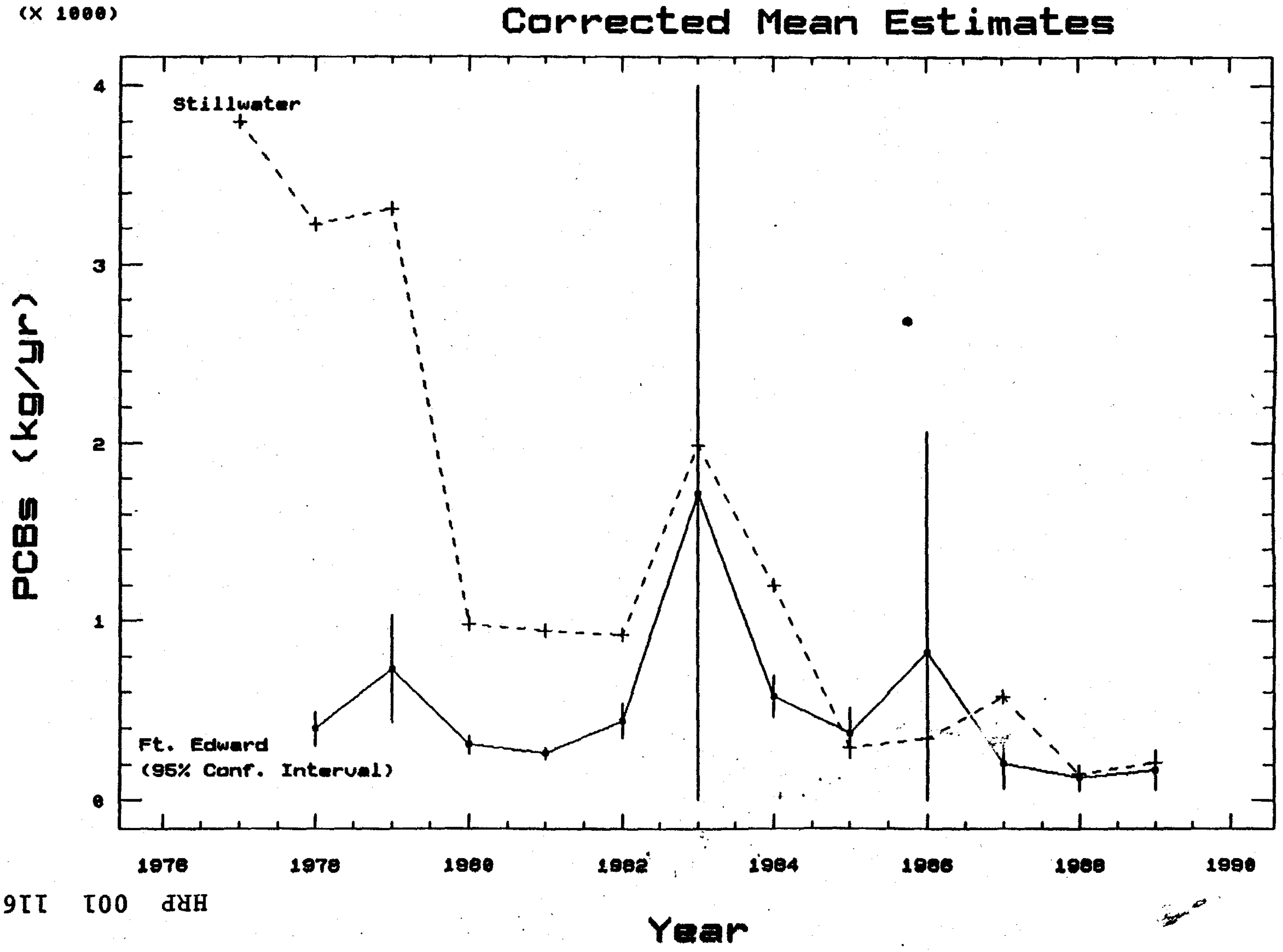
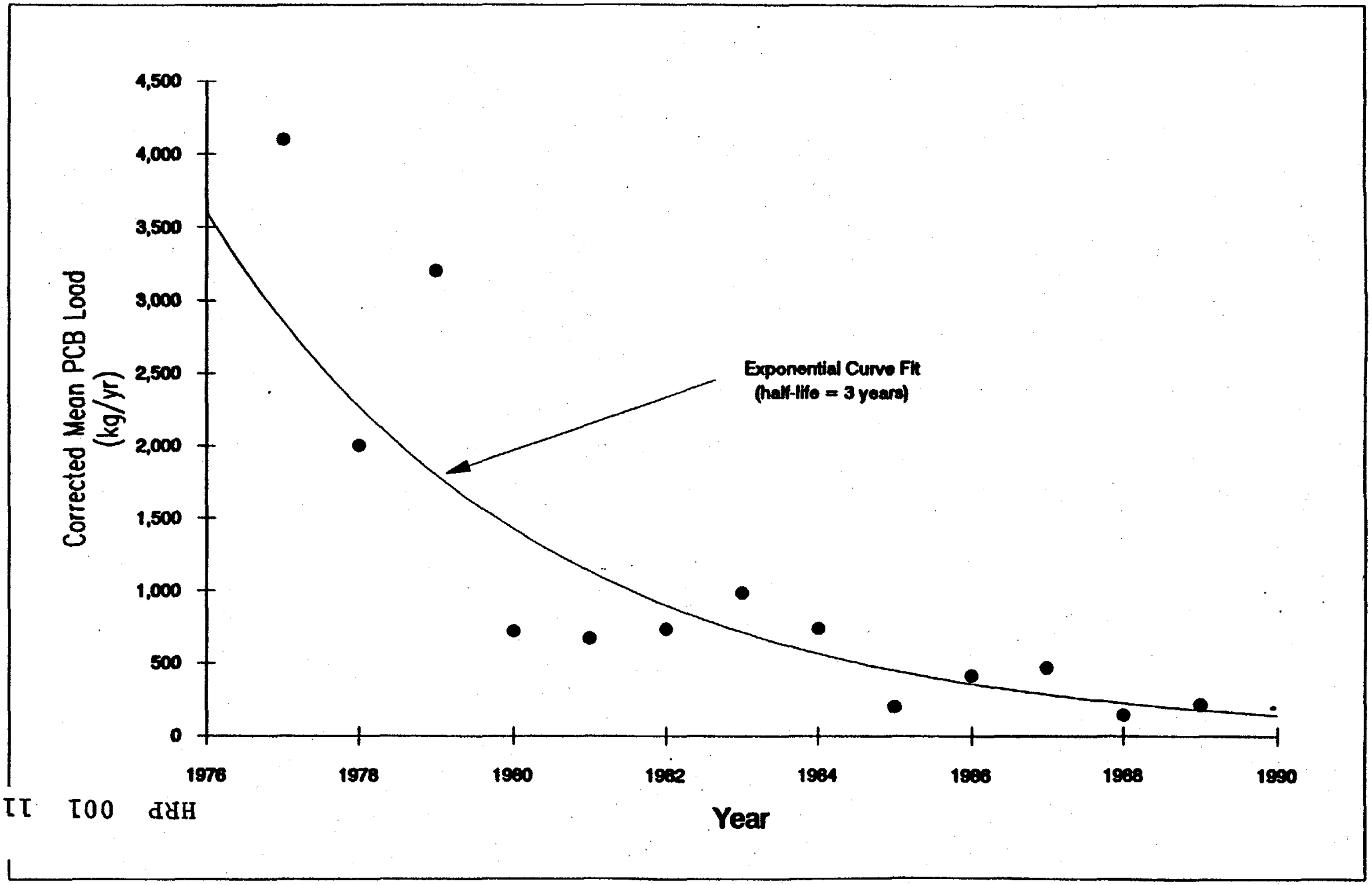


Figure B.4-21

Figure B.4-22
Estimated PCB Load Past Waterford



NOTE: A half-life of 3 years indicates PCB loads have decreased by approximately one-half every 3 years.

Figure B.4-23
Aroclor 1016 in Largemouth Bass (Lipid)
River Mile 175

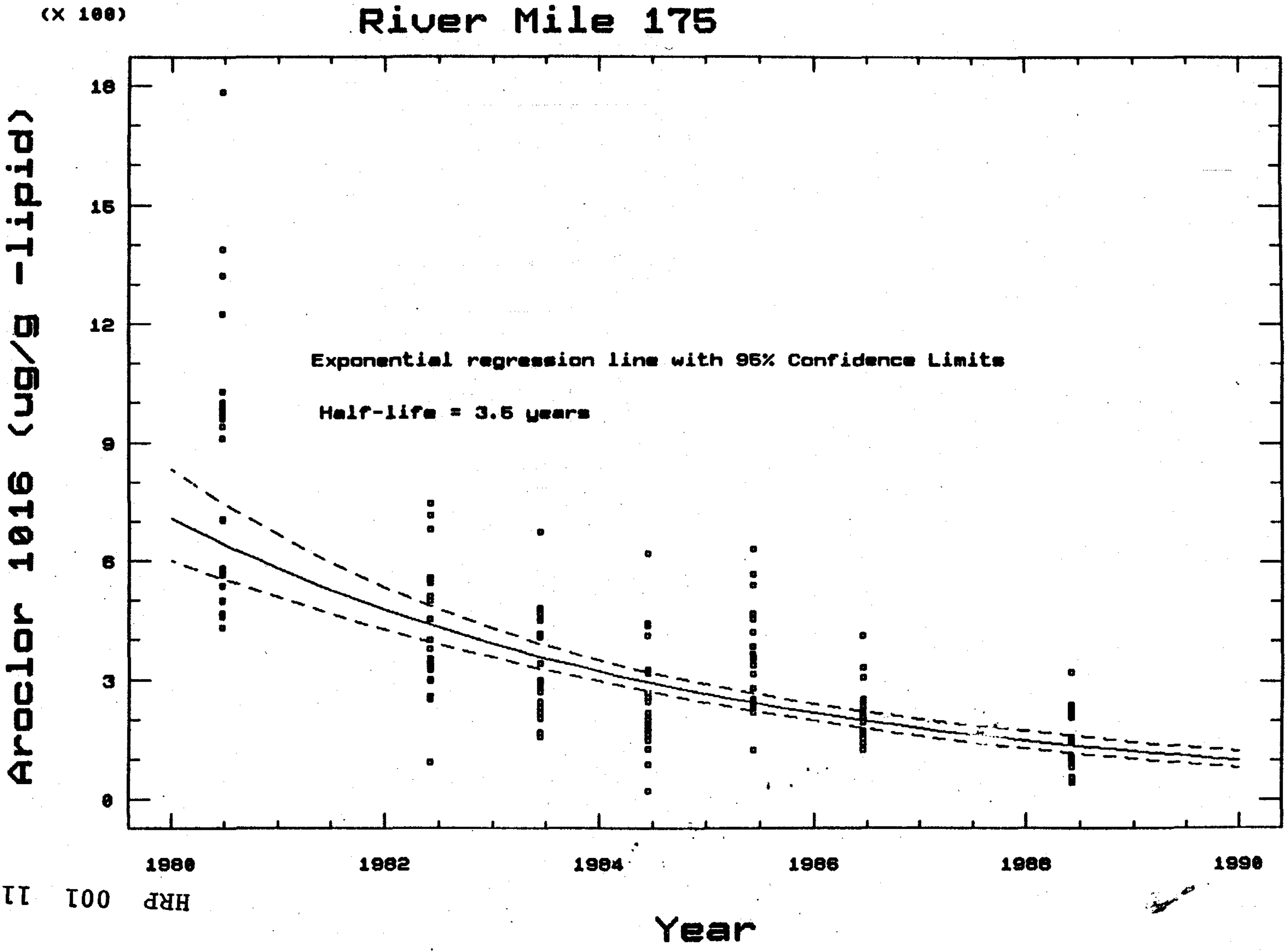
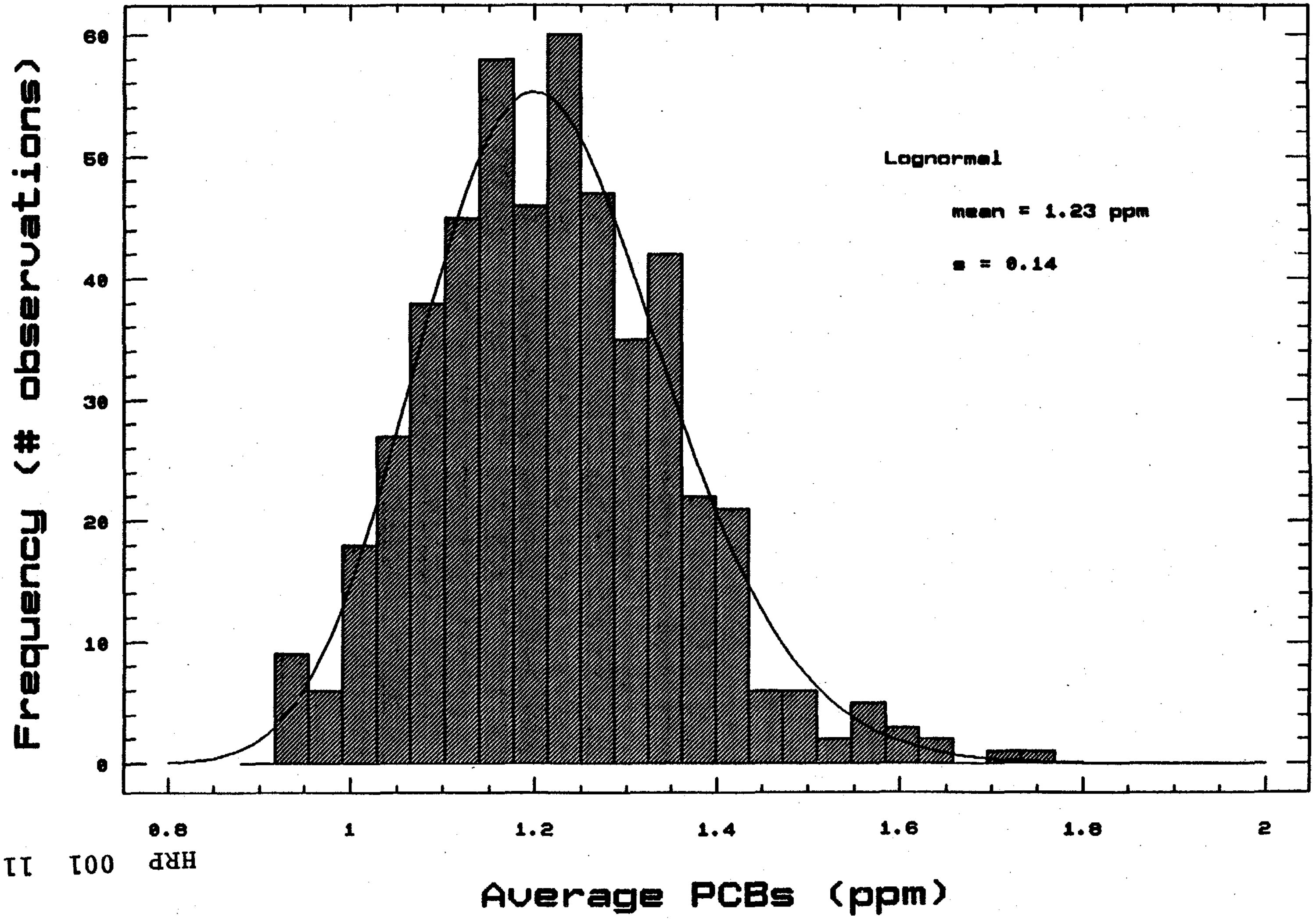


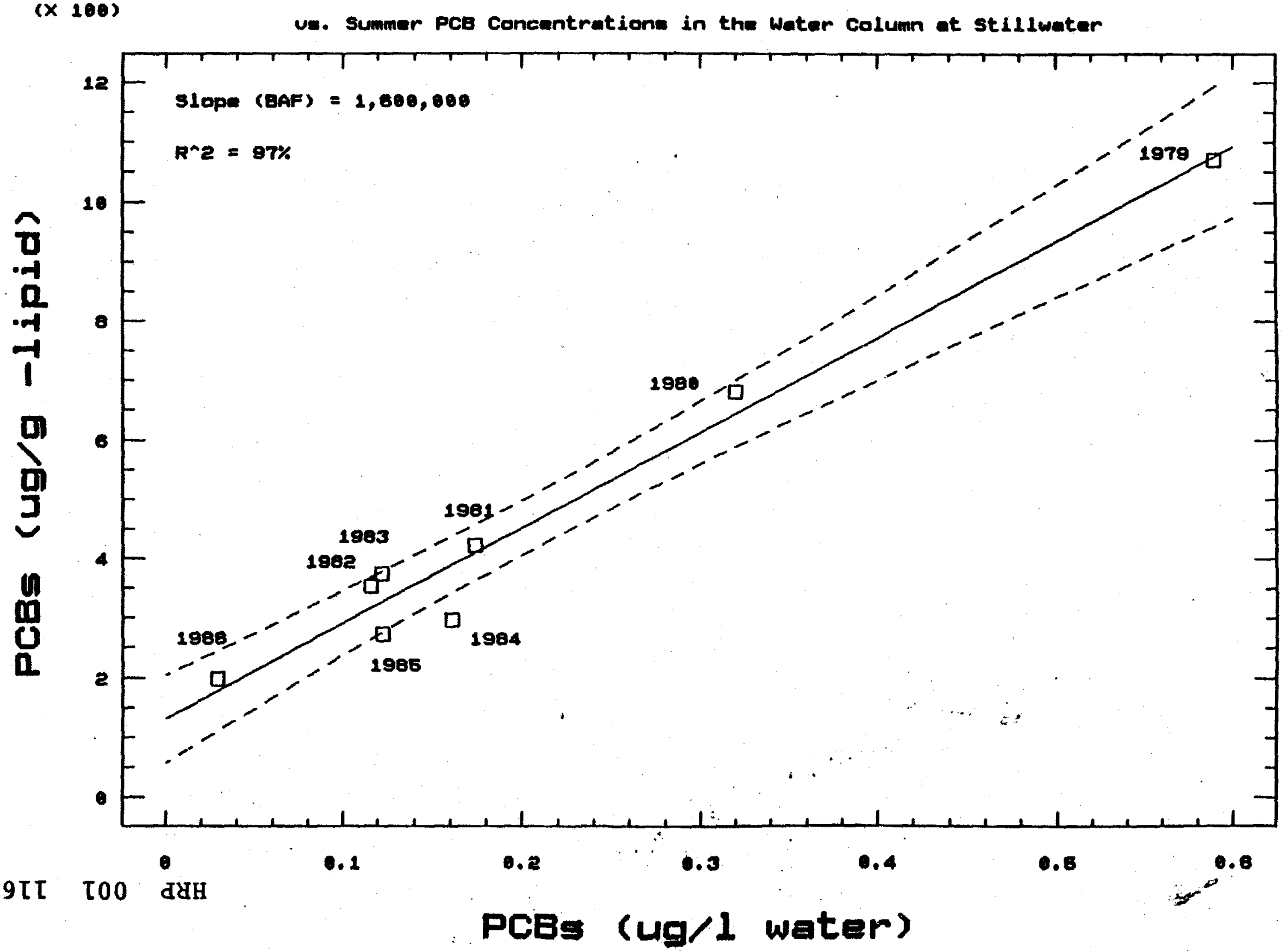
Figure B.4-23

Figure B.4-24
Simulated Average Total PCBs in Fish
Upper Hudson River, 1991-2020



500 30-year Simulations

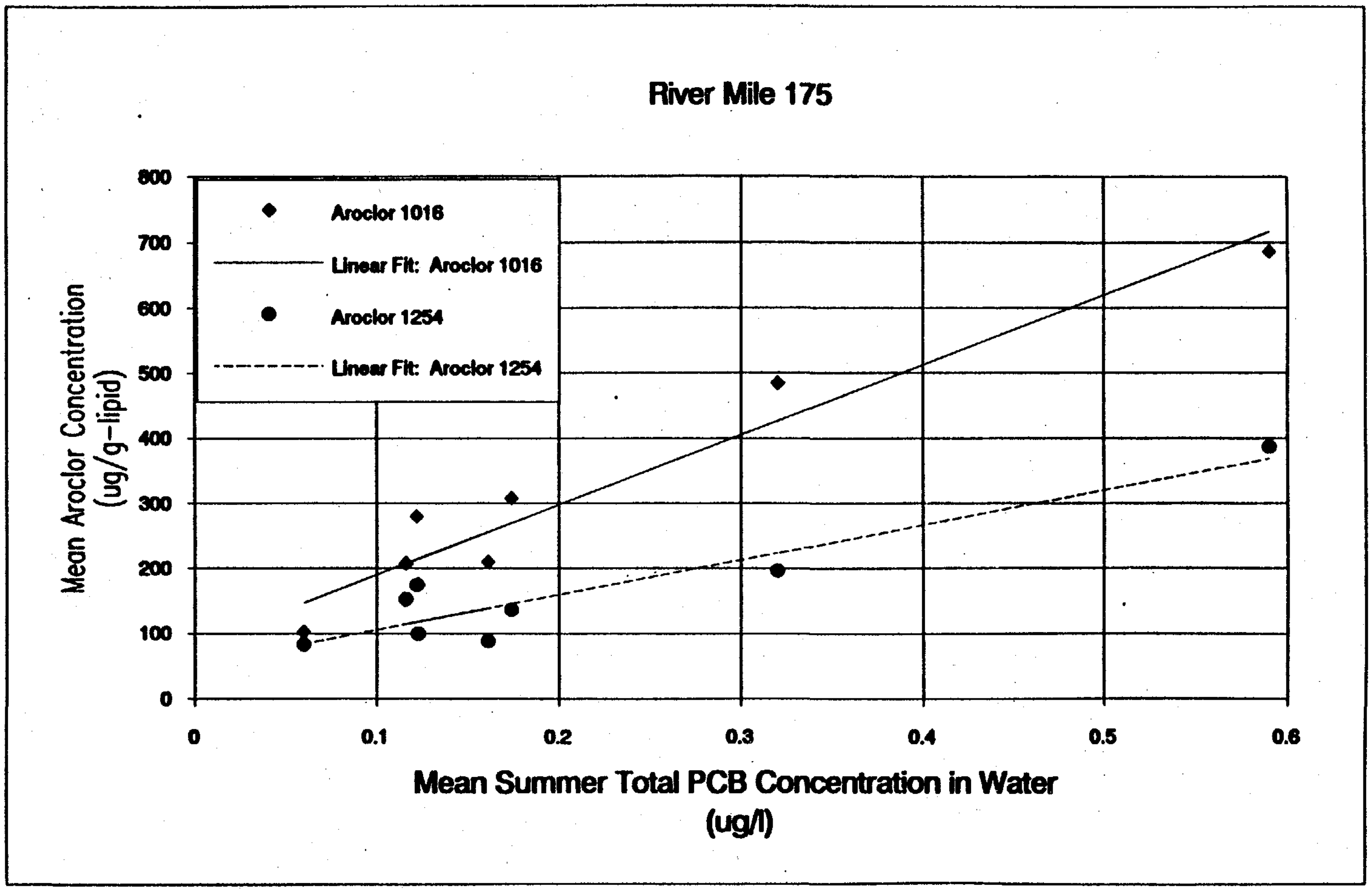
Figure B.4-25
Total PCBs in Yearling Pumpkinseed



Lipid-Basis Median Values

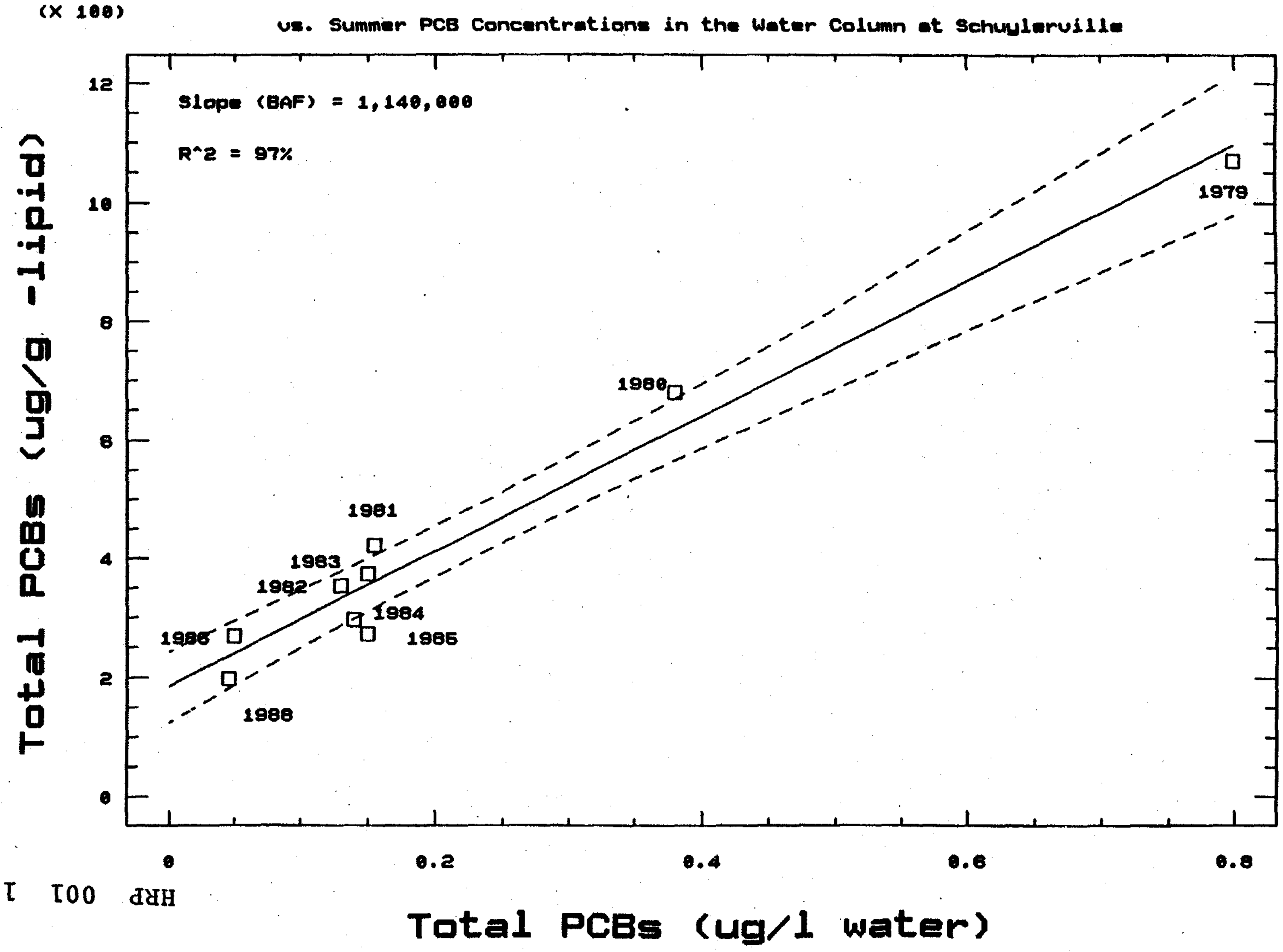
Figure B.4-25

Figure B.4-26
Aroclor Levels in Yearling Pumpkinseed Versus Summer Water-Column Total PCBs


River Mile 175

NOTE: Aroclor levels in fish are lipid-based.

Figure B.4-27
Total PCBs in Yearling Pumpkinseed

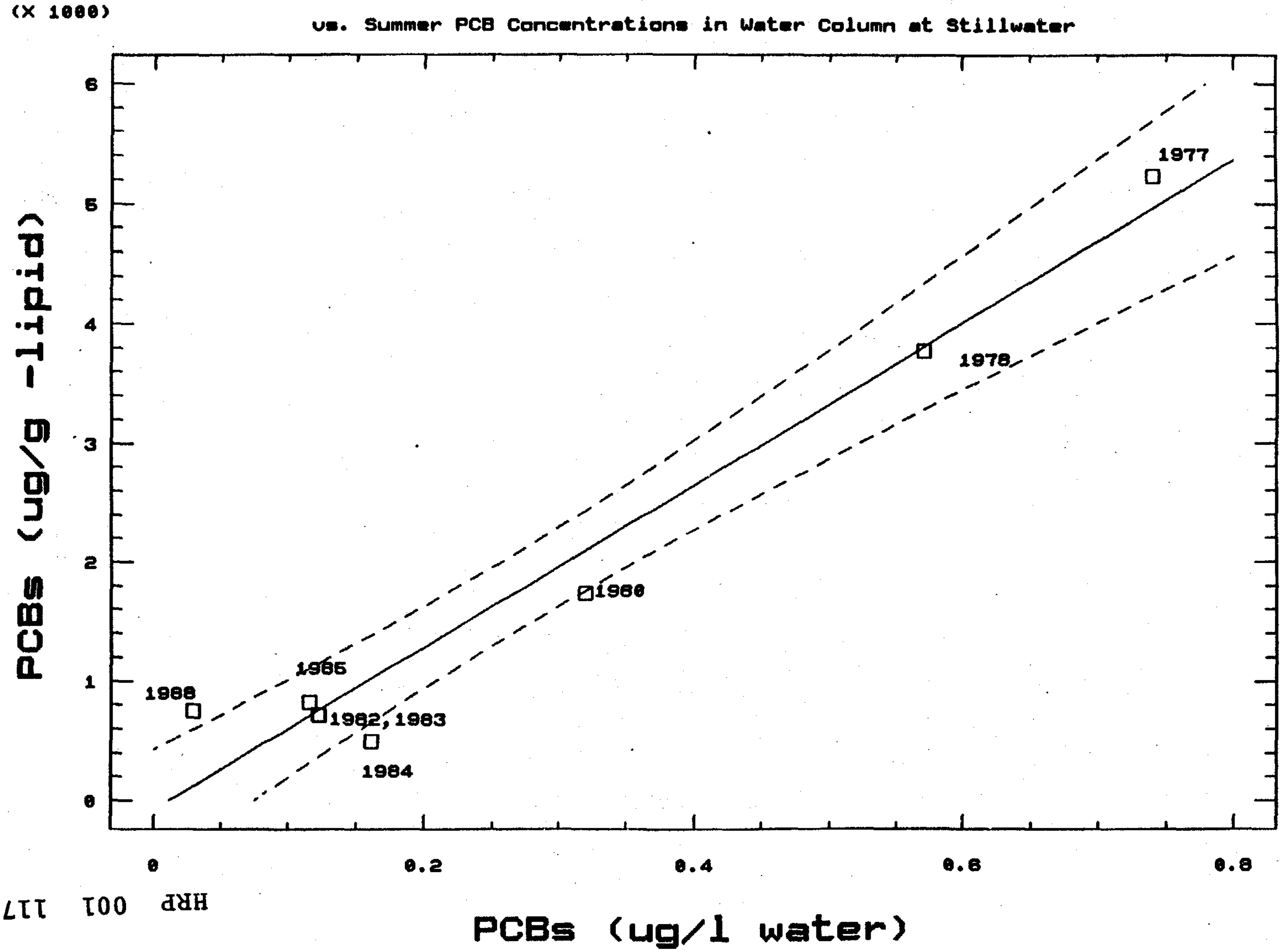


Lipid-Basis Median Values

Figure B.4-28

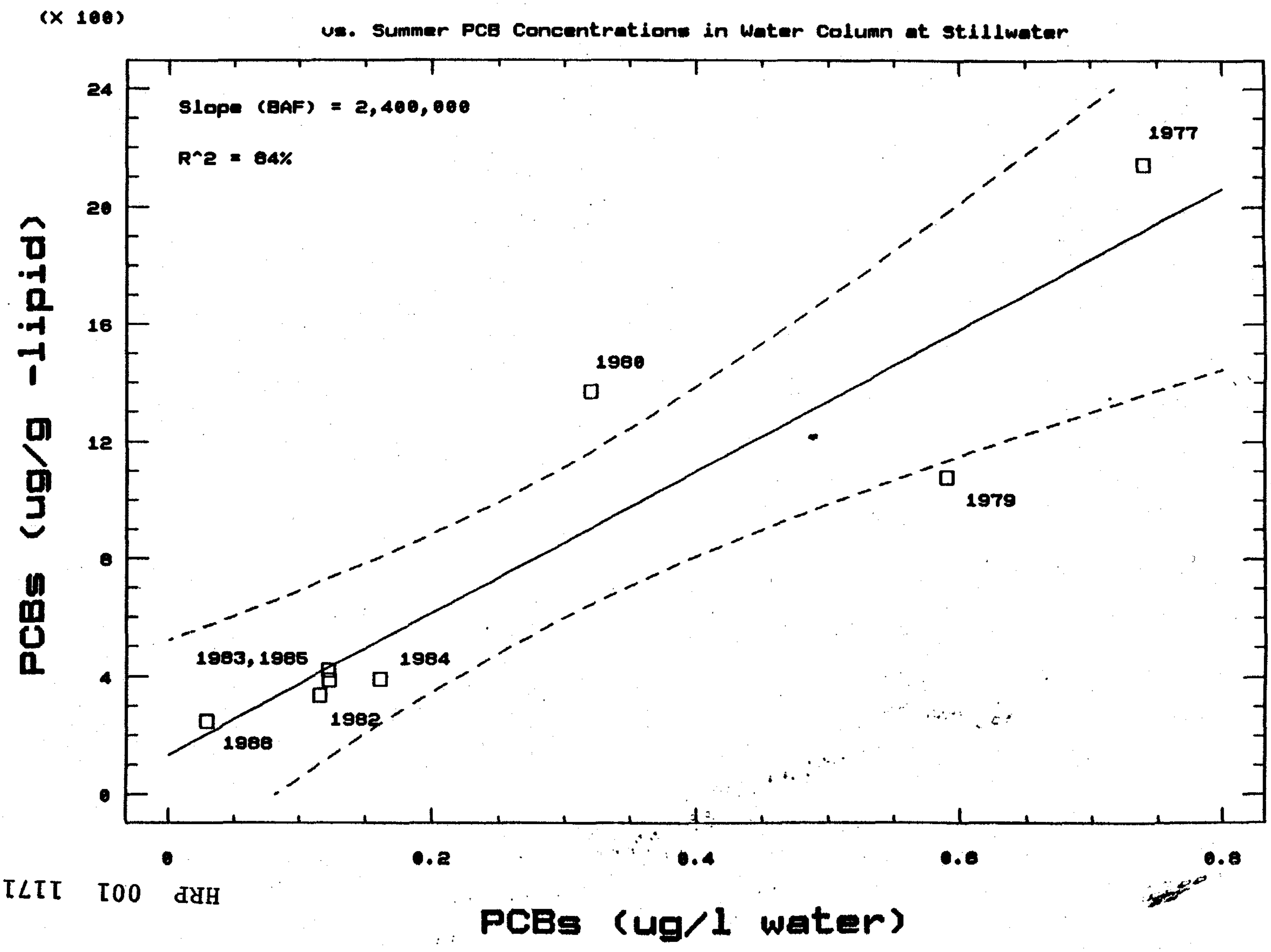
Total PCBs in Largemouth Bass

vs. Summer PCB Concentrations in Water Column at Stillwater



Lipid-Basis Median Values

Figure B.4-29
Total PCBs in Brown Bullhead



Lipid-Basis Median Values

Figure B.4-29

Figure B.5-1
Model Nodes and Links

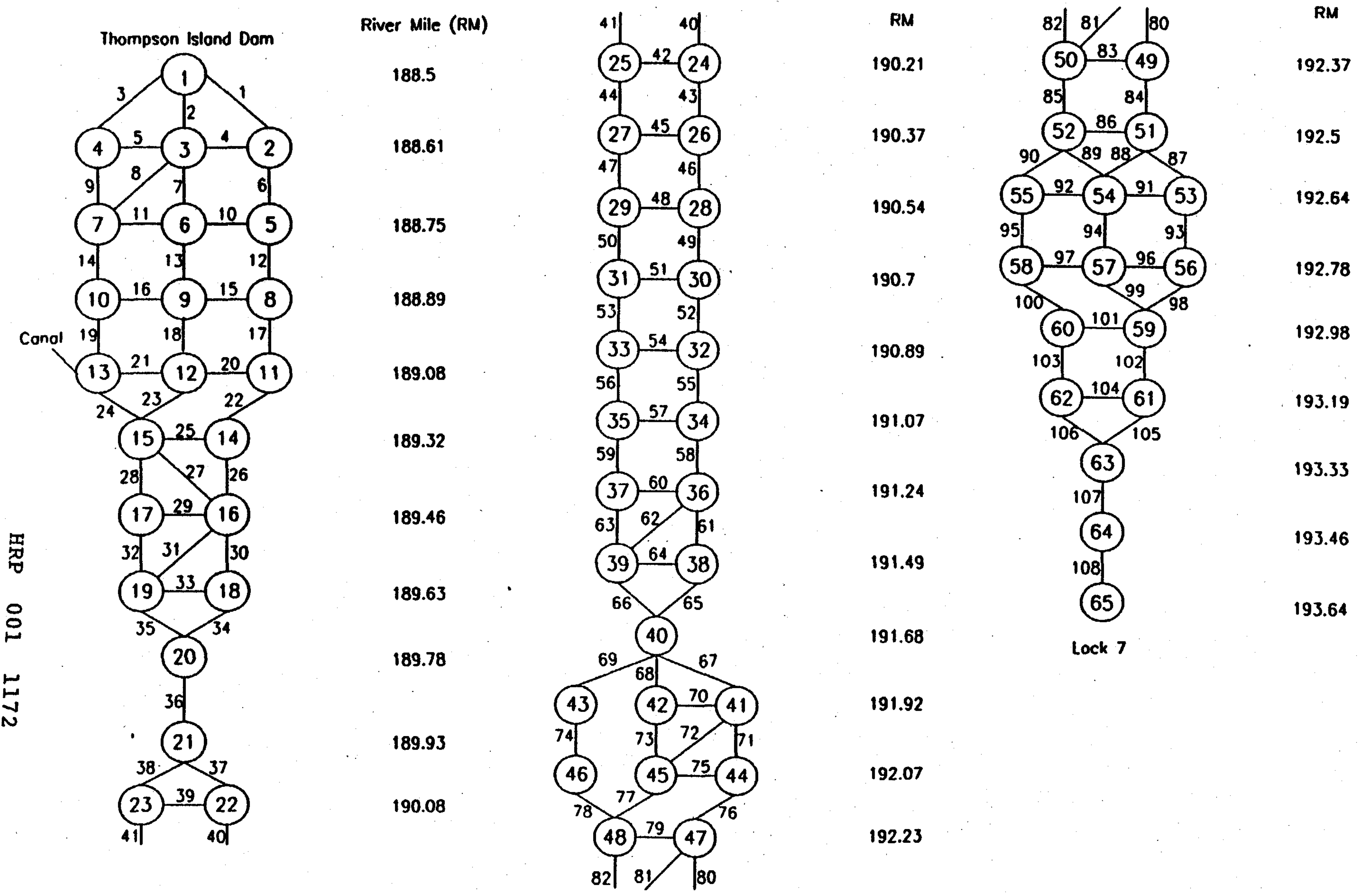


Figure B.5-2
Nodal Areas

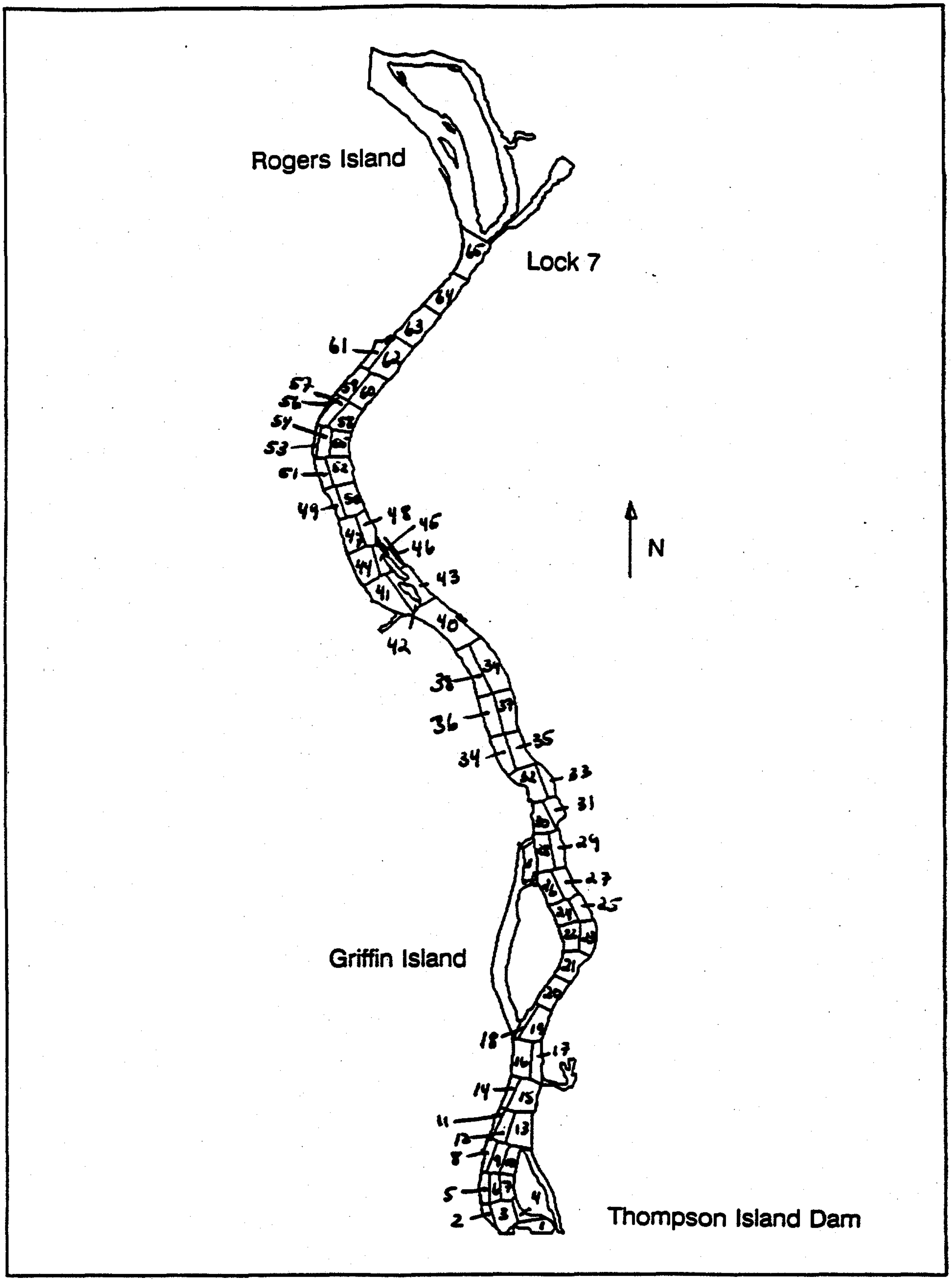


Figure B.5-3
Preliminary Hydraulic Calibration
1-D Model, Thompson Island Pool

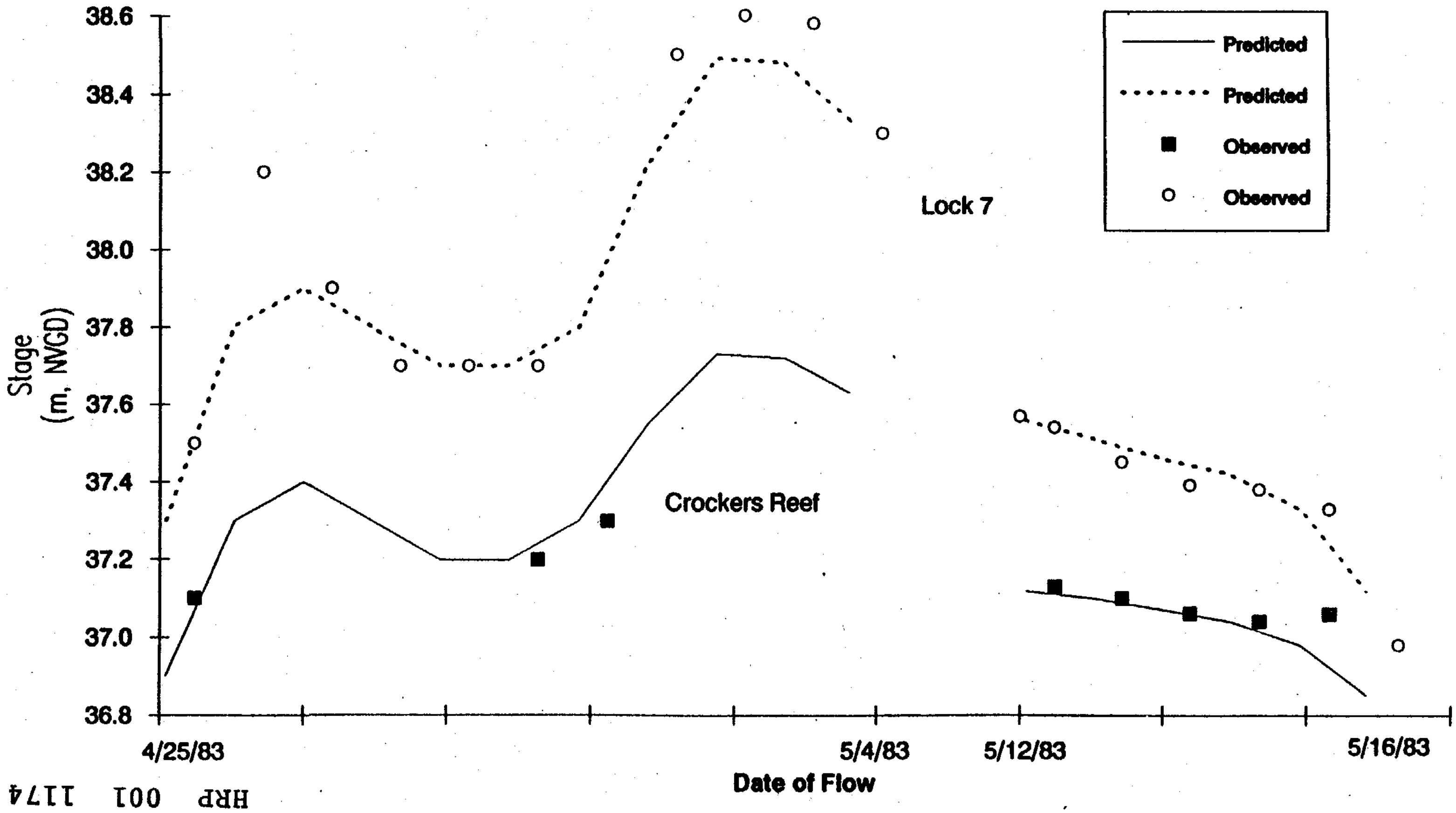
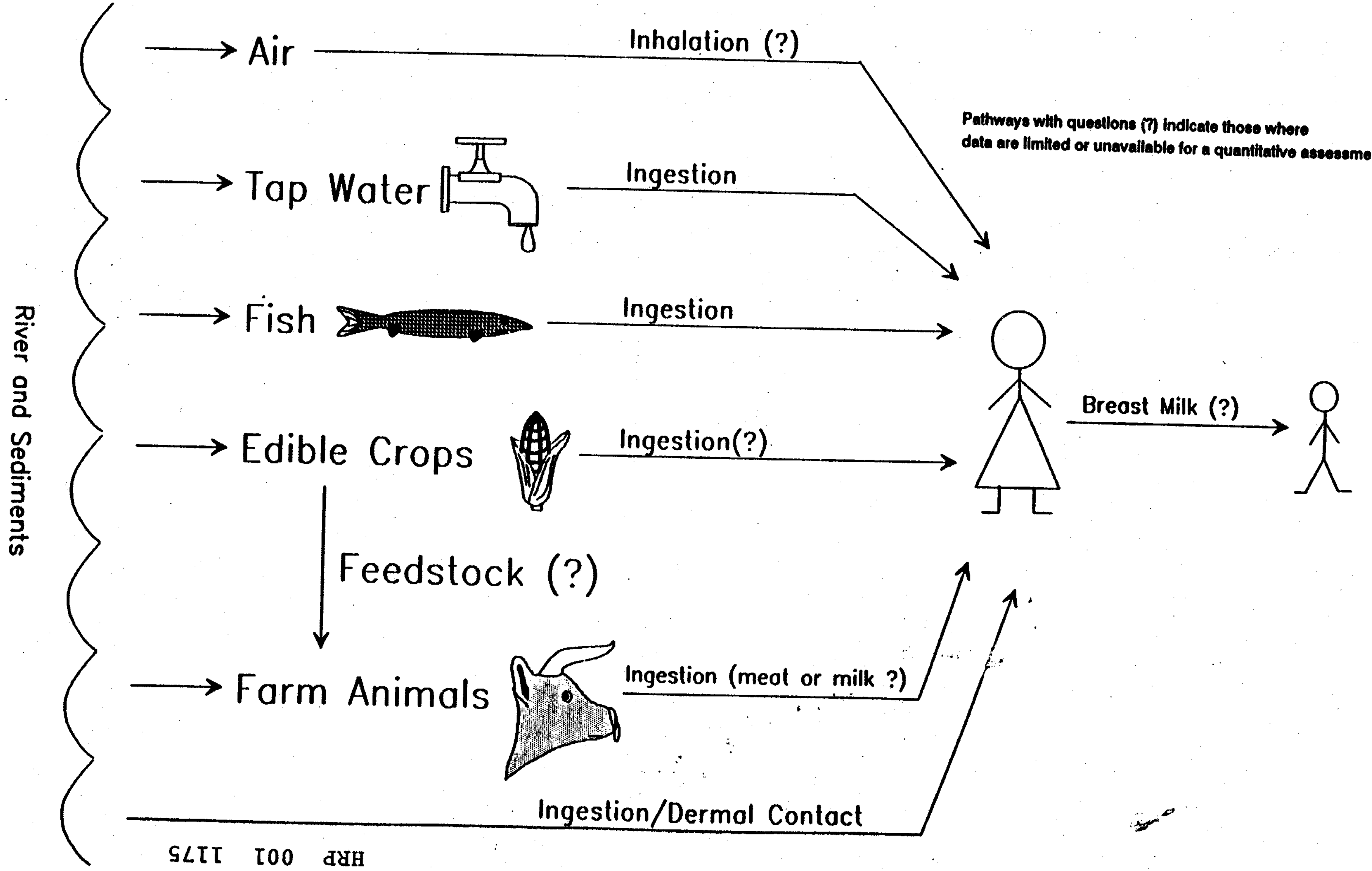
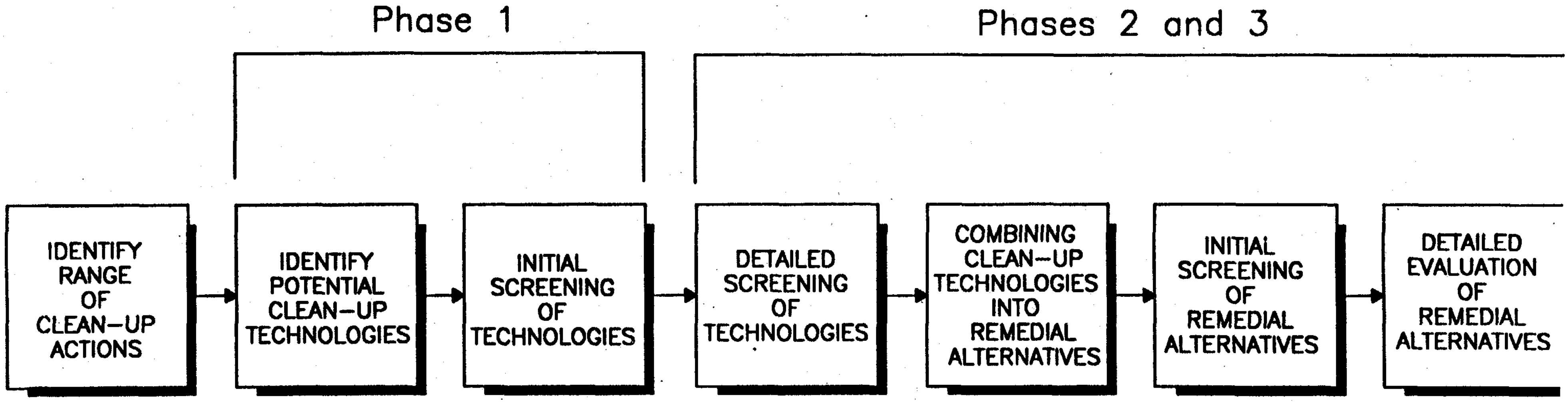


Figure B.6-1
Potential Exposure Pathways



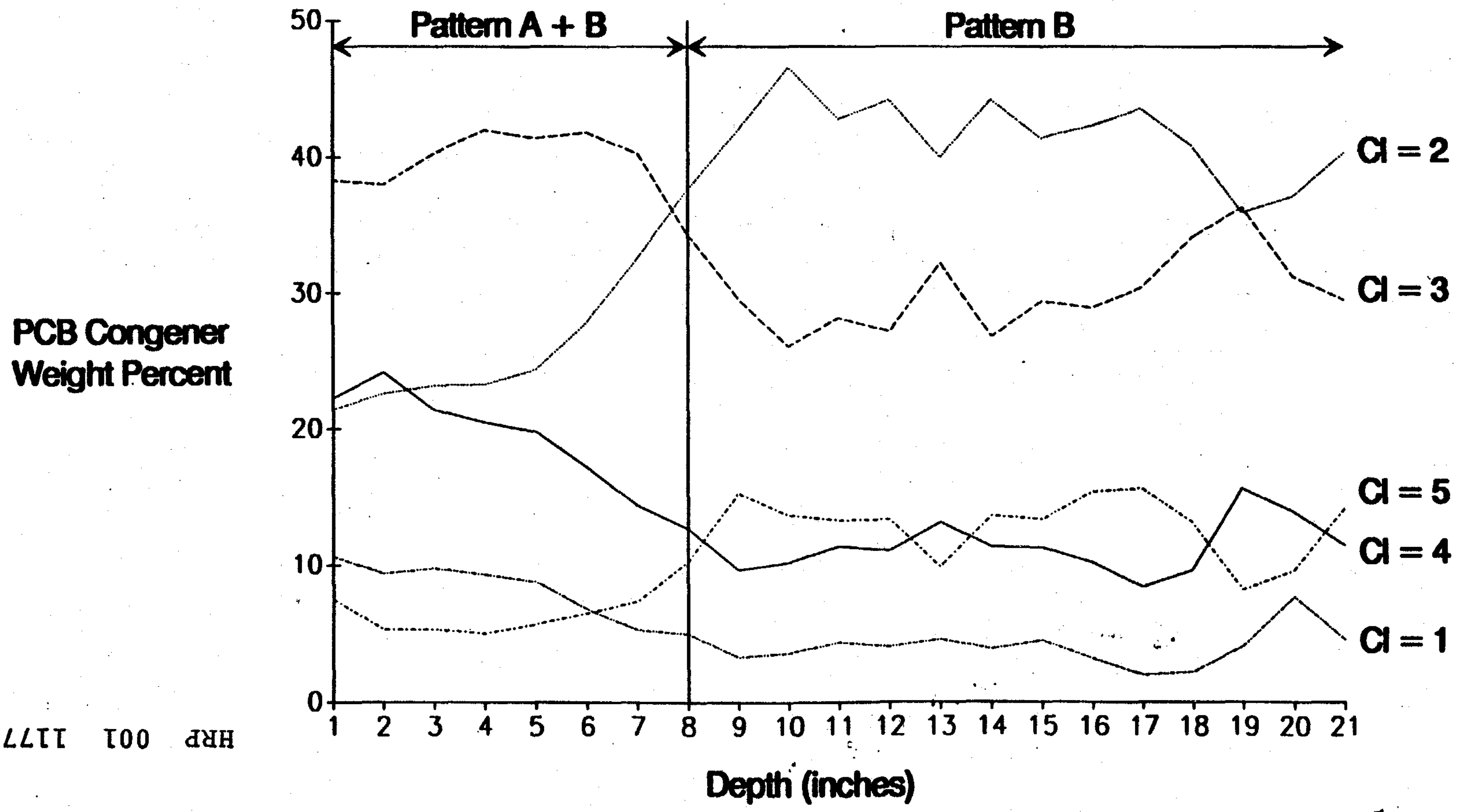
Pathways with questions (?) indicate those where data are limited or unavailable for a quantitative assessment.

Figure C.1-1
Overview of the FS Process



Source: USEPA (1988).

Figure C.4-1
PCB Content and Composition of Core 18-6
(Above Thompson Island Dam, January 1977)

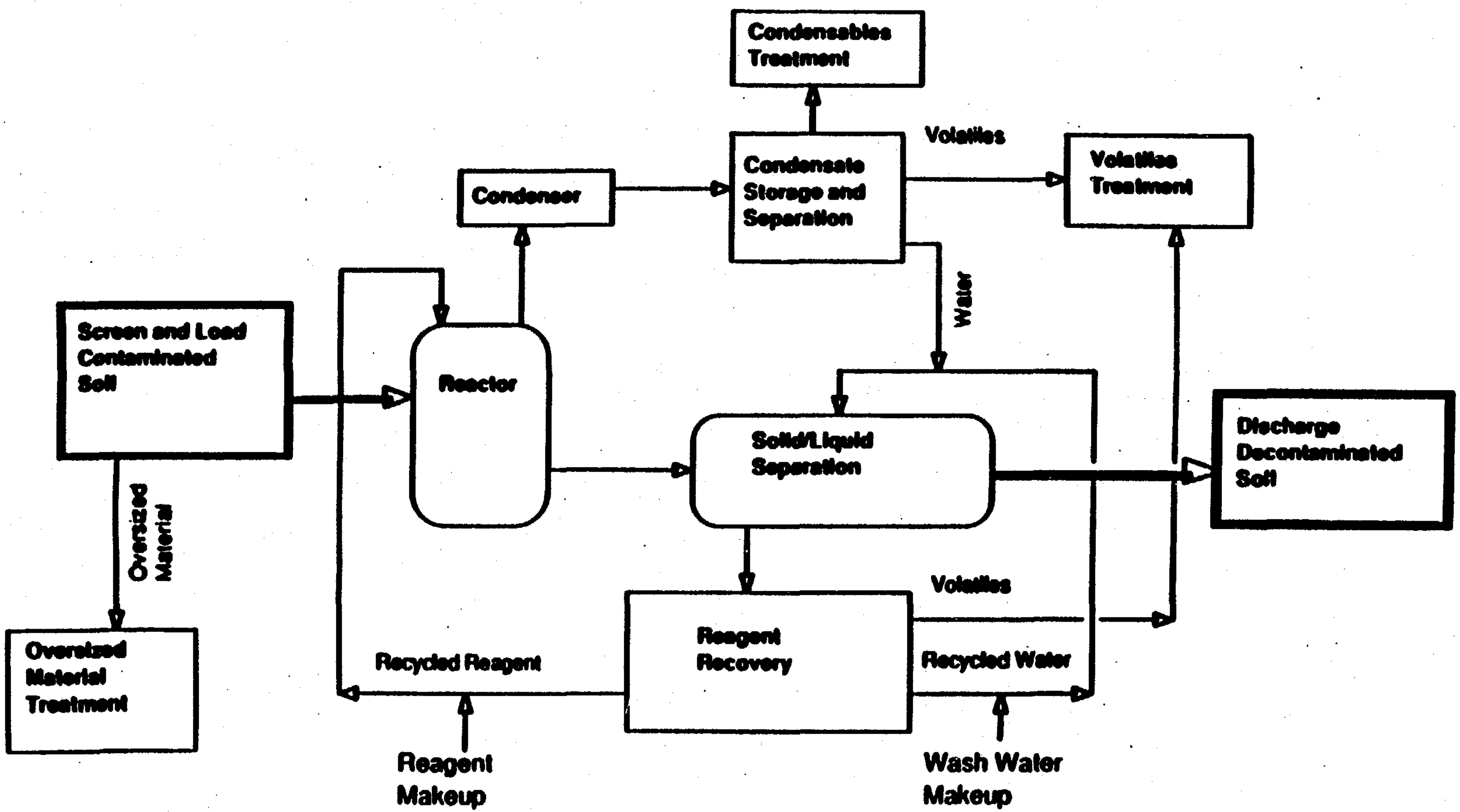


Note: Cl = Number of chlorines per biphenyl.
Plotted PCBs composited over one inch intervals.

Source: Adapted from Brown, Jr. et al. (1984).

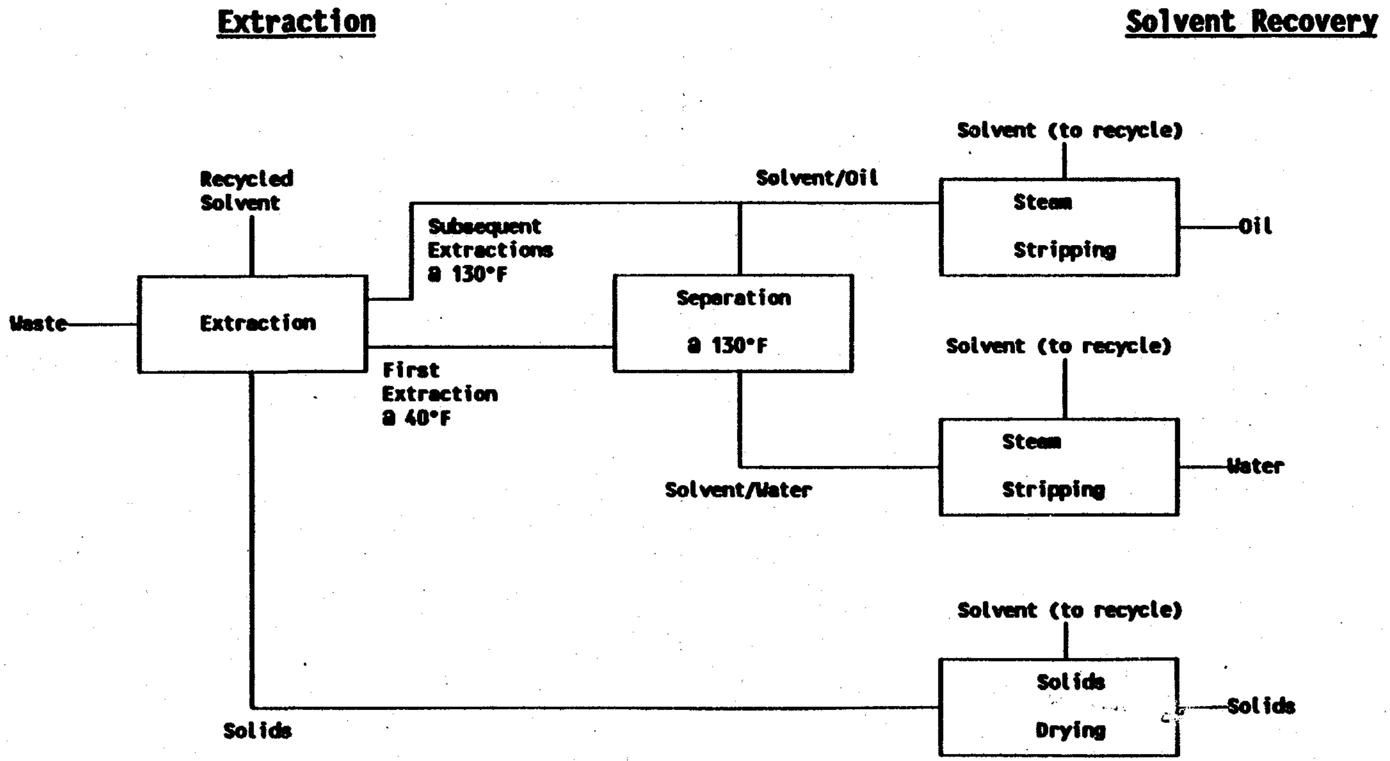
Figure C.4-2

KOHPEG Process Flow Diagram



Source: Galson Remediation Corporation (1991).

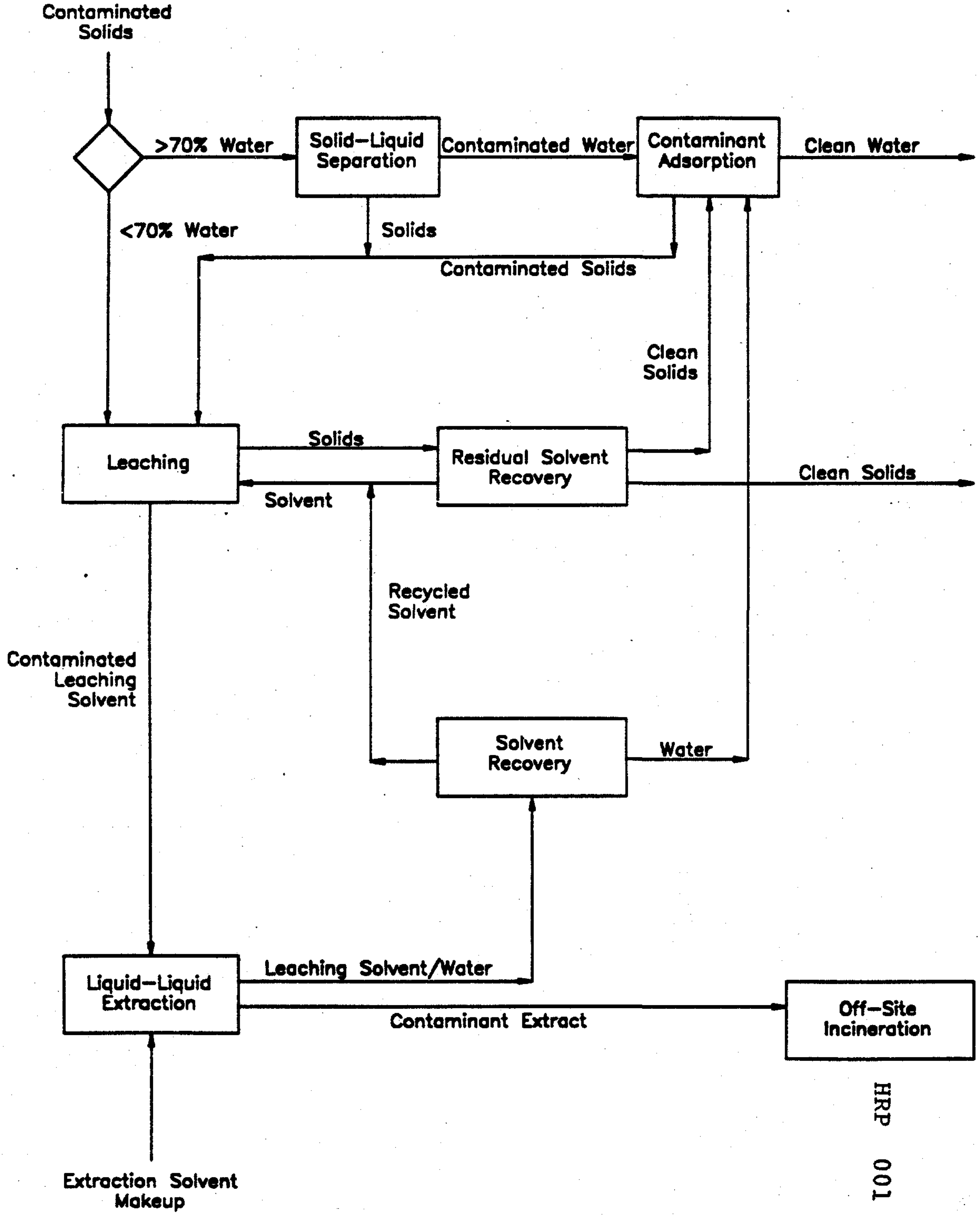
Figure C.4-3
B.E.S.T. Process



Source: Weimer (1990).

Figure C.4-4

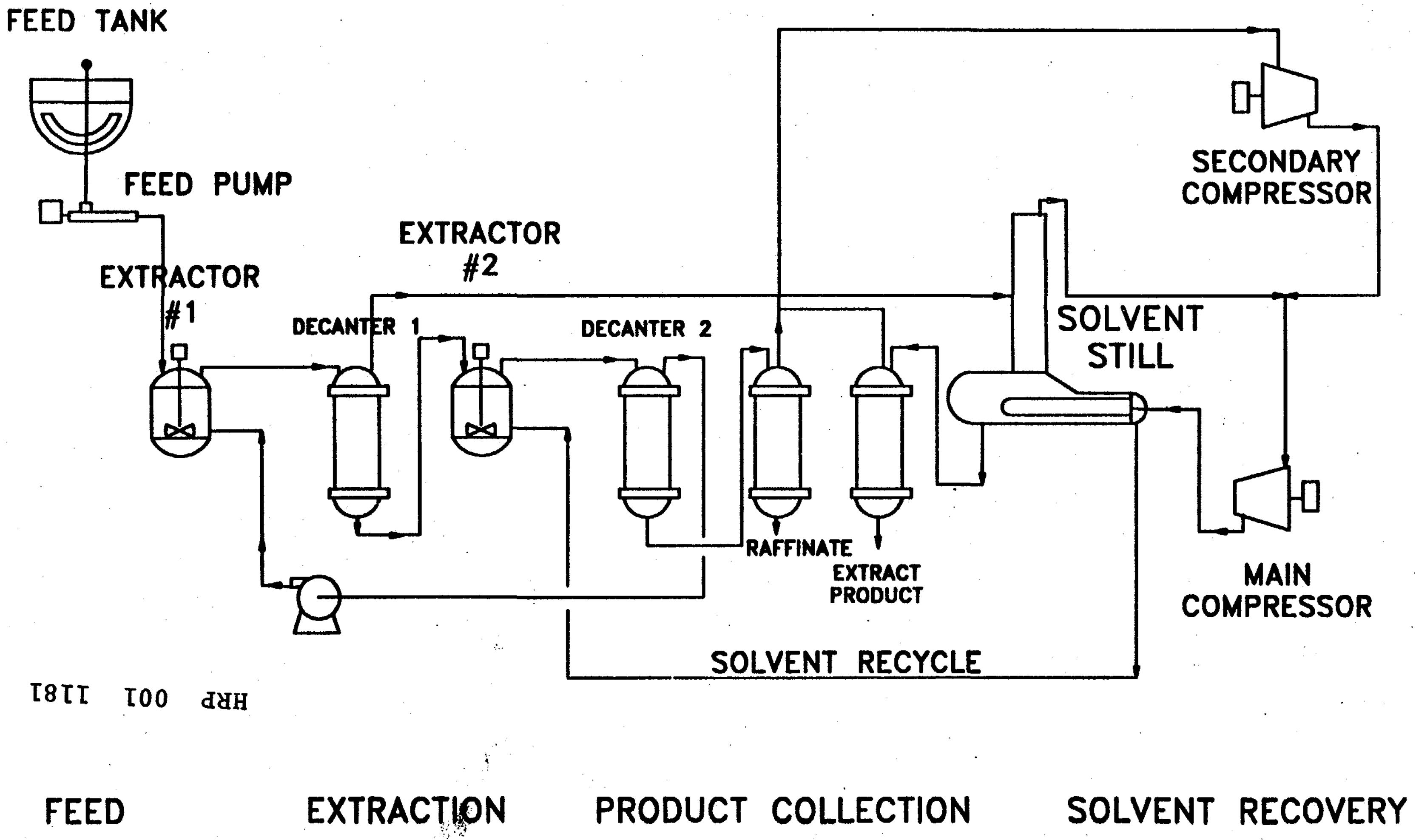
LEEP – Low Energy Extraction Process



Source: Steiner (1991).

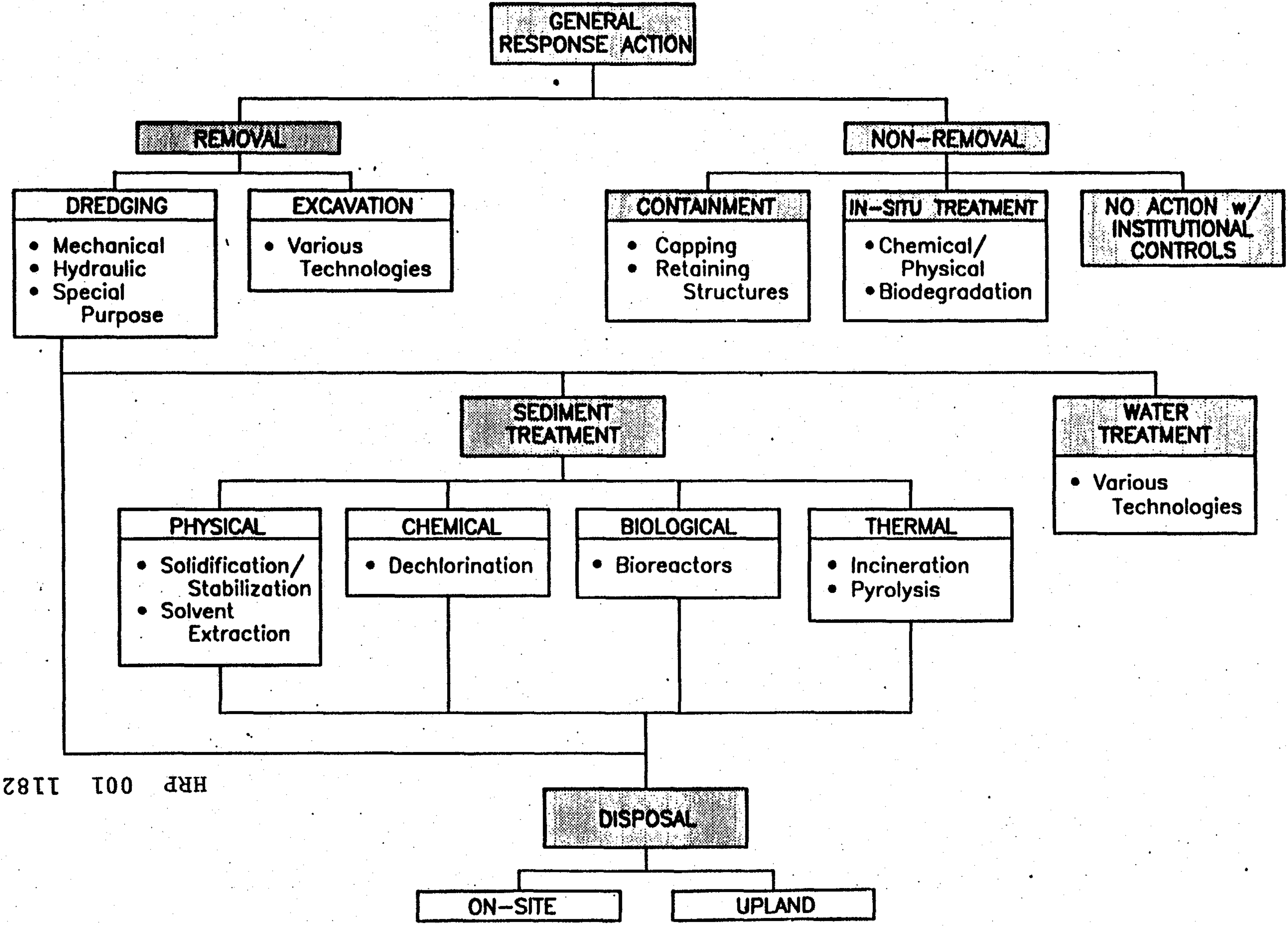
Figure C.4-5

Propane Extraction Process



Source: McGovern (1991).

Figure C.6-1
Response Actions and Associated Generic Technologies Retained for Further Analysis



Compiled from USEPA Guidance Material.

PLATES

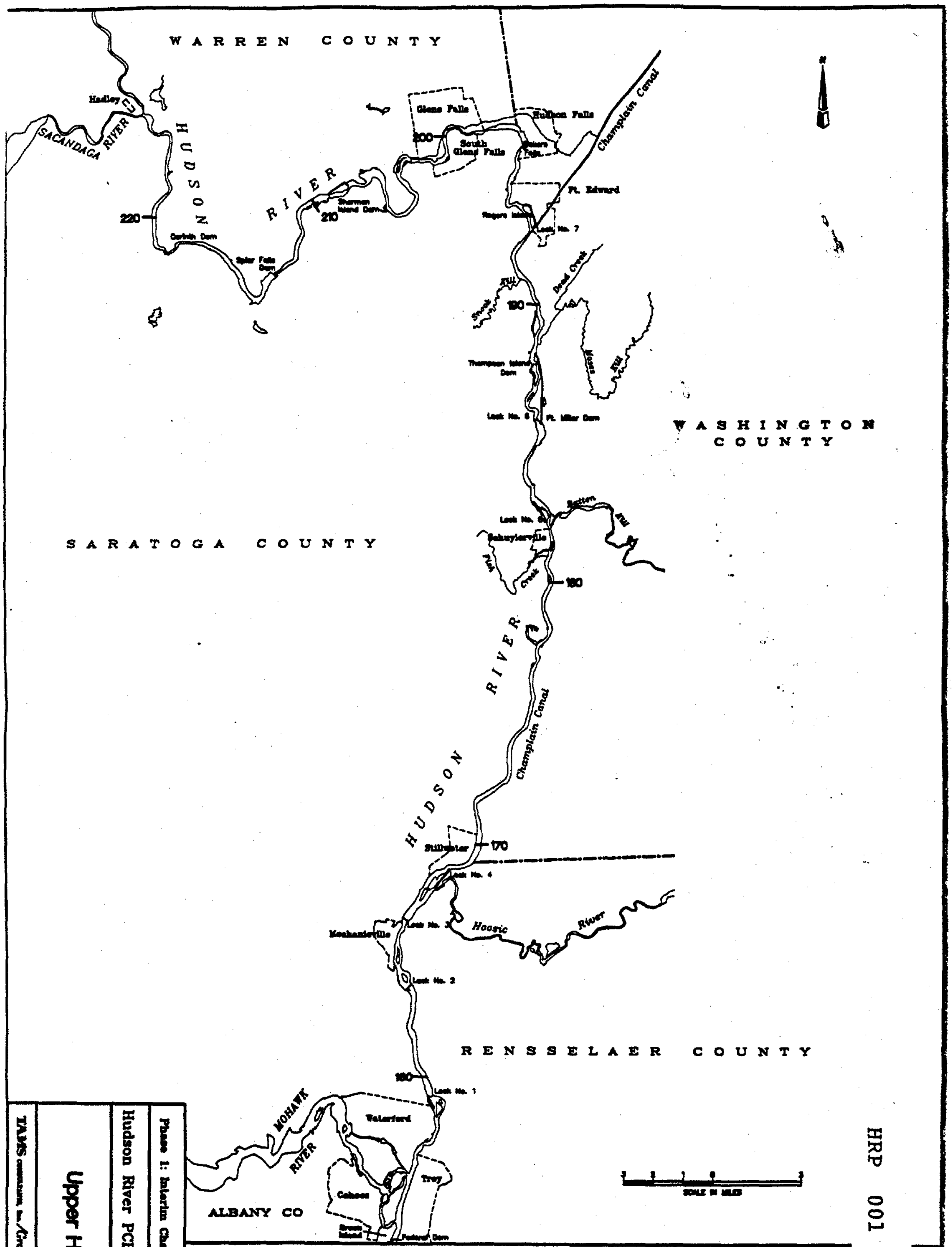
PHASE 1 REPORT

INTERIM CHARACTERIZATION AND EVALUATION

HUDSON RIVER PCB REASSESSMENT RI/FS

CONTENTS

PAGE INTENTIONALLY LEFT BLANK



Legend

180 River Mile

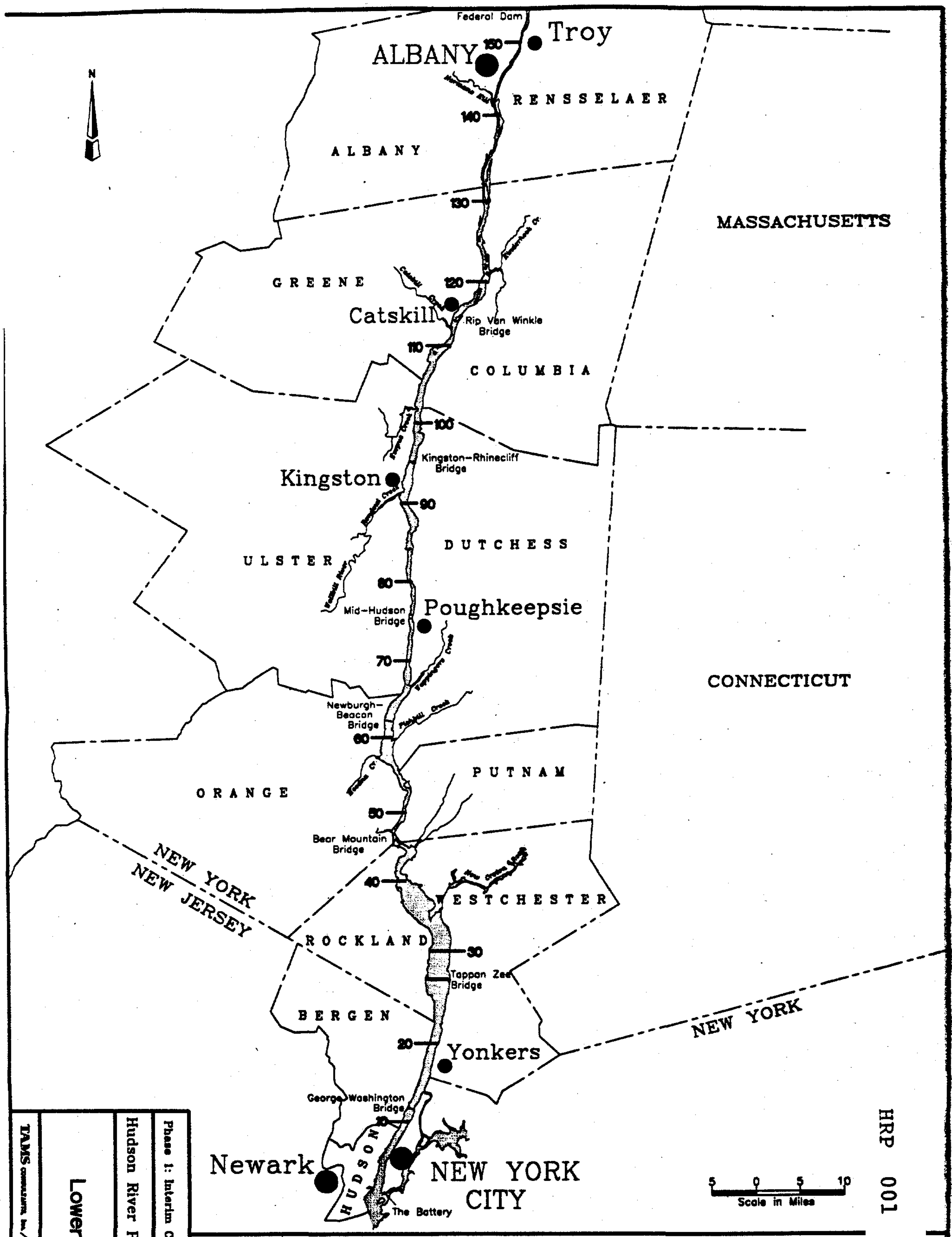
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson Site

TAMS Consultants, Inc./Gradient Corporation

Plate 1.2-1



Legend

100 River Mile

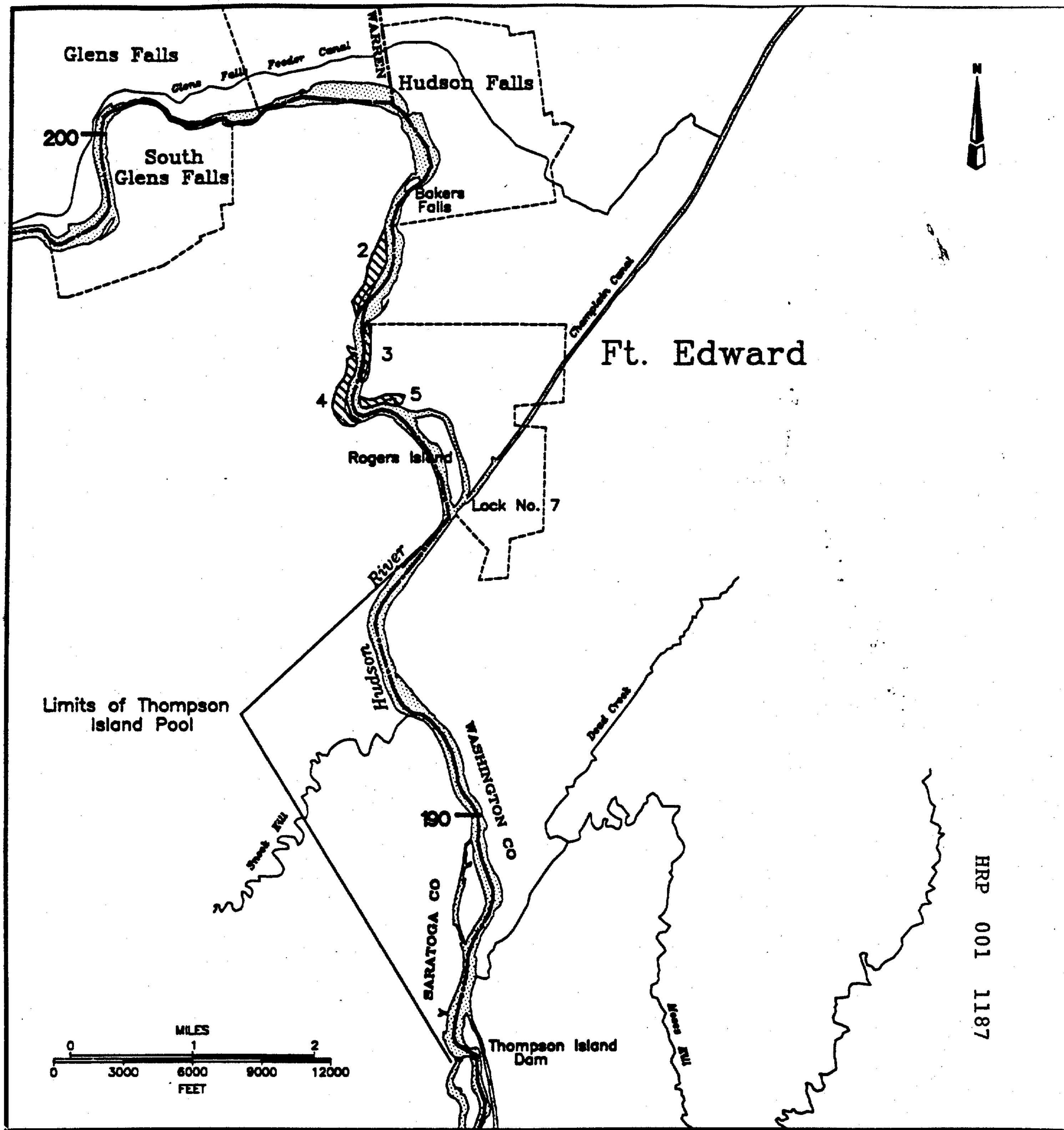
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Lower Hudson Site

TAMS Consultants, Inc./Gradient Corporation

Plate 1.2-2



Legend

3 Remnant Deposits

190 River Mile

Note: Remnant Deposit 1, eroded since 1984, is not shown.

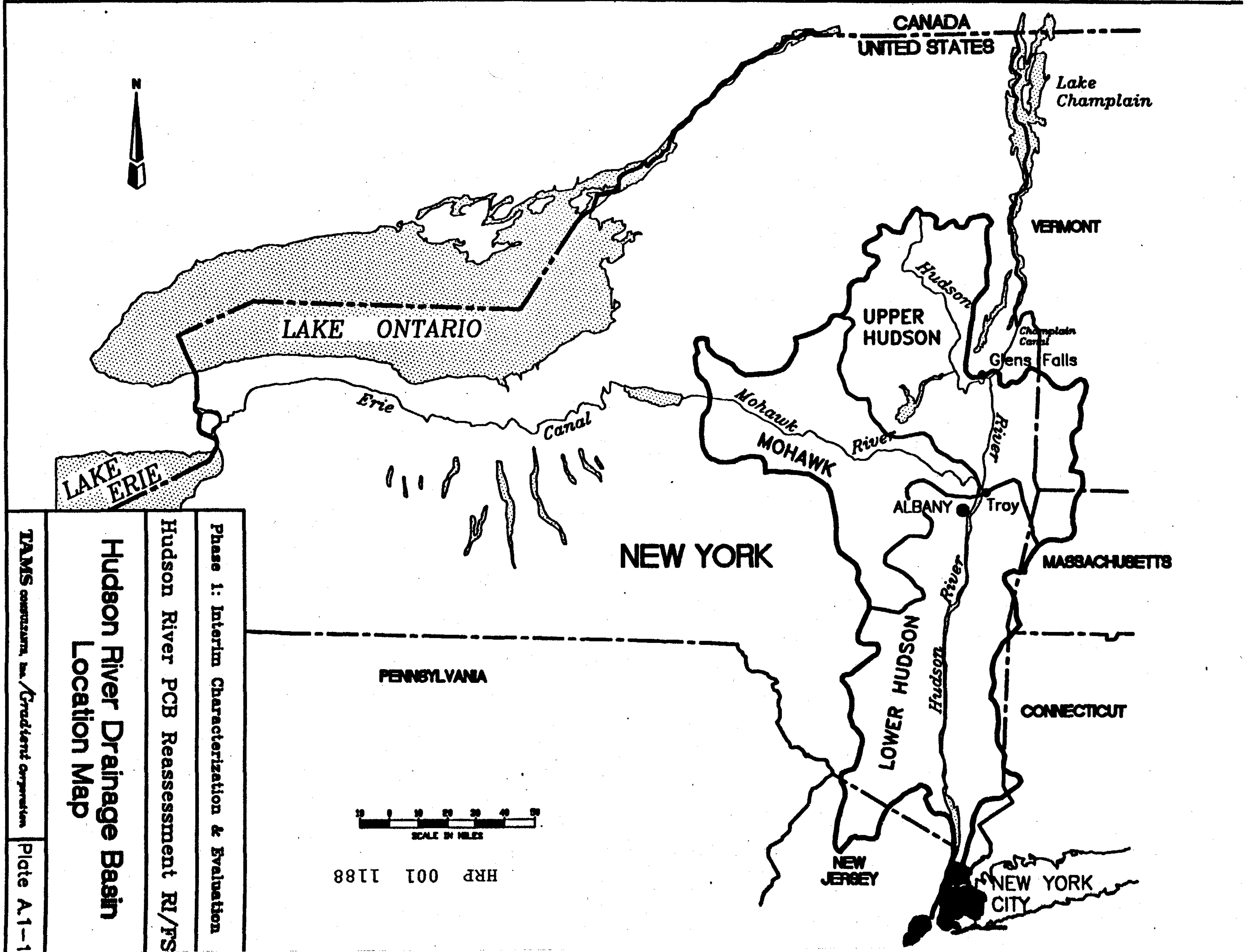
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/F

Thompson Island Pool and Remnant Deposits

TAMS Consultants, Inc./Gradient Corporation

Plate 1.2-3



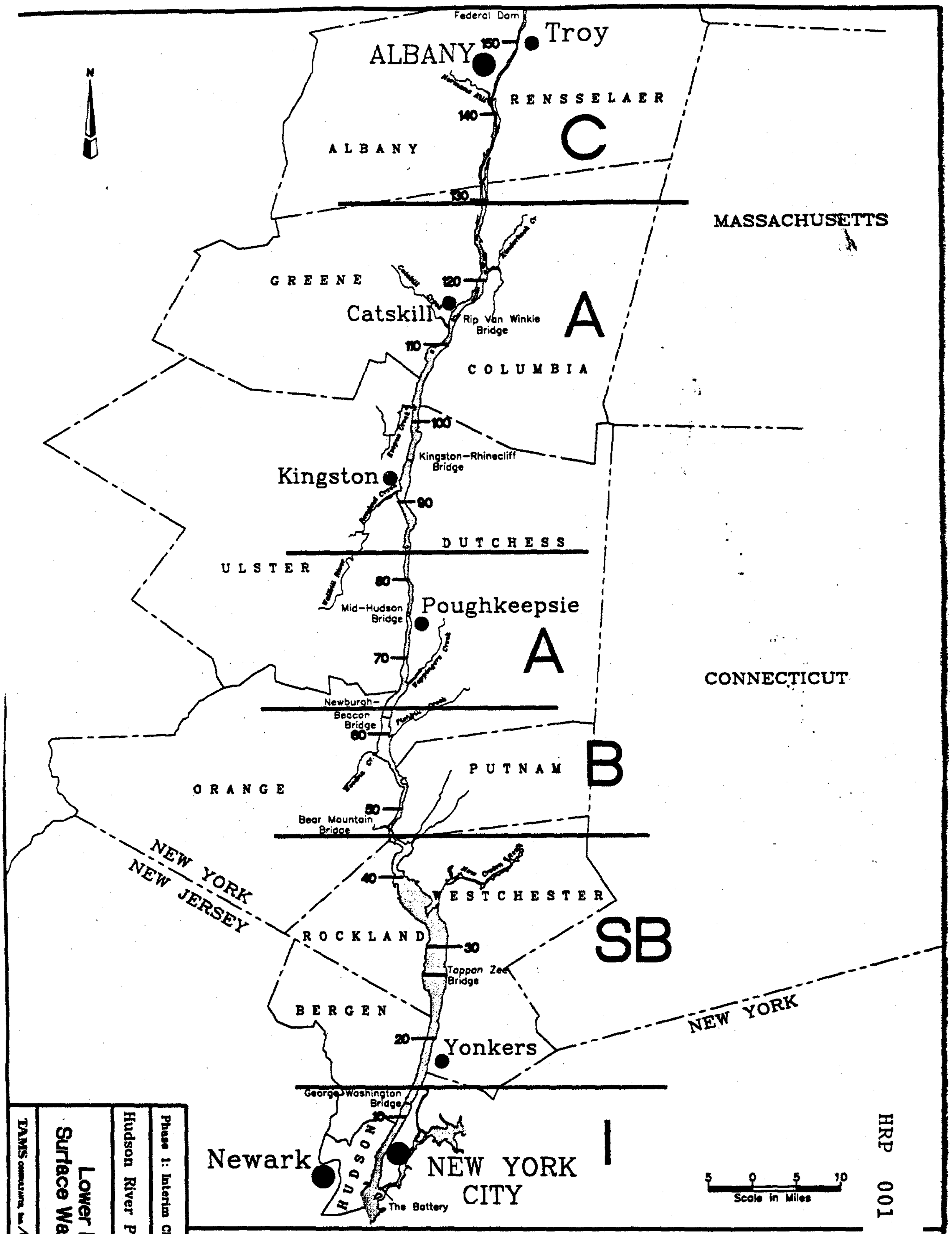
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Hudson River Drainage Basin Location Map

TAMS Consultants, Inc./Gradient Corporation

Plate A.1-1



Classification and Best Uses

A	Source of water supply for drinking, culinary or food processing purposes and any other usages.
B	Primary contact recreation and any other uses except source of water supply.
C	Waters are suitable for fishing and fish propagation; shall be suitable for primary and secondary contact recreation, unless other factors limit the use.
SB	Suitable for primary contact recreation, fishing (except shellfishing for market purposes) and fish propagation (saline).
I	Suitable for secondary contact recreation, fishing (except shellfishing for market purposes) and fish propagation (saline).

Source: 6NYCRR 700, et seq., 858 and 864.

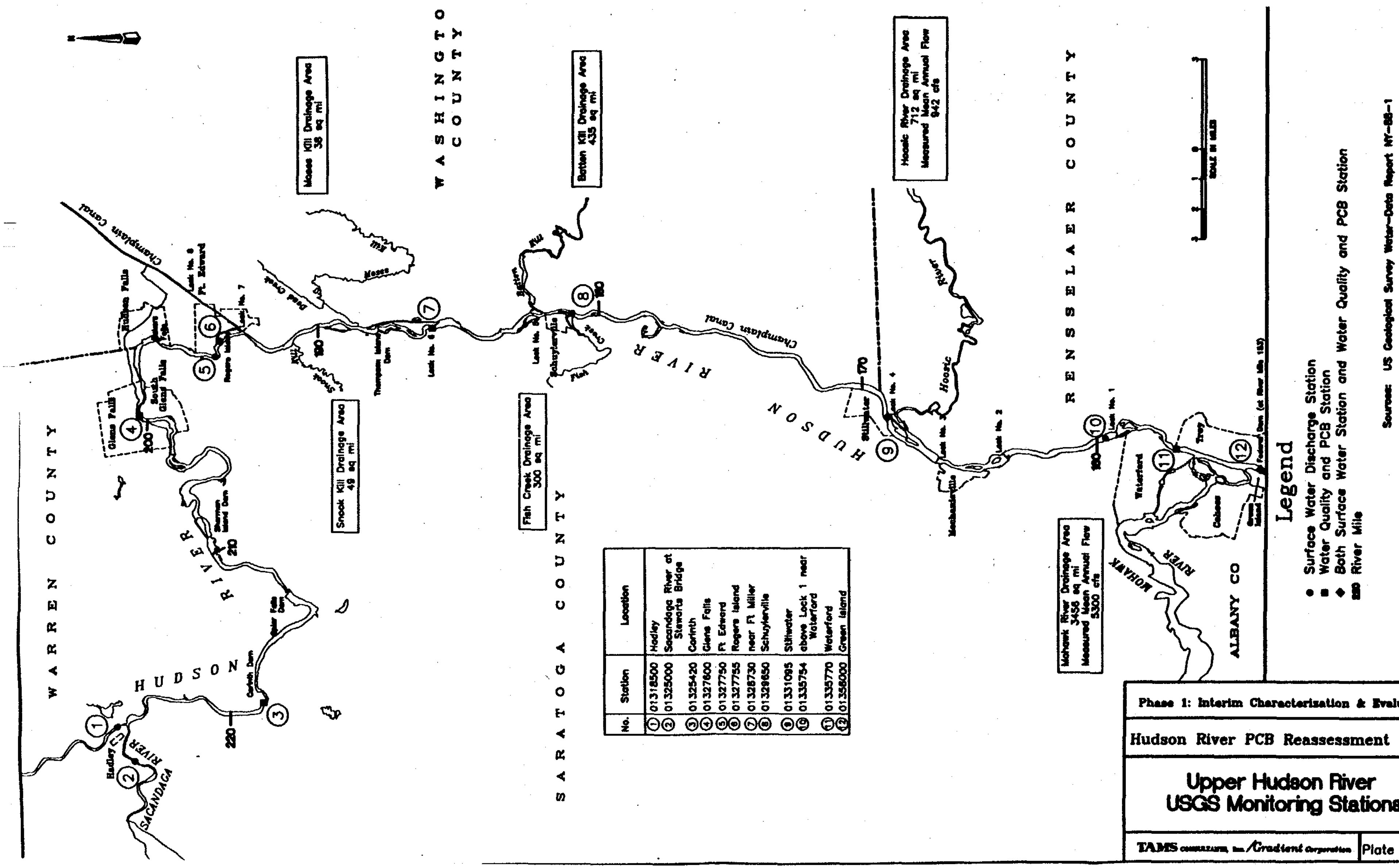
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Lower Hudson River Surface Water Classifications

TAMS Consultants, Inc./Gradient Corporation

Plate A.1-2



No.	Station	Location
①	01318500	Hadley
②	01325000	Sacandaga River at Stewarts Bridge
③	01325420	Corinth
④	01327600	Glens Falls
⑤	01327750	Ft Edward
⑥	01327755	Rogers Island
⑦	01328730	near Ft Miller
⑧	01329650	Schuylerville
⑨	01331095	Stillwater
⑩	01335754	above Lock 1 near Waterford
⑪	01335770	Waterford
⑫	01358000	Green Island

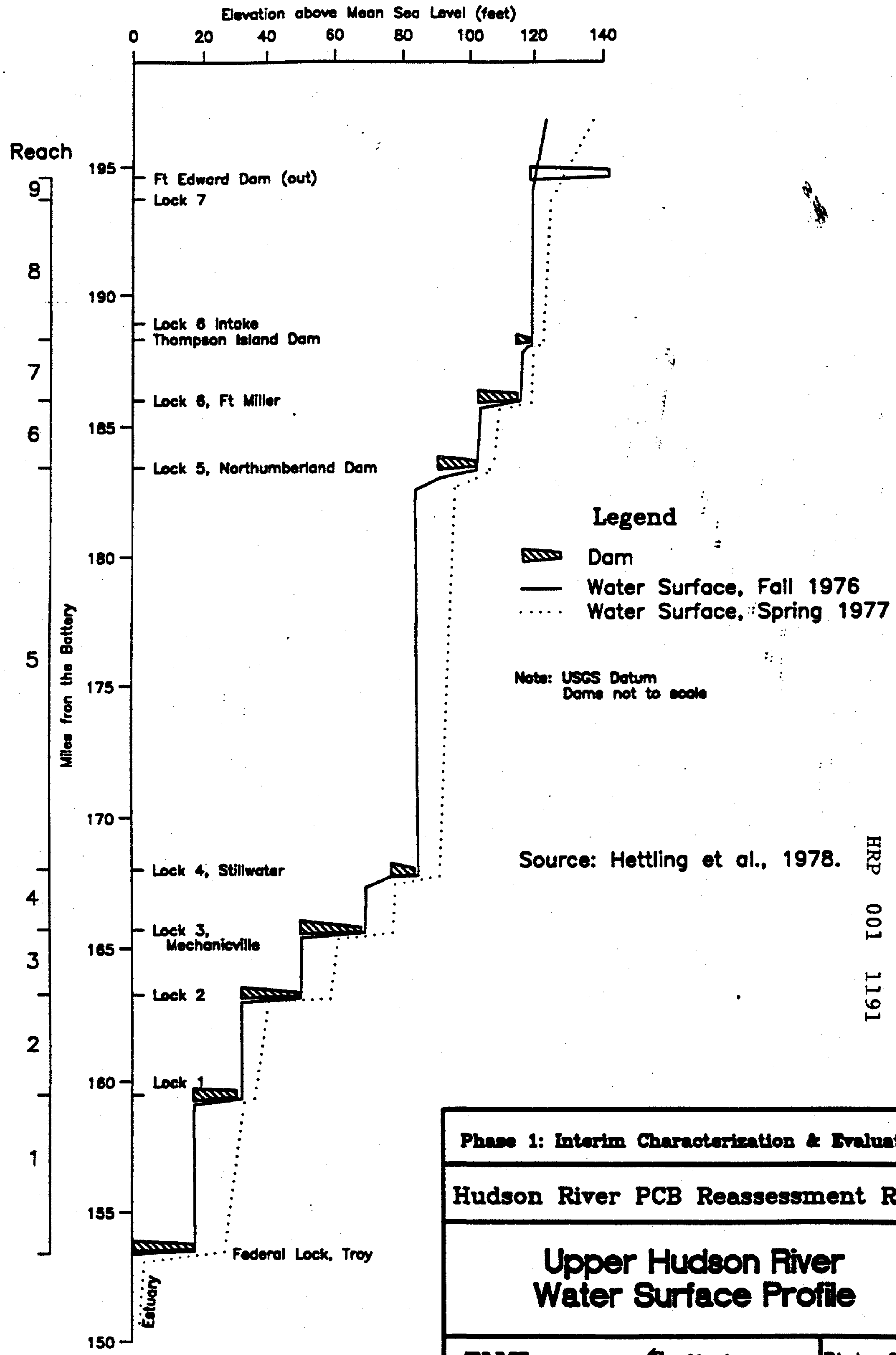
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson River USGS Monitoring Stations

TAMS Consultants, Inc./Gradient Corporation

Plate B.1-1



Source: Hettling et al., 1978.

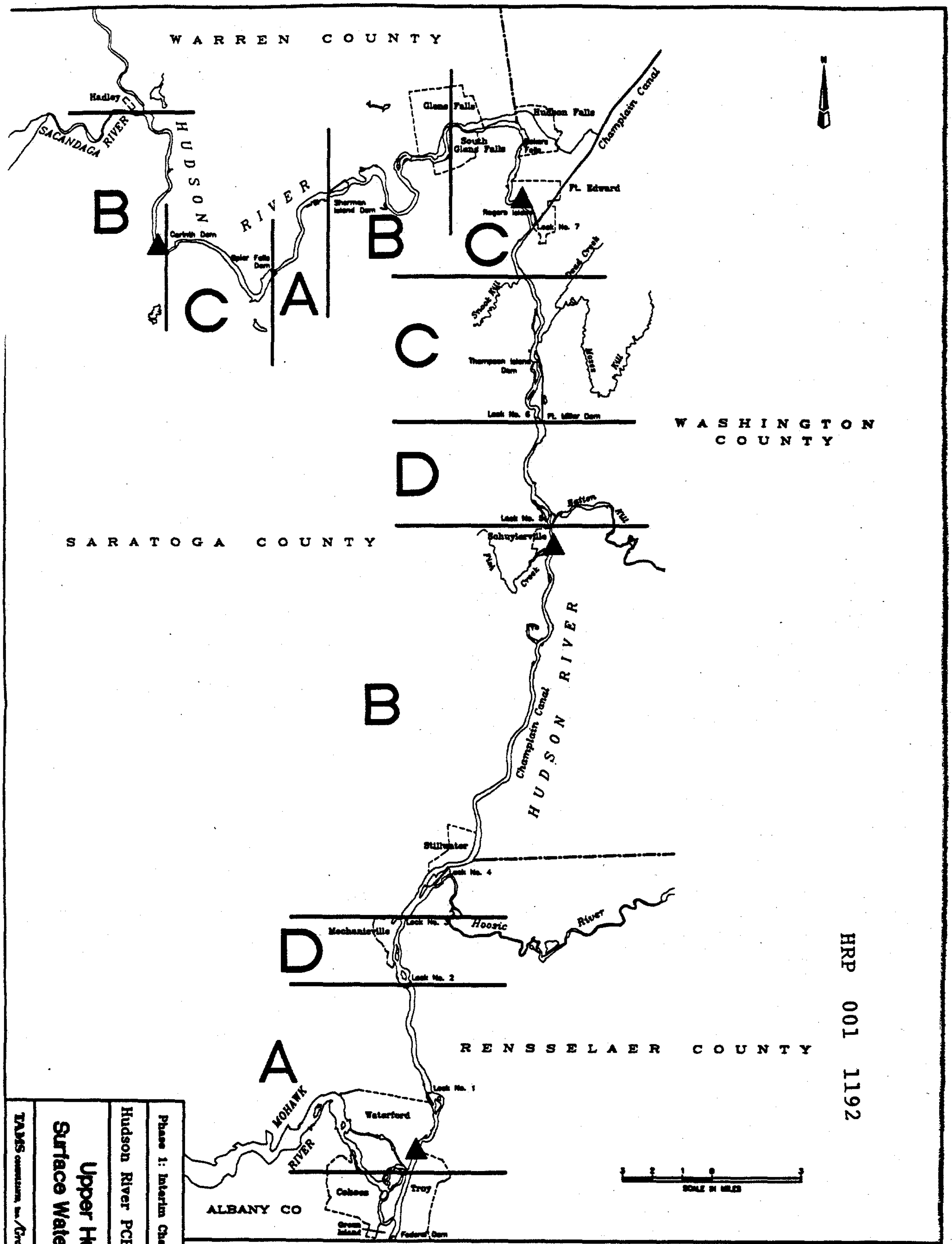
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson River Water Surface Profile

TAMS Consultants, Inc./*Gradient* Corporation

Plate B.1-2



Legend

▲ NYSDEC RIBS Station

Classification and Best Uses

- **A** Source of water supply for drinking, culinary or food processing purposes and any other usages.
- **B** Primary contact recreation and any other uses except source of water supply.
- **C** Waters are suitable for fishing and fish propogation; shall be suitable for primary and secondary contact recreation, unless other factors limit the use.
- **D** Suitable for fishing, not fish propogation; shall be suitable for primary and secondary contact recreation, unless other factors limit the use.
  Proposed for revision to Class C
  (NYSDEC, 1990)

Source: 5NYCRR 700, et seq., and 941.

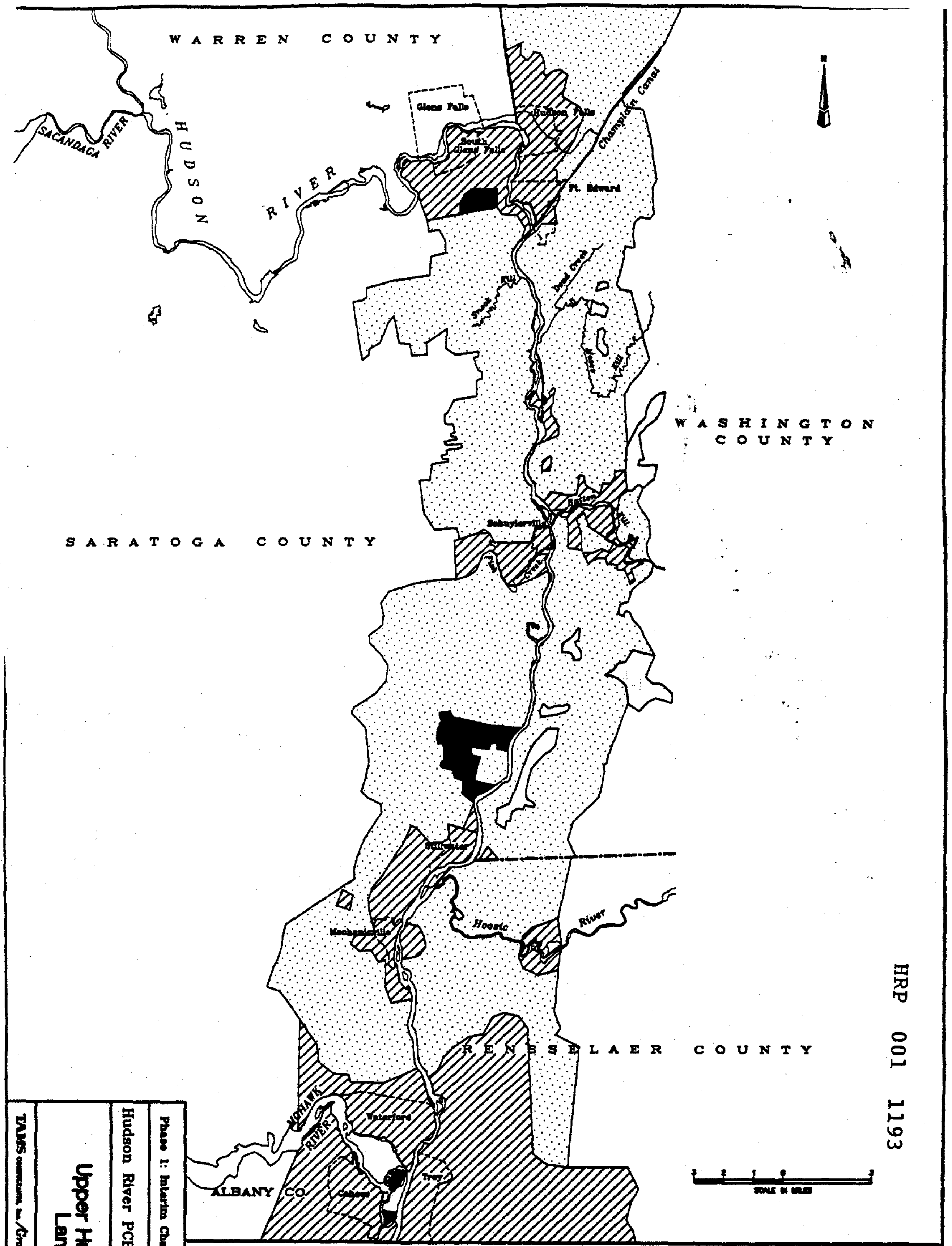
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson River
Surface Water Classifications

TAMS Consultants, Inc./Gradient Corporation

Plate B.1-



Legend

▨ Residential/Industrial/Commercial

░ Agricultural

☐ Forest

■ Recreational

Sources:

Land Use Development Plan for Saratoga County, February 1975.
Rensselaer County Master Plan, Land Use Map, November 1980.
Washington County Recommended Land Use Pattern Map, June 1976.

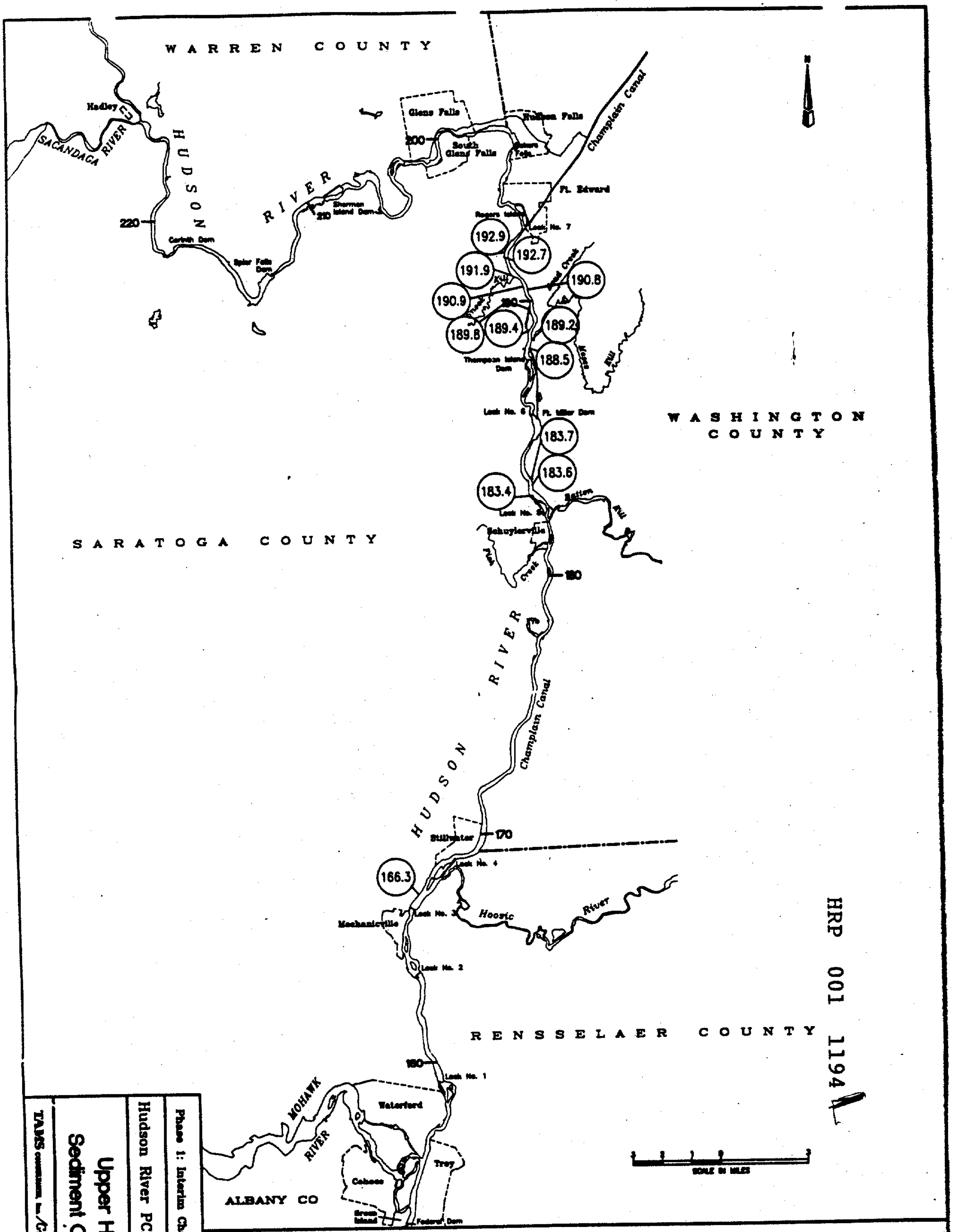
Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson River Land Use

TAMS Consultants, Inc./Gradient Corporation

Plate B.1-4



Legend

183.6 Core Location (Cores collected in 1983 and 1984)

160 River Mile

Source: Bopp et al, 1985.

Phase 1: Interim Characterization & Evaluation

Hudson River PCB Reassessment RI/FS

Upper Hudson River Sediment Core Locations

TAMS Consultants, Inc./Gradient Corporation

Plate B.3-1