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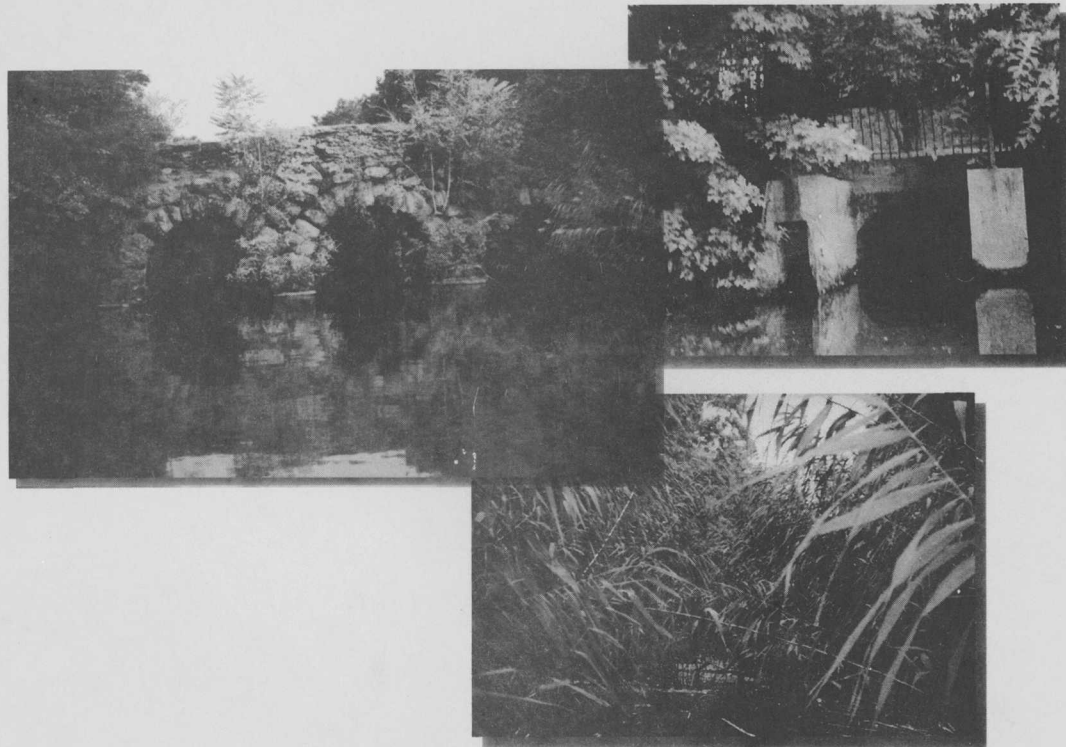
U.S. Department of the Interior
U.S. Geological Survey

Prepared in cooperation with the
Fenway Alliance,
U.S. Environmental Protection Agency,
Massachusetts Department of Environmental Management,
City of Boston, Department of Parks and Recreation,
Town of Brookline, Department of Public Works

Channel Morphology and Streambed-Sediment Quality in the Muddy River, Boston and Brookline, Massachusetts, October 1997

By ROBERT F. BREAUULT, PETER K. WEISKEL, and TIMOTHY D. McCOBB

Water-Resources Investigations Report 98-4027



Marlborough, Massachusetts
1998

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Tables to Accompany Water-Resources Investigations Report 98-4027

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SUPPLEMENTAL DATA

Concentrations of trace metals, organic compounds, total organic carbon, grain-size distributions, percentage of moisture, and toxicity characteristic leaching procedure were analyzed in streambed sediment samples collected at 15 sites in the Muddy River, Massachusetts, in October 1997. These data can be used in conjunction with those presented on the accompanying map report to assist in the design of a remedial program for Muddy River sediments such a program might consider including the advisability of sediment removal, and optimal disposal and re-use options for the dredged sediments.

REFERENCES USED IN SUPPLEMENTAL DATA TABLES

- American Public Health Association, American Water Works Association, and Water Pollution Control Association, 1995, Standard methods for the examination of water and wastewater, 19th ed: Washington, D.C., APHA (variously paginated)
- American Society for Testing and Materials, 1980, Natural Building Stones; Soil and Rock: Annual Book of ASTM Standards, part 19, Philadelphia, 634 p.
- U.S. Environmental Protection Agency, 1983, Methods for chemical analysis of water and wastes: U.S. Environmental Protection Agency, Cincinnati, Ohio, EPA-600/4-79-020, March 1979, Revised March 1983.
- _____, 1992, Test methods for evaluating solid waste, physical/chemical methods SW-846, 3rd ed., vol. IC, Chap. 8, sec. 8.4, rev. 0, final update, 7/92.
- _____, 1996, Test methods for evaluating solid waste, physical/chemical methods: SW-846, 3rd ed., Rev. 1 and 2, final update I, 7/92 and final update III, 12/96.

Table 1. Geographic distribution of trace metals and organic compounds in sediment cores, Muddy River, Massachusetts, October 1997

[All concentrations are in parts per million. **Trace metals:** Analyses were performed in accordance with sample preparation method 3050B and ICP method 6010B (U.S. Environmental Protection Agency, 1996, rev. 1 and 2). **Mercury:** Analyses were performed in accordance with method 245.5 (U.S. Environmental Protection Agency, 1983). **Organochlorine pesticides and polychlorinated biphenyls:** Sample preparation was done by the EPS Multi-Medial Consensus Organics Protocol-Revised 8/87. A macro-Florisor column was used for the sample cleanup. The analysis was carried out using high resolution capillary column chromatography. The 30-m dual capillary system consists of J&W DB-1701 and J&W DB-5, both with a 0.25 mm ID and a 0.25 micrometer film thickness (Peter Philbrook, Office of Measurement and Evaluation Division of the U.S. Environmental Protection Agency, Region I, written commun., 1997). **Polyaromatic and total petroleum hydrocarbons:** Sample analysis was performed according to EPA Region I Procedure for Polyaromatic Hydrocarbons in Sediment Samples PAHSELL1.SOP. The extracts were analyzed on the gas chromatograph/mass spectrometer using the selected ion monitoring Dick Siscanaw, Office of Measurement and Evaluation Division of the U.S. Environmental Protection Agency, Region I, written commun., 1997). D, duplicate split sample; No., number; e, estimated; <, less than method detection limit]

TRACE METALS								
Station No.	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
1	<40	3	122	203	919	1.4	29.3	574
2	<60	<2.7	41.3	240	657	1.2	29.2	527
3	<30	5	91.9	281	1,100	2	39.6	557
4	<30	<2.8	23.1	116	210	e6	18.4	225
5	<20	<2.7	49.5	148	532	1.4	24.8	276
5-D	<25	<3.0	56.7	169	590	1.3	27.8	310
6	<30	6	112	448	925	2.3	43.2	879
7	<60	<2.6	37.9	225	360	1	31.6	481
8	<30	<2.8	26.6	85.7	156	1.4	15.5	220
9	<45	8.3	344	710	1,320	6.3	70.6	1,070
10	<60	14.8	182	574	979	3.3	59.9	982
11	<25	6.9	66.3	389	1,270	2.8	37.3	778
12	<30	8.2	101	416	1,370	2.6	45.5	880
13	<35	8.9	78.6	478	1,410	3	44.6	882
14	<30	7.9	87.6	387	1,360	3.2	40.1	794
15	<50	9.7	78.2	605	1,260	2.5	44.8	965

Table 1. Geographic distribution of trace metals and organic compounds in sediment cores, Muddy River, Massachusetts, October 1997—Continued

Station No.	Aroclor								
	1016	1221	1232	1242	1248	1254	1260	1262	1268
1	<0.04	<0.04	<0.04	0.078	<0.04	<0.04	0.17	<0.04	<0.04
2	<.04	<.04	<.04	<.04	<.04	<.04	.11	<.04	<.04
3	<.04	<.04	<.04	.22	<.04	<.04	<.04	<.04	<.04
4	<.03	<.03	<.03	.081	<.03	<.03	.092	<.03	<.03
5	<.03	<.03	<.03	<.03	<.03	.14	.14	<.03	<.03
6	<.06	<.06	<.06	<.06	<.06	.43	.23	<.06	<.06
7	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04	<.04
8	<.04	<.04	<.04	<.04	<.04	.04	<.04	<.04	<.04
9	<.06	<.06	<.06	.33	<.06	1.3	.93	<.06	<.06
10	<.06	<.06	<.06	.16	<.06	.77	.45	<.06	<.06
11	<.04	<.04	<.04	.56	<.04	1.7	.71	<.04	<.04
12	<.04	<.04	<.04	.57	<.04	2.2	.62	<.04	<.04
13	<.05	<.05	<.05	.67	<.05	1.7	.73	<.05	<.05
14	<.04	<.04	<.04	.6	<.04	1.9	.58	<.04	<.04
14-D	<.04	<.04	<.04	.67	<.04	1.7	.6	<.04	<.04
15	<.05	<.05	<.05	.43	<.05	1.6	.59	<.05	<.05

POLYAROMATIC HYDROCARBONS

Station No.	Acenaphthene	Acenaphthylene	Anthracene	Benzo (a) anthracene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Benzo (ghi) perylene	Biphenyl
1	1.7	0.43	3.8	13	19	7	13	8.7	0.077
2	1.9	.53	5.5	19	26	8	17	11	.087
3	1.2	.23	3.3	8.5	11	4	7.8	5.1	.085
4	5.2	.43	9.2	24	30	8.6	23	13	.34
5	.54	.13	1.3	4.5	6.2	2.4	4.3	3	<.045
6	.57	.23	1.6	6.1	9.5	3.6	6.3	4.9	<.084
7	.76	.48	3.3	12	18	6.1	11	7.9	.08
8	.46	.39	1.7	7.9	18	6.2	11	8.5	.059
9	2.9	.81	8	18	26	9.4	18	13	.44
10	.38	.2	.66	3.8	7.8	2.3	4.6	3.8	<.086
11	1.9	.36	3.5	11	15	5.7	11	6.9	.12
12	1.1	.3	2.3	8.9	13	5.1	8.8	6.2	.099
13	1.4	.37	2.8	9.3	13	5.3	8.8	6.1	.14
14	.96	.33	2.2	7.7	11	4.6	8.1	5.6	.1
14-D	1.5	.44	3.1	10	16	6.2	11	7.5	.14
15	1.1	.32	2.3	8.5	13	4.3	8.7	5.8	.14

Table 1. Geographic distribution of trace metals and organic compounds in sediment cores, Muddy River, Massachusetts, October 1997—Continued

POLYAROMATIC HYDROCARBONS—Continued									
Station No.	Chrysene	Dibenzo (a,h) anthracene	Fluoranthene	Fluorene	"Indeon (1,2,3-cd) pyrene"	Naphthalene	2-Methyl-Napthalene	Phenanthrene	Pyrene
1	17	2.5	37	2.7	11	0.53	0.56	20	31
2	24	3.3	55	2.8	75	.41	.34	27	44
3	10	1.5	22	1.6	6.3	.5	.29	14	18
4	27	3.8	64	4.9	16	2.7	1.6	53	55
5	5.9	.8	12	.63	3.8	.17	.13	5.6	9.8
6	8.4	1.2	16	.99	5.7	.18	.43	8.2	14
7	16	2.2	32	1.3	10	.39	.28	11	26
8	12	2.2	19	.72	10	.27	.172	4.9	14
9	22	3	49	4	15	3	1.3	37	39
10	6.1	.86	10	.46	4.2	.27	.22	4.3	8.5
11	14	1.9	26	2.2	8.5	.49	1.2	20	23
12	12	1.5	23	1.5	7.3	.3	.34	14	20
13	12	1.5	24	2	7.3	.59	.55	16	21
14	10	1.5	20	1.3	6.7	.29	.43	11	18
14-D	14	2	25	1.9	9	.49	.51	17	23
15	11	1.5	21	1.5	7.1	.47	.51	13	19

Table 2. Geographic distribution of total petroleum hydrocarbon in sediment cores, Muddy River, Massachusetts, October 1997

[Total petroleum hydrocarbons: Concentrations are in parts per million. Standard analyses were performed in accordance with Methods for Chemical Analysis of Water and Wastes (U.S. Environmental Protection Agency, 1983), EPA-600/4/79-020, Test; Methods for Evaluating Solid Waste, SW-846 (U.S. Environmental Protection Agency, 1996), or standard methods for the examination of water and wastewater (American Public Health Association, 1995. D, duplicate split sample; No., number]

Station No.	Total petroleum hydrocarbon	Station No.	Total petroleum hydrocarbon
1	27,000	9	28,000
2	21,000	10	19,000
3	25,000	11	22,000
4	9,800	12	32,000
5	11,000	13	34,000
6	30,000	14	34,000
7	16,000	14-D	30,000
8	4,700	15	22,000

Table 3. Geographic distribution of total organic carbon in sediment cores, Muddy River, Massachusetts, October 1997

[All concentrations are in parts per million. Total organic carbon: Analyses were performed in accordance with New England Regional Laboratory Standard Operating Procedure (SOP) 14.1 using a Dohrmann DC-190 TOC Analyzer (William J. Andrade, Office of Measurement and Evaluation Division of the U.S. Environmental Protection Agency, Region I, written commun., 1997). D, duplicate split sample; No., number]

Station No.	Total organic carbon	Station No.	Total organic carbon
1	93,143	9	130,185
2	86,477	10	101,172
3	86,523	11	97,130
4	70,333	12	97,282
5	49,255	13	127,389
6	105,433	14	128,548
7	70,381	14-D	118,244
8	39,100	15	114,825

Table 4. Geographic distribution of grain size in sediment cores, Muddy River, Massachusetts, October 1997

[Grain-analysis was performed using ASTM Method D422-63 (American Society for Testing and Materials, 1980). Gravel: sieve number 4, greater than 4.75 millimeters. Coarse sand: Sieve number 10, less than 4.75 millimeters, greater than 2 millimeters. Medium sand: sieve number 40, less than 2.0 millimeters, greater than 0.425 millimeter. Fine sand: sieve number 200, less than 0.425 millimeter, greater than 0.075 millimeter. Silt and clay: less than 0.075 millimeter. D, duplicate split sample; No., number]

Station No.	Grain size (as percentage retained)				
	Gravel	Coarse sand	Medium sand	Fine sand	Silt and clay
1	0	0.4	12	28.1	57.4
2	1.3	8.67	29.3	23.4	37.4
3	.2	.4	10	37.7	51.7
4	1.9	6.6	34.7	33.5	23.3
5	2.1	7	24.5	39.7	26.7
6	.1	1.2	26.8	23.7	48.2
7	.4	5.4	31.6	24	61.4
8	6.4	11.5	44.6	22.9	14.6
9	0	4.1	31.1	22.2	42.6
10	.1	2.9	28.2	25.1	43.7
11	8	.2	10.1	60.3	29.4
12	.3	1.5	15.9	46	36.3
13	0	2.3	11.2	26.5	60
14	0	2.2	16.6	30.3	50.9
14-D	0	.5	16.3	31.2	52
15	0	.2	18.3	23.8	42.9

Table 5. Geographic distribution of percentage of moisture in sediment cores, Muddy River, Massachusetts, October 1997

[D, duplicate split sample; No., number]

Station No.	Percentage of moisture	Station No.	Percentage of moisture
1	58	9	73
2	56	10	71
3	56	11	54
4	43	12	61
5	45	13	64
6	70	14	58
7	58	14-D	59
8	50	15	40

Table 6. Geographic distribution of Toxicity Characteristic Leaching Procedure constituents in sediment cores, Muddy River, Massachusetts, October 1997

[Trace metals: Concentrations are in parts per million. TCLP was performed in accordance with method 1311 (U.S. Environmental Protection Agency, 1992). Sample preparation method 3010A and ICP method 6010B (U.S. Environmental Protection Agency 1996). Mercury: Only samples with a total mercury concentration of about 4 ppm or greater were analyzed. TCLP was performed in accordance with method 7470A (U.S. Environmental Protection Agency, 1996). D, duplicate split sample; No., number; <, less than method detection limit; --, not sampled]

Station No.	Silver	Arsenic	Barium	Cadmium	Chromium	Mercury	Lead	Selenium
1	<0.06	<0.25	0.43	<0.06	<0.03	--	1.1	<0.20
2	<0.06	<.25	.56	<0.06	<0.03	--	1.4	<.20
3	<.06	<.25	.54	<.06	<.03	--	2.2	<.20
4	<.06	<.25	.4	<.06	<.03	<0.50	.76	<.20
5	<.06	<.25	.44	<.06	<.03	--	1.7	<.20
5-D	<.06	<.25	.47	<.06	<.03	--	1.8	<.20
6	<.06	<.25	.5	<.06	<.03	--	.79	<.20
7	<.06	<.25	.45	<.06	<.03	--	.28	<.20
8	<.06	<.25	.29	<.06	<.03	--	.7	<.20
9	<.06	<.25	.53	.06	<.03	<.50	1.8	<.20
10	<.06	<.25	.45	.14	<.03	<.50	.87	<.20
11	<.06	<.25	.46	<.06	<.03	--	1.2	<.20
12	<.06	<.25	.5	<.06	<.03	--	1.4	<.20
13	<.06	<.25	.51	<.06	<.03	--	1.3	<.20
14	<.06	<.25	.61	<.08	<.03	--	2.9	<.20
15	<.06	<.25	.64	<.10	<.03	--	2.8	<.20