

Tables

Table 2-1
Buffalo River AOC Beneficial Use Impairment Indicators
Buffalo, NY

Impairment Indicator	1989 Status	2005 Status	2008 Status	Delisting Criteria/Restoration Target(s)
1. Restrictions on Fish & Wildlife Consumption	Impaired	Impaired	Impaired	1) There are no AOC-specific fish and wildlife consumption advisories by New York State (e.g. carp for PCBs); AND 2) When contaminant levels due to watershed or in-place contaminants in resident native and exotic fish and wildlife populations that could be consumed do not exceed current NYS standards.
2. Tainting of Fish & Wildlife Flavor	Likely Impaired	Likely Impaired	Impaired	1) No exceedances of water quality standards or criteria for compounds (specifically phenols) associated with tainting within the AOC; AND 2) No reports of tainting from fish and wildlife officials or informed public observers
3. Degradation of Fish & Wildlife Populations	Likely Impaired	Likely Impaired	Impaired	<p>Fish Populations</p> <p>1) Fish surveys find that the resident fish community is fair to good based on applicable fish community biological indices (IBI) for two consecutive surveys; AND</p> <p>2) The frequency of occurrence of DELT anomalies in bottom-dwelling fish does not exceed recommended levels; AND</p> <p>3) Whole-body concentrations of Endocrine Disruptors (including but not limited to: PCBs, dioxins, and pesticides) in bottom dwelling fish do not exceed critical tissue concentrations for adverse effects on fish; AND</p> <p>4) Water quality measures meet state standards for at least a Class C river.</p> <p>Wildlife Populations</p> <p>1) Wildlife surveys find that diversity and abundance of birds, mammals, reptiles, and amphibians in the AOC is comparable to a suitable reference site; AND</p> <p>2) No change from September 2008 criteria; AND</p> <p>3) Wildlife assessments confirm no significant toxicity from water column or sediment contaminants; AND</p> <p>4) Diversity of amphibian populations in AOC pocket wetlands is similar to upstream and/or Tift marsh levels; AND</p> <p>5) Diversity of benthic populations in the AOC is comparable to upstream levels.</p>
4. Fish Tumors and Other Deformities	Impaired	Impaired	Impaired	1) Survey data confirm the absence of neoplastic liver tumors in bullheads (as compared to control site) for two consecutive sampling events; AND 2) Contaminants in water and sediments in the AOC do not exceed NYS standards
5. Bird or Animal Deformities or Reproductive Problems	Likely Impaired	Likely Impaired	Impaired	1) Deformities or reproductive problem rates are not statistically different than inland background levels as reported from wildlife officials or trained observers; AND 2) Concentrations of bioaccumulative chemicals in fish do not exceed levels associated with reproductive problems in piscivorous wildlife; AND/OR 3) Concentrations in sediment do not exceed levels associated with benthic impairment that could result in reproductive problems in omnivorous and benthivorous birds and wildlife.
6. Degradation of Benthos	Impaired	Impaired	Impaired	1) Benthic macroinvertebrate communities are "non-impacted" or "slightly impacted" according to NYSDEC indices for two separate sampling events; OR 2) In the absence of conclusive community structure data, the toxicity of sediment-associated contaminants is not statically higher than controls.
7. Restrictions on Dredging	Impaired	Impaired	Impaired	1) There are no restrictions on routine commercial or recreational navigation dredging by the USACE or another entity across any part of the AOC, such that no special management measure or use of a confined disposal facility are required from the dredged material due to chemical contamination.
8. Eutrophication or Undesirable Algae	Not Impaired	Unknown	Not Impaired	None
9. Restrictions on Drinking Water Consumption or Taste and Odor Problems	Not Impaired	Not Applicable	Not Applicable	Not applicable
10. Beach Closings	Not Impaired	Not Applicable	Not Applicable	Not applicable

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Buffalo River AOC Beneficial Use Impairment Indicators
Buffalo, NY**

Impairment Indicator	1989 Status	2005 Status	2008 Status	Delisting Criteria/Restoration Target(s)
11. Degradation of Aesthetics	Not Impaired	Impaired	Impaired	1) Minimize debris, general litter, floatables, or contaminants in the river or shoreline via point source or non-point sources through the implementation of Best Management Practices; AND 2) Organic, chemical, and biological contaminants should not persist in concentrations that can be detected as visible film, sheen, or discoloration on the surface, detected by odor, or form deposits on shorelines and bottom sediments.
12. Added Costs to Agriculture and Industry	Not Impaired	Not Impaired	Not Applicable	Not applicable
13. Degradation of Phytoplankton and Zooplankton Populations	Not Impaired	Not Impaired for Zooplankton; Unknown for Phytoplankton	Not Impaired	None
14. Loss of Fish & Wildlife Habitat	Impaired	Impaired	Impaired	<p>Restore Habitat Connectivity</p> <p>1) A minimum 100-foot buffer of native vegetation on new development on each riverbank is maintained and enforced upstream from the Ohio Street Bridge.</p> <p>2) Significant floodplain, wetland, or riparian habitat areas in the AOC are protected and/or restored,</p> <p>3) A minimum 25% of the AOC shoreline is restored to natural slope, shallows, and aquatic (emergent and submerged) native vegetation, including naturalizing areas of the City Ship Canal shoreline.</p> <p>Improve Stream Quality Index scores from "poor" to at least "good"</p> <p>1) Basic water quality measures (based on NYS RIBS) consistently meet state standards for at least a Class C river.</p> <p>2) Aquatic habitat scores are fair to good AND/OR the lower Buffalo River is no longer listed as "stressed" for aquatic life on the NYS Priority Waterbodies List.</p> <p>Restore hydrologic function to support habitat and species goals listed in BUI #3</p> <p>1) Reduce navigational dredging in the AOC to support aquatic habitat and species goals (BUI #3) AND/OR</p> <p>2) Restore and protect natural flows, meanders, and stream habitat in River Corridor opportunity areas upstream of the AOC.</p>

Source: BNR 2008, Ecology and Environment 2008

AOC - Area of Concern
BUI - Beneficial use impairments
PCB - Polychlorinated biphenyl

Table 2-2a
Total PAH Surface Sediment Concentrations, Summary Statistics
Buffalo River, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	6	6	3.9	5.9	4.6	0.75	4.6
River Mile 0.5 - 1.0	33	33	2.0	48	8.4	10	6.1
River Mile 1.0 - 1.5	24	20	0.66	23	6.5	4.3	5.4
River Mile 1.5 - 2.0	24	23	0.66	15	5.7	3.0	5.0
River Mile 2.0 - 2.5	22	22	3.3	18	5.3	3.1	4.8
River Mile 2.5 - 3.0	26	26	3.2	39	6.9	7.1	5.6
River Mile 3.0 - 3.5	26	26	2.5	47	9.9	9.6	7.5
River Mile 3.5 - 4.0	41	41	3.5	91	16	22	8.7
River Mile 4.0 - 4.5	30	29	2.5	150	27	40	12
River Mile 4.5 - 5.0	35	35	2.5	85	13	21	6.9
River Mile 5.0 - 5.5	34	34	1.1	280	13	48	5.0
River Mile 5.5 - 6.0	23	23	1.2	10	5.5	2.3	5.0
River Mile 6.0 - 6.2	13	13	1.5	16	4.0	4.0	3.1
River Mile 6.2- 6.5, Upstream of the AOC	1	1	18	18	18	-	18
River Mile 6.5 - 7.0, Upstream of the AOC	1	1	3.8	3.8	3.8	-	3.8
Buffalo Harbor, Downstream of the AOC	9	9	1.8	42	7.1	13	3.6
City Ship Canal	59	56	1.7	300	21	41	11
Cazenovia Creek	2	2	2.1	3.4	2.8	0.94	2.7

mg/kg - milligrams per kilogram

Table 2-2b
Total PAH Subsurface Sediment Concentrations, Summary Statistics
Buffalo, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	12	12	3.1	41	15	16	9.3
River Mile 0.5 - 1.0	32	32	3.8	82	15	18	9.8
River Mile 1.0 - 1.5	38	36	0.62	110	23	27	12
River Mile 1.5 - 2.0	16	16	0.64	160	51	49	24
River Mile 2.0 - 2.5	21	21	3.1	58	12	16	7.0
River Mile 2.5 - 3.0	36	36	3.5	330	26	57	11
River Mile 3.0 - 3.5	25	25	2.2	42	11	9.9	8.0
River Mile 3.5 - 4.0	90	89	2.1	450	47	80	14
River Mile 4.0 - 4.5	62	60	2.4	410	56	90	18
River Mile 4.5 - 5.0	66	66	2.0	1800	120	330	14
River Mile 5.0 - 5.5	55	55	2.1	160	16	29	7.2
River Mile 5.5 - 6.0	29	29	2.1	13	5.5	2.8	5.0
River Mile 6.0 - 6.2	2	1	5.0	5.4	5.2	0.34	5.2
River Mile 6.2- 6.5, Upstream of the AOC	0	-	-	-	-	-	-
River Mile 6.5- 7.0, Upstream of the AOC	0	-	-	-	-	-	-
Buffalo Harbor, Downstream of the AOC	3	3	3.5	4.3	3.8	0.41	3.8
City Ship Canal	55	51	2.1	250	25	37	14
Cazenovia Creek	0	-	-	-	-	-	-

mg/kg - milligrams per kilogram

Table 2-3a
Total PCB Surface Sediment Concentrations, Summary Statistics
Buffalo, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	6	2	0.048	0.067	0.052	0.0074	0.052
River Mile 0.5 - 1.0	33	20	0.035	1.3	0.16	0.28	0.086
River Mile 1.0 - 1.5	24	9	0.030	0.70	0.10	0.14	0.065
River Mile 1.5 - 2.0	24	15	0.027	0.55	0.11	0.12	0.076
River Mile 2.0 - 2.5	22	10	0.044	0.54	0.094	0.11	0.071
River Mile 2.5 - 3.0	26	25	0.044	1.5	0.32	0.37	0.20
River Mile 3.0 - 3.5	26	15	0.038	0.60	0.16	0.16	0.10
River Mile 3.5 - 4.0	41	23	0.032	4.7	0.27	0.73	0.11
River Mile 4.0 - 4.5	30	18	0.012	10	0.62	1.9	0.13
River Mile 4.5 - 5.0	35	12	0.033	2.3	0.16	0.41	0.067
River Mile 5.0 - 5.5	34	12	0.032	1.1	0.12	0.20	0.075
River Mile 5.5 - 6.0	23	4	0.029	0.18	0.058	0.033	0.053
River Mile 6.0 - 6.2	13	2	0.027	0.36	0.063	0.090	0.042
River Mile 6.2- 6.5, Upstream of the AOC	1	0	0.069	0.069	0.069	0.00	0.069
River Mile 6.5 - 7.0, Upstream of the AOC	1	0	0.045	0.045	0.045	0.00	0.045
Buffalo Harbor, Downstream of the AOC	9	3	0.032	0.13	0.055	0.029	0.050
City Ship Canal	59	46	0.030	1.4	0.20	0.22	0.13
Cazenovia Creek	2	0	0.036	0.039	0.038	0.0021	0.037

mg/kg - milligrams per kilogram

Table 2-3b
Total PCB Subsurface Sediment Concentrations, Summary Statistics
Buffalo, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	12	11	0.038	1.0	0.33	0.36	0.18
River Mile 0.5 - 1.0	32	32	0.046	4.1	0.60	0.95	0.29
River Mile 1.0 - 1.5	38	32	0.029	3.1	0.47	0.82	0.17
River Mile 1.5 - 2.0	16	13	0.029	2.6	0.55	0.63	0.28
River Mile 2.0 - 2.5	21	16	0.039	1.4	0.22	0.32	0.12
River Mile 2.5 - 3.0	36	35	0.0033	2.9	0.41	0.56	0.22
River Mile 3.0 - 3.5	25	16	0.00087	1.6	0.22	0.35	0.080
River Mile 3.5 - 4.0	90	54	0.010	5.1	0.42	0.90	0.12
River Mile 4.0 - 4.5	62	40	0.032	10	1.0	2.1	0.20
River Mile 4.5 - 5.0	66	38	0.030	7.4	0.39	1.2	0.10
River Mile 5.0 - 5.5	55	33	0.035	160	4.5	22	0.19
River Mile 5.5 - 6.0	29	9	0.030	0.74	0.10	0.15	0.061
River Mile 6.0 - 6.2	2	1	0.047	0.86	0.45	0.58	0.20
River Mile 6.2- 6.5, Upstream of the AOC	0	-	-	-	-	-	-
River Mile 6.5- 7.0, Upstream of the AOC	0	-	-	-	-	-	-
Buffalo Harbor, Downstream of the AOC	3	3	0.083	0.22	0.13	0.073	0.12
City Ship Canal	55	40	0.029	4.9	0.54	0.96	0.20
Cazenovia Creek	0	-	-	-	-	-	-

mg/kg - milligrams per kilogram

Table 2-4a
Lead Surface Sediment Concentrations, Summary Statistics
Buffalo, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	6	6	26	38	33	5.0	33
River Mile 0.5 - 1.0	33	33	27	320	65	69	49
River Mile 1.0 - 1.5	24	24	10	490	69	99	43
River Mile 1.5 - 2.0	24	24	3.1	74	41	18	35
River Mile 2.0 - 2.5	22	22	26	250	45	47	38
River Mile 2.5 - 3.0	26	26	32	200	62	36	56
River Mile 3.0 - 3.5	26	26	25	250	70	57	56
River Mile 3.5 - 4.0	41	41	27	1100	120	180	69
River Mile 4.0 - 4.5	30	30	8.1	690	110	140	73
River Mile 4.5 - 5.0	35	35	19	2600	160	440	59
River Mile 5.0 - 5.5	34	34	14	430	51	71	38
River Mile 5.5 - 6.0	23	23	12	120	32	20	29
River Mile 6.0 - 6.2	13	13	6.2	98	26	26	19
River Mile 6.2- 6.5, Upstream of the AOC	1	1	24	24	24	0.00	24
River Mile 6.5 - 7.0, Upstream of the AOC	1	1	19	19	19	0.00	19
Buffalo Harbor, Downstream of the AOC	9	9	9.2	66	31	22	25
City Ship Canal	59	59	1.9	2700	130	350	68
Cazenovia Creek	2	2	12	18	15	4.2	15

mg/kg - milligrams per kilogram

Table 2-4b
Lead Subsurface Sediment Concentrations, Summary Statistics
Buffalo, NY

Location	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	12	12	34	260	85	71	65
River Mile 0.5 - 1.0	32	32	34	600	130	150	88
River Mile 1.0 - 1.5	38	38	9.1	730	160	170	94
River Mile 1.5 - 2.0	16	16	12	640	220	200	140
River Mile 2.0 - 2.5	21	21	31	530	110	130	71
River Mile 2.5 - 3.0	36	36	31	450	110	95	87
River Mile 3.0 - 3.5	25	25	11	230	76	51	61
River Mile 3.5 - 4.0	90	90	14	740	140	150	88
River Mile 4.0 - 4.5	62	62	14	1300	240	310	120
River Mile 4.5 - 5.0	66	66	24	8500	390	1100	110
River Mile 5.0 - 5.5	55	55	22	740	100	130	62
River Mile 5.5 - 6.0	29	29	14	120	39	22	35
River Mile 6.0 - 6.2	2	2	20	39	29	14	28
River Mile 6.2- 6.5, Upstream of the AOC	0	-	-	-	-	-	-
River Mile 6.5- 7.0, Upstream of the AOC	0	-	-	-	-	-	-
Buffalo Harbor, Downstream of the AOC	3	3	45	74	58	15	56
City Ship Canal	55	55	7.5	580	160	140	97
Cazenovia Creek	0	-	-	-	-	-	-

mg/kg - milligrams per kilogram

Table 2-5a
Mercury Surface Sediment Concentrations, Summary Statistics
Buffalo, NY

Mile Marker	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	6	6	0.053	0.17	0.11	0.047	0.10
River Mile 0.5 - 1.0	33	33	0.047	6.1	0.53	1.20	0.18
River Mile 1.0 - 1.5	24	20	0.0055	0.80	0.14	0.17	0.074
River Mile 1.5 - 2.0	24	22	0.0047	0.58	0.15	0.14	0.10
River Mile 2.0 - 2.5	22	22	0.031	0.37	0.10	0.075	0.087
River Mile 2.5 - 3.0	26	25	0.014	2.1	0.25	0.42	0.15
River Mile 3.0 - 3.5	26	24	0.013	1.8	0.25	0.36	0.14
River Mile 3.5 - 4.0	41	37	0.0085	9.5	0.85	1.70	0.22
River Mile 4.0 - 4.5	30	28	0.0090	7.1	0.81	1.60	0.21
River Mile 4.5 - 5.0	34	33	0.011	3.5	0.38	0.70	0.13
River Mile 5.0 - 5.5	34	33	0.0060	4.8	0.27	0.81	0.10
River Mile 5.5 - 6.0	23	18	0.0090	0.36	0.066	0.071	0.045
River Mile 6.0 - 6.2	13	4	0.0049	0.14	0.023	0.038	0.012
River Mile 6.2- 6.5, Upstream of the AOC	1	1	0.10	0.10	0.10	0.00	0.10
River Mile 6.5 - 7.0, Upstream of the AOC	1	1	0.019	0.019	0.019	0.00	0.019
Buffalo Harbor, Downstream of the AOC	9	9	0.026	0.44	0.11	0.13	0.078
City Ship Canal	59	55	0.0050	8.5	0.78	1.20	0.37
Cazenovia Creek	2	2	0.012	0.041	0.027	0.021	0.022

mg/kg - milligrams per kilogram

Table 2-5b
Mercury Subsurface Sediment Concentrations, Summary Statistics
Buffalo, NY

Mile Marker	Number of Samples	Number of Detects	Minimum Result (mg/kg)	Maximum Result (mg/kg)	Average Result (mg/kg)	Standard Deviation	Geometric Mean Result (mg/kg)
Buffalo River							
Downstream AOC Boundary - River Mile 0.5	12	12	0.066	4.0	1.1	1.4	0.41
River Mile 0.5 - 1.0	32	32	0.097	9.7	1.4	2.2	0.49
River Mile 1.0 - 1.5	38	37	0.0040	14	2.3	3.5	0.42
River Mile 1.5 - 2.0	16	15	0.0038	9.0	3.0	3.3	0.92
River Mile 2.0 - 2.5	21	21	0.066	5.8	0.89	1.7	0.27
River Mile 2.5 - 3.0	36	36	0.061	6.3	0.75	1.3	0.29
River Mile 3.0 - 3.5	25	25	0.036	2.7	0.53	0.77	0.23
River Mile 3.5 - 4.0	90	84	0.0043	15	1.9	3.2	0.43
River Mile 4.0 - 4.5	62	58	0.0081	9.2	1.8	2.6	0.43
River Mile 4.5 - 5.0	64	64	0.031	32	3.0	6.2	0.43
River Mile 5.0 - 5.5	55	55	0.044	44	1.9	6.4	0.25
River Mile 5.5 - 6.0	29	29	0.021	0.34	0.094	0.070	0.077
River Mile 6.0 - 6.2	2	1	0.014	0.14	0.077	0.089	0.043
River Mile 6.2- 6.5, Upstream of the AOC	0	-	-	-	-	-	-
River Mile 6.5- 7.0, Upstream of the AOC	0	-	-	-	-	-	-
Buffalo Harbor, Downstream of the AOC	3	3	0.10	0.37	0.21	0.14	0.18
City Ship Canal	55	50	0.0033	21	3.2	4.4	0.80
Cazenovia Creek	0	-	-	-	-	-	-

mg/kg - milligrams per kilogram

Table 2-6
Summary of Sediment Pore Water PAH Concentrations and Log Koc Values
Buffalo, NY

Chemical	Number of Detected Samples	Detection Limit	Pore Water Min Detected Sample	Pore Water Max Detected Sample	Pore Water Mean Detected Sample	Log Koc Minimum	Log Koc Maximum	Log Koc Mean
		ng/g	ng/g	ng/g	ng/g			
naphthalene	5	0.1	0.110	0.302	0.164	4.37	5.26	4.72
2-methylnaphthalene	1	0.05	0.078	0.078	0.078	4.86	4.86	4.86
1-methylnaphthalene	3	0.05	0.050	0.194	0.117	4.55	4.72	4.61
C2 naphthalenes	13	0.15	0.161	1.584	0.324	4.71	5.33	5.02
C3 naphthalenes	9	0.05	0.108	5.407	0.770	4.51	5.37	5.08
C4 naphthalenes	1	0.15	5.044	5.044	5.044	4.79	4.79	4.79
acenaphthylene	0	0.2	—	—	—	—	—	—
acenaphthene	3	0.1	0.037	0.430	0.194	4.45	5.11	4.74
fluorene	4	0.04	0.032	0.264	0.096	4.67	5.46	5.16
C1 fluorenes	10	0.02	0.038	0.646	0.137	5.21	5.59	5.42
C2 fluorenes	1	0.05	0.638	0.638	0.638	5.57	5.57	5.57
C3 fluorenes	0	0.06	—	—	—	—	—	—
phenanthrene	2	0.1	0.047	0.224	0.136	5.31	5.96	5.63
anthracene	2	0.05	0.014	0.184	0.099	5.54	6.34	5.94
C1 phenanthrenes/anthracenes	2	0.02	0.094	0.493	0.294	5.42	5.80	5.61
C2 phenanthrenes/anthracenes	1	0.05	0.938	0.938	0.938	5.92	5.92	5.92
C3 phenanthrenes/anthracenes	1	0.04	0.808	0.808	0.808	5.99	5.99	5.99
C4 phenanthrenes/anthracenes	0	0.02	—	—	—	—	—	—
fluoranthene	19	0.01	0.011	0.149	0.030	5.81	6.67	6.37
pyrene	18	0.01	0.010	0.151	0.028	5.77	6.62	6.33
C1 fluoranthenes/pyrenes	1	0.01	0.139	0.139	0.139	6.00	6.00	6.00
benz[a]anthracene	7	0.001	0.001	0.012	0.004	6.62	7.35	7.07
chrysene	7	0.001	0.002	0.016	0.005	6.57	7.74	7.16
C1 chrysenes	0	0.005	—	—	—	—	—	—
C2 chrysenes	0	0.01	—	—	—	—	—	—
C3 chrysenes	0	0.01	—	—	—	—	—	—
C4 chrysenes	0	0.01	—	—	—	—	—	—
benzo[b+k]fluoranthene	0	0.005	—	—	—	—	—	—
benzo[e]pyrene	0	0.005	—	—	—	—	—	—
benzo[a]pyrene	0	0.008	—	—	—	—	—	—
perylene	0	0.004	—	—	—	—	—	—
indeno[1,2,3-cd]pyrene	0	0.001	—	—	—	—	—	—
dibenz[ah]anthracene	0	0.002	—	—	—	—	—	—
benzo[ghi]perylene	0	0.001	—	—	—	—	—	—

ng/g - nanograms per gram

Table 2-7
Summary of Sediment Pore Water PCB Concentrations and Log Koc Values
Buffalo, NY

PCB Congener	Congener Number	Number of Detected Pore Water Samples	Detection Limit	Pore Water Min Detected Sample	Pore Water Max Detected Sample	Pore Water Mean Detected Sample	Log Koc Minimum	Log Koc Maximum	Log Koc Mean
			pg/L	pg/L	pg/L	pg/L			
2,2'-dichlorobiphenyl	4	17	34	27.5	1065	201	5.6	6.4	6.1
2,3'-dichlorobiphenyl	6	18	19	11.7	480	94.0	5.7	6.9	6.2
2,4'-dichlorobiphenyl	8	18	17	22.3	1400	178	5.5	6.5	6.0
4,4'-dichlorobiphenyl	15	20	8.1	89.3	978	196	6.1	6.9	6.5
2,2',3 (2,4',6)-trichlorobiphenyl	16+32	20	3.7	33.7	932	127	6.1	6.8	6.4
2,2',4-trichlorobiphenyl	17	18	3.4	18.0	602	85.6	5.9	6.7	6.3
2,2',5-trichlorobiphenyl	18	20	4.4	40.9	1933	234	5.6	6.7	6.2
2,3,4'-trichlorobiphenyl	22	19	2.4	14.0	460	62.6	6.2	7.1	6.5
2,3',5-trichlorobiphenyl	26	19	2.1	8.2	203	35.6	6.2	6.8	6.5
2,4,4'-trichlorobiphenyl	28	20	1.0	14.5	636	72.7	6.1	7.1	6.8
2,4',5-trichlorobiphenyl	31	20	1.8	24.2	898	107	6.0	6.9	6.6
2',3,4-trichlorobiphenyl	33	20	2.2	15.9	712	79.1	6.0	7.0	6.6
3,4,4'-trichlorobiphenyl	37	17	1.9	4.3	133	19.5	6.6	8.0	7.5
2,2',3,4'-tetrachlorobiphenyl	42	19	1.0	3.2	120	17.4	6.5	7.7	7.3
2,2',3,5'-tetrachlorobiphenyl	44	20	1.3	15.8	498	67.5	6.3	7.3	6.9
2,2',3,6-tetrachlorobiphenyl	45	15	2.4	4.5	185	32.4	6.3	7.4	6.9
2,2',4,4 (2,2',4,5)-tetrachlorobiphenyl	47+48	20	1.2	7.4	139	34.6	6.2	7.3	6.9
2,2',4,5'-tetrachlorobiphenyl	49	20	0.8	8.3	264	39.7	6.4	7.7	7.1
2,2',5,5'-tetrachlorobiphenyl	52	20	1.1	25.9	535	80.1	6.7	7.6	7.1
2,3,3',4' (2,3,4,4')-tetrachlorobiphenyl	56+60	20	0.3	3.6	66.2	10.5	6.9	7.9	7.4
2,3,4',6-tetrachlorobiphenyl	64	20	0.8	9.7	175	28.0	6.2	7.2	6.8
2,3',4,4'-tetrachlorobiphenyl	66	20	0.5	4.2	167	19.5	6.9	7.6	7.4
2,3',4',5-tetrachlorobiphenyl	70	20	0.5	5.6	221	25.8	6.5	7.5	7.2
2,4,4',5-tetrachlorobiphenyl	74	20	0.4	3.2	97.1	11.7	7.1	7.7	7.5
2,2',3,3',4-pentachlorobiphenyl	82	15	0.4	1.4	14.5	3.6	7.4	7.9	7.6
2,2',3,3',6-(2,2',4,4',6)pentachlorobiphenyl	84+101	20	0.2	3.0	46.4	8.9	7.4	8.0	7.8
2,2',3,4,4'-pentachlorobiphenyl	85	19	0.3	0.9	13.2	2.7	7.4	7.9	7.6
2,2',3,4,5'-pentachlorobiphenyl	87	20	0.4	2.2	38.3	7.3	7.2	8.1	7.8
2,2',3,5',6-pentachlorobiphenyl	95	20	0.7	10.1	126	25.1	6.8	7.3	7.1
2,2',3',4,5-pentachlorobiphenyl	97	20	0.5	2.1	36.5	6.5	7.0	8.0	7.5
2,2',4,4',5-pentachlorobiphenyl	99	20	0.3	1.5	31.3	5.9	7.2	7.8	7.6
2,3,3',4,4'-pentachlorobiphenyl	105	20	0.2	0.8	15.9	3.0	7.5	8.1	7.8
2,3,3',4',6-pentachlorobiphenyl	110	20	0.4	4.7	79.6	14.1	7.1	7.7	7.5
2,3',4,4',5-pentachlorobiphenyl	118	20	0.4	3.4	63.4	10.9	7.5	8.4	8.2
2,2',3,3',4,4'-hexachlorobiphenyl	128	18	0.1	0.2	2.2	0.8	8.5	8.5	8.5
2,2',3,3',4,6'-hexachlorobiphenyl	132	19	0.3	0.9	8.5	2.3	7.4	8.1	7.8
2,2',3,3',5,6'-hexachlorobiphenyl	135	19	0.5	0.6	7.4	2.4	7.4	8.1	7.7
2,2',3,3',6,6'-hexachlorobiphenyl	136	19	0.5	0.6	6.8	2.2	7.2	7.8	7.5
2,2',3,4,4',5'-(2,3,3',4',5,6)hexachlorobiphenyl	138+163	20	0.1	0.6	6.3	1.7	7.3	8.6	8.2
2,2',3,4,5,5'-hexachlorobiphenyl	141	19	0.2	0.2	3.4	1.1	7.5	8.2	7.8
2,2',3,4',5,5'-hexachlorobiphenyl	146	18	0.2	0.2	4.7	1.4	7.4	8.1	7.8
2,2',3,4',5',6-hexachlorobiphenyl	149	20	0.3	1.4	21.1	5.2	7.4	8.0	7.7
2,2',3,5,5',6-hexachlorobiphenyl	151	19	0.3	0.4	7.3	2.2	7.4	8.1	7.8
2,2',4,4',5,5'-hexachlorobiphenyl	153	20	0.1	0.8	8.4	2.1	7.7	8.5	8.1
2,3,3',4,4',5-hexachlorobiphenyl	156	16	0.1	0.1	1.4	0.6	8.4	8.8	8.6
2,2',3,3',4,4',5-heptachlorobiphenyl	170	16	0.1	0.2	3.4	1.3	8.5	8.8	8.6
2,2',3,3',4,4',6-heptachlorobiphenyl	171	16	0.1	0.1	1.3	0.6	8.1	8.7	8.4
2,2',3,3',4,5,6'-heptachlorobiphenyl	174	20	0.2	0.2	3.5	1.2	7.9	8.4	8.2
2,2',3,3',4',5,6-heptachlorobiphenyl	177	18	0.1	0.2	2.2	0.8	8.1	8.6	8.4
2,2',3,3',5,6,6'-heptachlorobiphenyl	179	16	0.3	0.2	2.6	1.0	7.4	8.6	8.1
2,2',3,4,4',5,5'-heptachlorobiphenyl	180	20	0.1	0.3	4.0	1.3	8.3	8.8	8.5
2,2',3,4,4',5',6-heptachlorobiphenyl	183	18	0.2	0.2	1.9	0.8	7.6	8.5	8.1
2,2',3,4',5,5',6-heptachlorobiphenyl	187	20	0.2	0.5	3.9	1.4	7.7	8.4	8.2
2,3,3',4,4',5',6-heptachlorobiphenyl	191	9	0.1	0.3	1.6	0.8	NA ^a	NA	NA
2,2',3,3',4,4',5,5'-octachlorobiphenyl	194	9	0.2	0.2	1.7	0.8	8.3	8.3	8.3
2,2',3,3',4,5,6,6'-octachlorobiphenyl	199	10	0.4	0.6	4.0	1.8	7.8	8.3	8.1
2,2',3,4,4',5,5',6-octachlorobiphenyl	203	9	0.2	0.3	1.7	0.8	8.1	8.5	8.3

(a) 2,2',3,3',4,4',5,5'-octachlorobiphenyl was not detected in any of the sediment extracts (detection limit =1.0 ng/g). Therefore log Koc values were not calculated for this chemical.

PCB - Polychlorinated biphenyl
pg/L - Picogram per liter
NA - Not Available
ng/g - nanograms per gram

Table 2-8
Summary of Mean Metrics Calculated for Sediment Grab Samples
Buffalo, NY

	All Buffalo River Stations	Buffalo River Upstream Stations	Buffalo River Downstream Stations	Cazenovia Creek	Cattaraugus Creek Reference Site	Tonawanda Creek Reference Site
Number of Stations	8	3	5	1	3	3
Species Richness	8.65	10	7.84	7.2	6.13	5.2
Abundance	158	76.5	206	93.6	54.9	25.4
EPT Richness	0.65	0.533	0.72*	0.6	0.2	0
Hilsenhoff Biotic Index	9.58	9.12	9.85	9.67	8.81	9.59
Percent Model Affinity	29%	27%	30%	26%	23%	16%
Species Diversity (base 2)	1.47	1.78	1.29	1.12	1.58	1.76
Dominance	67%	64%	69%	79%	60%	51%
Dominance-3	91%	85%	94%	94%	91%	89%
Non-Chironomid / Oligochaete Richness	5	4.6	5.24	3.2	2.6	3.13
Number of Deformities	22/471	5/249	17/222	3/36	14/416	5/95
	4.7%	2.0%	7.7%	8.3%	3.4%	5.3%

Notes:

*This EPT score includes the BR4-PP1 replicate which contained a large number of mayflies in comparison to the other replicates at that location.

EPT	Ephemeroptera, Plecoptera, and Trichoptera
Dominance-3	Dominance of the three most numerous organisms

Table 2-9
Summary of Mean Metrics Calculated for Hester-Dendy Samplers
Buffalo, NY

	All Buffalo River Stations	Buffalo River Upstream Stations	Buffalo River Downstream Stations	Cazenovia Creek	Cattaraugus Creek Reference Site	Tonawanda Creek Reference Site
Mean Number of Families	6.3	5.4	7.4	6.8	8.5	8.1
Mean Number of Species	18	17	20	21	19	21
Mean Number of Organisms	320	340	320	200	490	220
Mean EPT Species Richness	1.3	0.93	2.1	1.4	3.9	1.1
Mean Hilsenhoff Biotic Index	8	8.2	7.4	7.1	6.5	7.2
Mean Percent Model Affinity	46%	42%	47%	47%	38%	45%
Mean Species Diversity (Base 2)	3	2.9	3.1	3.4	2.7	3.4
Mean Dominance	35%	34%	34%	24%	43%	29%
Mean Dominance of top 3 organisms	64%	64%	62%	56%	68%	54%
Mean Non-Chironomid / Oligochaetes Richness	4.6	3.6	5.7	4.8	7	6.2
Total Number of Chironomid Deformities	54/7104	41/3144	13/3960	20/728	13/2388	20/2072
Percentage of deformed chironomids	0.8%	1.3%	0.3%	2.7%	0.5%	1.0%

Notes:

EPT - Ephemeroptera, Plecoptera, and Trichoptera

Table 2-10
Electrofishing Catch per Unit Effort (CPUE) on the Buffalo River and Cazenovia Creek during the Fish Community Assessment
Buffalo, NY

Scientific Name*	Common Name	Electrofishing Catch per Unit Effort (CPUE)					CC
		BR1 RM 7.25	BR2 RM 6.6	BR3 RM 6.25	BR4 RM 5.5	BR5 RM 4.5	
<i>Hybopsis amblops</i>	Bigeye chub						3.9
<i>Lepomis macrochirus</i>	Bluegill	3.9	7.9	3.9	10	47.5	7.9
<i>Pimephales notatus</i>	Bluntnose minnow	3.9	4	3.9	4	15.8	102.1
<i>Ameiurus nebulosus</i>	Brown bullhead	3.9					
<i>Cyprinus carpio</i>	Common carp	11.7	11.9	11.6	8	11.9	
<i>Luxilus cornutus</i>	Common shiner	19.5	4	11.6	4	4	11.8
<i>Dorosoma cepedianum</i>	Gizzard shad	3.9	27.7	19.3		27.7	
<i>Moxostoma erythrurum</i>	Golden redhorse	3.9			4		3.9
<i>Notemigonus crysoleucas</i>	Golden shiner	3.9			14	79.2	
<i>Etheostoma nigrum</i>	Johnny darter				2	7.9	
<i>Micropterus salmoides</i>	Largemouth bass	7.8	15.8	23.1	44.1	67.3	27.5
<i>Hypentelium nigricans</i>	Northern hogsucker					4	3.9
<i>Lepomis gibbosus</i>	Pumpkinseed	11.7	27.7	27	10	35.6	3.9
<i>Oncorhynchus mykiss</i>	Rainbow trout	3.9					3.9
<i>Ambloplites rupestris</i>	Rock bass	3.9		11.6		4	11.8
<i>Micropterus dolomieu</i>	Smallmouth bass	3.9					
<i>Ictiobus bubalus</i>	Smallmouth buffalo					4	
<i>Notropis hudsonius</i>	Spottail shiner			3.9			
<i>Minytrema melanops</i>	Spotted sucker					4	
<i>Catostomus commersonii</i>	White sucker		4	7.7		7.9	3.9
<i>Ameiurus natalis</i>	Yellow bullhead					4	
<i>Perca flavescens</i>	Yellow perch				8		3.9
CPUE Totals		86	103	124	108	325	188

Source

MACTEC 2008

Notes

* Only fish species that were collected via electrofishing are included.

BR - Buffalo River

CC - Cazenovia Creek

CPUE - Catch per unit effort (#1 hour)

RM - River mile

Table 2-11
Fish Community Metrics for Locations within the Buffalo River and Cazenovia Creek^(a)
Buffalo, NY

	CC	BR1 RM 7.25	BR2 RM 6.6	BR3 RM 6.25	BR4 RM 5.5	BR5 RM 4.5
Total Taxa	12	15	8	10	10	15
Percent Centrarchids	27%	13%	50%	53%	59%	48%
Percent Catostomidae	6.3%	3.3%	3.8%	6.3%	3.7%	6.1%
Percent Cyprinidae	63%	80%	19%	25%	28%	34%
Percent Dominant Species	54%	49%	27%	22%	41%	24%
Similarity Index	NA	60%	75%	80%	70%	53%
Shannon-Wiener Diversity Index	1.7	1.7	1.8	2.1	1.9	2.2
Percent Tolerant Species	56%	56%	19%	19%	24%	37%
Percent Intolerant Species	2.1%	2.2%	0%	0%	0%	1.2%
Percent Omnivores	56%	56%	46%	34%	24%	44%
Percent Top Carnivores	23%	8.8%	15%	28%	41%	22%
Abundance (b)	0.052	0.099	0.029	0.034	0.060	0.090
Mean Condition Factor (K) (c)	0.98	1.1	1.3	1.4	1.3	1.3

Notes:

- (a) Includes fish caught via electrofishing and seining.
- (b) Only includes fish caught via electrofishing.
- (c) Calculated based on Williams (2000).

AOC - Area of Concern
BR - Buffalo River
CC - Cazenovia Creek
NA - Not applicable
RM - River mile

Table 2-12
Summary of Fish Community Metrics: Buffalo River AOC, Buffalo River - Upstream, Cazenovia Creek^(a)
Buffalo, NY

	Cazenovia Creek	Buffalo River AOC Mean	Buffalo River Upstream Mean
Number of Stations	1	2	3
Total Taxa	12	13	11
Percent Centrarchids	27%	54%	39%
Percent Catostomidae	6.3%	4.9%	4.5%
Percent Cyprinidae	63%	31%	41%
Percent Dominant Species	54%	33%	33%
Similarity Index	NA	62%	72%
Shannon-Wiener Diversity Index	1.7	2.0	1.9
Percent Tolerant Species	56%	31%	31%
Percent Intolerant Species	2.1%	0.60%	0.73%
Percent Omnivores	56%	34%	45%
Percent Top Carnivores	23%	32%	17%
Abundance (b)	0.052	0.075	0.054
Mean Condition Factor (K) (c)	0.98	1.3	1.3

Notes:

(a) Includes fish caught via electrofishing and seining.

(b) Only includes fish caught via electrofishing.

(c) Calculated based on Williams (2000).

AOC - Area of Concern

NA - Not applicable

Table 2-13
Histopathological Evaluation of Liver Lesions in Brown Bullhead
Buffalo, NY

<i>n</i>	37
Foci of Cellular Alteration (%)	29.8
Hepatocellular Carcinomas (%)	5.4
Cholangiocarcinomas (%)	0
Hepatocellular Tumors (%)	2.7
Bile Ductular Tumors (%)	0
Total Liver Tumors (%)	8.1

Notes:

% - Percent

n - Number of samples

Table 2-14
Physical and Chemical Characteristics of the Buffalo River by River Mile
Buffalo, NY

	RM 0.0 - 1.0	RM 1.0 - 2.0	RM 2.0 - 3.5	RM 3.5 - 5.0	RM 5.0+	City Ship Canal
Bathymetry / Cross-section	Shallower, with defined nav channel and shoulders	Narrow reach with deeper channel and narrow shoulders	Depths vary with bends; point bars and holes	Depths vary with bends; point bars and holes	Defined nav channel and shoulders	Shallower, U-shaped section
Hydrodynamics	Low velocity, lake impacted	High velocities	Moderate velocities	Moderate velocities	Low-moderate velocities	Low velocities
Bottom Stress	Low stress, moderated by lake	High event stress	Variable, zones of higher stress	Variable, generally lower stress	Low stress	Very low stress
Substrate Type	Fines (95%)	Fines/sand/gravel mix	Fines/ sand/ some gravel	Fines / sands/ limited gravel	Sand and fines	Fines
River Geomorphology	Mouth: wide, shallow	Straight, narrow reach	Highly sinuous	Highly sinuous	Lower sinuosity	
Sedimentation Rates	Deposition of fines from lake	Minimal deposition	Some deposition	Higher deposition of fines, some sands	Bedload deposition and some fines	Fines deposition, local biotic solids
Surficial Contaminant Distribution	Relatively low levels	Low to moderate levels	Moderate levels	Higher levels	Low to moderate levels	Moderate levels

% - Percent

RM River Mile

Table 3-1
Remedial Action Objectives and Supporting Goals for Buffalo River AOC
Buffalo, NY

	Target Environmental Medium or Receptor	Duration	RAO/Supporting Goal
RAO 1	Sediment and Human Health	Short-Term and Long-Term	Reduce human exposures for direct sediment contact and fish consumption from the Buffalo River by reducing the availability and/or concentration of COCs in sediments
RAO 2	Ecology	Short-Term and Long-Term	Reduce the exposure of wildlife populations and the aquatic community to sediment COC concentrations that are above protective levels
RAO 3	Sediment	Short-Term and Long-Term	Reduce or otherwise address legacy sediment COC concentrations to improve the likelihood that future dredged sediments (for routine navigational, commercial, and recreational purposes) will not require confined disposal
RAO 4	Ecology	Short-Term and Long-Term	Implement a remedy that is compatible with the Buffalo-River Remedial Advisory Committee's goal of protecting and restoring habitat and supporting wildlife goals
Supporting Goal 1	Sediment	Short-Term and Long-Term	Reduce the potential of COC contaminated sediments to migrate outside of the Buffalo River AOC.
Supporting Goal 2	Ecology	Short-Term and Long-Term	Implement a sediment remedy that is compatible with and complements ongoing regional redevelopment goals, upland remediation, and restoration activities

AOC - Area of Concern
COC - Chemical of concern
RAO - Remedial Action Objective

Table 3-2
Comparison of Remedial Action Objectives and Supporting Goals to Beneficial Use Impairments for the Buffalo River AOC
Buffalo, NY

		Beneficial Use Impairments						
		Restrictions on fish and wildlife consumption	Fish tumors or other deformities	Degradation of aesthetics	Degradation of benthos	Restrictions on dredging activities	Loss of Fish and Wildlife Habitat	Degradation of fish and wildlife populations
Remedial Action Objectives (RAOs)								
RAO 1	Reduce human exposures for direct sediment contact and fish consumption from the Buffalo River by reducing the availability and/or concentration of COCs in sediments.	X						
RAO 2	Reduce the exposure of wildlife populations and the aquatic community to sediment COC concentrations that are above protective levels.		X		X			X
RAO 3	Reduce or otherwise address legacy sediment COC concentrations to improve the likelihood that future dredged sediments (for routine navigational, commercial, and recreational purposes) will not require confined disposal.					X		X
RAO 4	Implement a remedy that is compatible with the Buffalo-River Remedial Advisory Committee's goal of protecting and restoring habitat and supporting wildlife goals.	X	X	X	X		X	X
Supporting Goals								
Supporting Goal 1	Reduce the potential of COC contaminated sediments to migrate outside of the Buffalo River AOC.							
Supporting Goal 2	Implement a sediment remedy that is compatible with and complements ongoing regional redevelopment goals, upland remediation, and restoration activities.	X	X	X	X	X	X	X

Table 4-1
Summary of Technology and Process Options Retained for the Buffalo River Feasibility Study
Buffalo, NY

General Response Action	Appropriate Remedial Technology and Process Option	Reason for Consideration
No Action	No Action	Retain as required by the NCP for comparison to other alternatives.
Institutional Controls	Deed Restrictions	Routinely implemented and effective when combined with other process options to form an overall risk-management strategy. Retain as a component of other remedial alternatives.
	Recreational Use Restrictions	Routinely implemented and effective when combined with other process options to form an overall risk-management strategy. Retain as a component of other remedial alternatives.
Natural Recovery	Monitored Natural Recovery	MNR is readily implementable and can be highly effective at low-risk sites with strong evidence for natural recovery processes, such as the Buffalo River due to the natural depositional nature of large portions of the River. Additional lines of evidence supporting MNR include historically reduced fish liver lesions, historical improvement in fish habitat, and historical decreases in edible fish PCB and mercury concentrations.
Sediment Capping	Isolation Capping an/or Thin Layer Capping	Areas suitable for capping within the Buffalo River are limited to non-navigable areas in the Buffalo River and City Ship Canal. This includes the narrow portions of the river and ship canal that border the navigational channel and the non-navigable portion at the end of the City Ship Canal. Thin-layer capping may also be considered in other areas of the AOC to augment remedies if it can be demonstrated that thin-layer capping does not exceed FEMA restrictions on increased flood potential during a 100-year flood event, or if thin capping can support a restoration alternative.
Sediment Removal	Mechanical and/or Hydraulic Dredging	Dredging can be implemented at the Buffalo River using the existing CDF facility at the Buffalo Harbor. As a mass-removal or source-removal technology, dredging is effective. However, dredging generally is ineffective at achieving low surface sediment concentrations. Apart from actual dredging, sediment removal involves transportation of dredged material from the contaminated site, and disposal of dredged material (see below). A combination of dredging techniques may be required to dredge around piers and abutments, submerged debris, cross channel utilities, and near bulkheads. Special consideration will be also required for slope backs from existing bulkheads so as to not compromise their structural integrity.
Dredged Material Dewatering, Transportation and Disposal	Confined Disposal Facility No. 4	The presence of CDF No. 4, specifically designed for the management and disposal of sediments from the Buffalo River, and within 3 to 9 miles of the area of concern, makes the CDF the most attractive alternative for the dewatering/stabilization and disposal of dredged sediments and barge transport or hydraulic conveyance the preferred sediment transport alternatives. The bulk of the materials can be off-loaded directly to the open water portion of the CDF. Staging areas may be required within the upland portions of the CDF to stage materials considered by USEPA and USACE as unsuitable for placement in the open water portion of the CDF. These materials can be placed within earthen berms to control sediment transport within the CDF. A much smaller fraction of material may require off-site disposal, if contaminant concentrations are considered by USEPA and USACE too high for CDF disposal. This material will likely require dewatering or physical stabilization and identification of a suitable upland disposal site. An alternative may be to add stabilizing materials to this subset of dredged sediment to allow CDF placement.

CDF Confined Disposal Facility
NCP National Contingency Plan
PCB Polychlorinated biphenyl

Table 5-1a
Surface Area of the Buffalo River AOC, Acres
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Main Channel	88	154	242
City Ship Canal	20	16	36
Total	108	170	278

Table 5-1b
Remedy Alternative 3 Surface Area, Acres
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Main Channel	43	95	138
City Ship Canal	15	11	26
Total	58	106	164

Table 5-1c
Remedy Alternative 4 Surface Area, Acres
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Main Channel	14	27	41
City Ship Canal	10	5	15
Total	24	32	56

Table 5-1d
Remedy Alternative 5 Surface Area, Acres
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Main Channel	22	35	57
City Ship Canal	12	7	19
Total	34	42	76

NOTE: Surface areas in the City Ship Canal, outside of the navigation channel, include the cap surface area of 6.7 acres for Remedy Alternatives 3, 4 and 5.

Table 5-2a
Remedy Alternative 3: Sediment Volumes Removed
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Buffalo River	1,010,000	560,000	1,570,000
City Ship Canal	150,000	30,000	180,000
Total	1,160,000	590,000	1,750,000

Table 5-2b
Remedy Alternative 4: Sediment Volumes Removed
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Buffalo River	420,000	140,000	560,000
City Ship Canal	60,000	20,000	80,000
Total	480,000	160,000	640,000

Table 5-2c
Remedy Alternative 5: Sediment Volumes Removed
Buffalo, NY

	Outside of Nav Channel	Inside Nav Channel	Total
Buffalo River	530,000	190,000	720,000
City Ship Canal	80,000	20,000	100,000
Total	610,000	210,000	820,000

Notes: Current volume estimates assume removal to shoreline and do not consider a dredge slope factor. Volumes are subject to change based an updated understanding of dredge delineation boundaries and shoreline offsets.

Table 6-1a
Time Recovery for Different Biological Health Metrics and Different Remediation Activities
Buffalo, NY

BUI	Location	Action	Recovery Time (Years)	Reference
Benthic Community	River Hull (UK)	Dredging	0.5	Pearson (1984) ^a
Benthic Community	James River (VA)	Dredging	0.25	Diaz 1994
Benthic Community	Ashtabula River (OH)	Dredging	5	OEPA (2006)
Vegetation	San Marcos River (TX)	Dredging	0.5 to 1.0	Hannan and Doris (1970) ^a
Fish Tumors	Black River (OH)	Dredging	4	Baumann et al. 2000
Benthic Community	Un-named Stream (AK)	Construction	1	Peterson and Nyquist (1972) ^a
Benthic Community	Joe Wright Creek (CO)	Construction	Rapid	Cline et al. (1977) ^a
Benthic Community	Archibald Creek (BC)	Construction	2	Tsui and McCart (1981) ^a
Benthic Community	Coastal Plain stream (NC)	Restoration	2	Price and Roessler (2005)
Benthic Community	Reinikoski Rapids (Finland)	Restoration with Refugia	0.08	Korsu (2004)
Benthic Community	Headland Waters (Finland)	Restoration with Refugia	4 to 8	Muotka et al. (2002)
Benthic Community	Black River (OH)	Infrastructure	5	BRRAPCC (2005)
Benthic Community	North Platte River (WY)	Sedimentation	0.06	Gray and Ward (1982) ^a
Benthic Community	Rhone River (France)	Sedimentation	1	Roux (1984) ^a
Benthic Community	Black River E. Branch	WWTP improvements	5	BRRAPCC (2005)
Benthic Community	Cuyahoga River	WWTP decommissioning	4	Mack (2000)
Fish Tumors	Presque Isle Bay (PA)	WWTP improvements and curtailment of CSO overflows	5	Baumann et al. 2000

(a) References cited within Yount and Niemi 1990.

BUI - Beneficial use impairment

CSO - Combined sewer overflow

WWTP - Wasterwater treament facility

Table 6-1b
Aquatic Vegetation Impacted by Remedy
Buffalo, NY

	Buffalo River	City Ship Canal	Total
Current Conditions			
Length of Shoreline with EV and SAV, ft	22,468	8,012	30,480
Remedy Alternative 3			
Length of Shoreline with EV and SAV Impacted by Remedy, ft	16,118	5,516	21,634
Percent of Shoreline with EV and SAV Impacted by Remedy	72%	69%	71%
Remedy Alternative 4			
Length of Shoreline with EV and SAV Impacted by Remedy, ft	6,625	3,947	10,572
Percent of Shoreline with EV and SAV Impacted by Remedy	29%	49%	35%
Remedy Alternative 5			
Length of Shoreline with EV and SAV Impacted by Remedy, ft	8,461	4,528	12,989
Percent of Shoreline with EV and SAV Impacted by Remedy	38%	57%	43%

EV - Emergent Vegetation

SAV - Submerged Aquatic Vegetation

Table 6-2a
SWACs, Current Conditions
Buffalo, NY

River Miles	Total PAHs, mg/kg	Lead, mg/kg	Mercury, mg/kg	Total PCBs, mg/kg
Buffalo River				
0.33 - 0.67	5.0	38	0.17	0.09
0.67 - 1.0	10	70	0.76	0.19
1.0 - 1.33	6.0	77	0.15	0.08
1.33 - 1.67	6.1	39	0.12	0.08
1.67 - 2.0	4.8	38	0.12	0.09
2.0 - 2.33	4.5	34	0.11	0.08
2.33 - 2.67	6.8	62	0.21	0.17
2.67 - 3.0	5.7	64	0.17	0.31
3.0 - 3.33	7.0	56	0.17	0.13
3.33 - 3.67	10	100	0.38	0.15
3.67 - 4.0	24	129	0.81	0.36
4.0 - 4.33	31	136	1.02	0.75
4.33 - 4.67	19	67	0.42	0.12
4.67 - 5.0	17	173	0.49	0.27
5.0 - 5.33	19	64	0.39	0.15
5.33 - 5.67	4.6	29	0.08	0.05
5.67 - 6.0	5.0	35	0.06	0.07
City Ship Canal				
0.0 - 0.33	13	331	0.65	0.21
0.33 - 0.67	13	73	0.60	0.15
0.67 - 1.0	10	62	0.82	0.20
1.0 - 1.33	13	116	1.00	0.21
1.33 - 1.45	70	156	0.60	0.30

Table 6-2b
SWACs Based on Remedy Alternative 3
Buffalo, NY

River Miles	Total PAHs, mg/kg	Lead, mg/kg	Mercury, mg/kg	Total PCBs, mg/kg
Buffalo River				
0.33 - 0.67	5.3	30	0.07	0.04
0.67 - 1.0	6.1	34	0.16	0.05
1.0 - 1.33	5.8	42	0.09	0.05
1.33 - 1.67	5.9	24	0.04	0.02
1.67 - 2.0	5.8	26	0.05	0.03
2.0 - 2.33	5.1	31	0.09	0.06
2.33 - 2.67	6.9	61	0.21	0.16
2.67 - 3.0	6.1	24	0.04	0.04
3.0 - 3.33	5.6	38	0.10	0.09
3.33 - 3.67	6.0	46	0.06	0.04
3.67 - 4.0	6.1	24	0.04	0.03
4.0 - 4.33	6.1	22	0.03	0.01
4.33 - 4.67	6.1	22	0.03	0.01
4.67 - 5.0	6.1	24	0.04	0.02
5.0 - 5.33	6.5	26	0.06	0.04
5.33 - 5.67	4.9	27	0.07	0.04
5.67 - 6.0	5.0	35	0.06	0.07
City Ship Canal				
0.0 - 0.33	6.7	30	0.06	0.03
0.33 - 0.67	7.8	38	0.22	0.06
0.67 - 1.0	4.6	28	0.21	0.08
1.0 - 1.33	6.3	37	0.25	0.05
1.33 - 1.45	6.1	22	0.03	0.01

NOTES:

- 1) IDW interpolations of the 2005/2007 and 2008 surface sediment data are used to calculate SWACs.
- 2) Post remediation SWACs are calculated by applying average upstream surface sediment concentrations to remediated areas. The average upstream surface sediment concentrations are total PAHs, 6.1 mg/kg; Pb, 21.7 mg/kg; Hg, 0.029 mg/kg; total PCBs, 0.014 mg/kg.

Hg - Mercury

mg/kg - milligrams per kilogram

PAHs - Polycyclic aromatic hydrocarbons

PCBs - Polychlorinated biphenyl

Table 6-2c
SWACs Based on Remedy Alternative 4
Buffalo, NY

River Miles	Total PAHs, mg/kg	Lead, mg/kg	Mercury, mg/kg	Total PCBs, mg/kg
Buffalo River				
0.33 - 0.67	5.0	38	0.17	0.09
0.67 - 1.0	7.1	51	0.35	0.12
1.0 - 1.33	6.0	77	0.15	0.08
1.33 - 1.67	6.1	39	0.12	0.08
1.67 - 2.0	4.8	38	0.12	0.09
2.0 - 2.33	4.5	34	0.11	0.08
2.33 - 2.67	6.8	62	0.21	0.17
2.67 - 3.0	5.8	55	0.15	0.19
3.0 - 3.33	6.9	56	0.17	0.13
3.33 - 3.67	6.8	73	0.23	0.08
3.67 - 4.0	7.0	36	0.11	0.06
4.0 - 4.33	7.5	33	0.07	0.07
4.33 - 4.67	7.7	40	0.14	0.05
4.67 - 5.0	8.1	60	0.17	0.09
5.0 - 5.33	6.0	38	0.12	0.08
5.33 - 5.67	4.6	29	0.08	0.05
5.67 - 6.0	5.0	35	0.06	0.07
City Ship Canal				
0.0 - 0.33	7.8	78	0.28	0.10
0.33 - 0.67	10	56	0.42	0.11
0.67 - 1.0	5.0	41	0.32	0.09
1.0 - 1.33	6.3	37	0.25	0.05
1.33 - 1.45	6.1	22	0.03	0.01

Table 6-2d
SWACs Based on Remedy Alternative 5
Buffalo, NY

River Miles	Total PAHs, mg/kg	Lead, mg/kg	Mercury, mg/kg	Total PCBs, mg/kg
Buffalo River				
0.33 - 0.67	5.0	38	0.17	0.09
0.67 - 1.0	7.1	51	0.35	0.12
1.0 - 1.33	6.0	77	0.15	0.08
1.33 - 1.67	6.1	39	0.12	0.08
1.67 - 2.0	4.8	37	0.11	0.08
2.0 - 2.33	4.5	34	0.11	0.08
2.33 - 2.67	6.8	62	0.21	0.17
2.67 - 3.0	5.6	43	0.08	0.11
3.0 - 3.33	6.0	40	0.10	0.08
3.33 - 3.67	6.4	64	0.20	0.07
3.67 - 4.0	6.8	32	0.09	0.04
4.0 - 4.33	7.5	32	0.07	0.07
4.33 - 4.67	7.6	38	0.13	0.04
4.67 - 5.0	7.9	36	0.11	0.07
5.0 - 5.33	5.8	34	0.10	0.07
5.33 - 5.67	4.7	28	0.08	0.05
5.67 - 6.0	5.0	35	0.06	0.07
City Ship Canal				
0.0 - 0.33	7.3	50	0.24	0.08
0.33 - 0.67	8.9	46	0.31	0.08
0.67 - 1.0	4.9	38	0.29	0.09
1.0 - 1.33	6.3	37	0.25	0.05
1.33 - 1.45	6.1	22	0.03	0.01

NOTES:

1) IDW interpolations of the 2005/2007 and 2008 surface sediment data are used to calculate SWACs.
2) Post remediation SWACs are calculated by applying average upstream surface sediment concentrations to remediated areas. The average upstream surface sediment concentrations are total PAHs, 6.1 mg/kg; Pb, 21.7 mg/kg; Hg, 0.029 mg/kg; total PCBs, 0.014 mg/kg.

Hg - Mercury

mg/kg - milligrams per kilogram

PAHs - Polycyclic aromatic hydrocarbons

PCBs - Polychlorinated biphenyl

Table 6-3a
Current Conditions: Estimated Mass of Chemicals in Buffalo River AOC
Buffalo, NY

	PAH	Lead	Mercury	PCB
Buffalo River				
Outside Nav Channel, kg	52,000	171,000	1,600	1,150
Inside Nav Channel, kg	13,400	57,700	470	230
City Ship Canal				
Outside Nav Channel, kg	3,000	28,000	370	70
Inside Nav Channel, kg	600	7,000	60	13

Table 6-3b
Remedy Alternative 3: Estimated Mass of Chemicals Removed
Buffalo, NY

	PAH	Lead	Mercury	PCB
Buffalo River				
Outside Nav Channel				
Mass removed, kg	51,000	163,000	1,500	1,100
Percent of Current Mass	98%	96%	97%	96%
Inside Nav Channel				
Mass removed, kg	12,700	50,300	440	220
Percent of Current Mass	95%	90%	94%	92%
City Ship Canal				
Outside Nav Channel				
Mass removed, kg	2,200	19,800	290	50
Percent of Current Mass	72%	71%	78%	69%
Inside Nav Channel				
Mass removed, kg	500	5,700	40	10
Percent of Current Mass	81%	83%	77%	77%

Note: Volumes and mass removals are subject to change based on an updated understanding of dredge delineation boundaries and shoreline offsets. Currently volumes and mass removal assume removal to shoreline and do not consider a dredge slope factor.

Table 6-3c
Remedy Alternative 4: Estimated Mass of Chemicals Removed
Buffalo, NY

	PAH	Lead	Mercury	PCB
Buffalo River				
Outside Nav Channel				
Mass removed, kg	26000	70,300	730	180
Percent of Current Mass	50%	41%	46%	15%
Inside Nav Channel				
Mass removed, kg	4000	16,700	160	60
Percent of Current Mass	30%	30%	33%	25%
City Ship Canal				
Outside Nav Channel				
Mass removed, kg	1300	12,600	180	30
Percent of Current Mass	41%	45%	48%	38%
Inside Nav Channel				
Mass removed, kg	300	3,900	20	6
Percent of Current Mass	44%	57%	43%	46%

Table 6-3d
Remedy Alternative 5: Estimated Mass of Chemicals Removed
Buffalo, NY

	PAH	Lead	Mercury	PCB
Buffalo River				
Outside Nav Channel				
Mass removed, kg	37,000	99,000	930	450
Percent of Current Mass	71%	58%	59%	39%
Inside Nav Channel				
Mass removed, kg	8,000	24,300	230	90
Percent of Current Mass	58%	43%	49%	40%
City Ship Canal				
Outside Nav Channel				
Mass removed, kg	1,600	14,700	200	30
Percent of Current Mass	53%	52%	54%	45%
Inside Nav Channel				
Mass removed, kg	400	4,500	30	6
Percent of Current Mass	59%	66%	52%	46%

Note: Volumes and mass removals are subject to change based on an updated understanding of dredge delineation boundaries and shoreline offsets. Currently volumes and mass removal assume removal to shoreline and do not consider a dredge slope factor.

AOC - Area of Concern

kg - Kilogram

PAH - Polycyclic aromatic hydrocarbon

PCB - Polychlorinated biphenyl

Table 6-4
Remedial Alternative Cost Estimate Summary
Buffalo, NY

	Remedial Area	Remedial Volume	Cap Area	Total Cost	Unit Cost
Remedy 1 No Action	0 SF	0 CY	0 SF	\$0	
Remedy 2 Monitored Natural Recovery of the Entire River	11,632,400 SF	0 CY	0 SF	\$2,453,000	\$0.21 /SF
Remedy 3 Sediment removal targeting the PAH RG of 1 TU at all sediment depths, and SWAC RGs for PCBs, Hg, and Pb and capping of the ship canal	6,309,200 SF	1,750,000 CY	292,400 SF	\$73,883,000	\$38 /CY dredged \$9 /SF capped
Remedy 4 Sediment removal targeting the PAH RG of 1 TU in surface (0-1 ft) sediment, and SWAC RGs for PCBs, Hg, and Pb and capping of the ship canal	2,074,800 SF	640,000 CY	292,400 SF	\$31,817,000	\$41 /CY dredged \$9 /SF capped
Remedy 5 Sediment removal targeting the PAH RG of 1 TU in surface (0-1 ft) sediment, SWAC RGs for PCBs, Hg, and Pb, and maximum residual PAH, PCB, Hg, and Pb concentrations in buried and surface sediments and capping of the ship canal	2,780,800 SF	820,000 CY	292,800 SF	\$38,733,000	\$41 /CY dredged \$9 /SF capped

Key assumptions

USACE performs the dredging and only turbidity monitoring is required.
The percent debris in the total volume of sediments is 2.5 percent.
The percent of the total volume of sediments requiring additional confinement within the CDF is 5 percent.
None of the excavated sediments will require off-site disposal as hazardous waste.
No shoreline stabilization or improvements will be performed as part of the remedy.
Additional confinement within CDF will be performed using on-site materials. No importation will be required.

CDF	Confined Disposal Facility
CY	Cubic yards
SF	Square feet
Hg	Mercury
PAH	Polycyclic aromatic hydrocarbon
Pb	Lead
PCB	Polychlorinated biphenyl

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
CHEMICAL-SPECIFIC ARARS AND TBCS			
Clean Water Act 40 [Federal Water Pollution Control Act; as amended], 33 USC §§ 1251- 1387	40 CFR Part 129	Toxic Pollutant Effluent Standards for aldrin/dieldrin, DDT, endrin, toxaphene, benzidene and PCBs.	Part 129 is a potential relevant and appropriate chemical-specific ARAR for purposes of on-site response.
Safe Drinking Water Act, 42 USC §§ 300f - 300j-26	40 CFR Part 141	National Primary Drinking Water Regulations	Part 141 is a potential relevant and appropriate chemical-specific ARAR for purposes of on-site response.
New York State Environmental Conservation Law (ECL) Article 15, Title 3 and Article 17, Titles 3 and 8	6 NYCRR Part 608, Section 608.5	Section 608.5 includes the requirement to obtain a SPDES permit for certain discharges in any navigable waters of the State.	Sections 608.5 is potential relevant and appropriate chemical-specific ARARs for purposes of on-site response.
	7 NYCRR Part 608, Sections 608.6(a) and 608.9(a)	Section 608.6(a) requires development and submission of a sufficiently detailed construction plan with a map. Section 608.9(a) requires that construction or operation of facilities that may result in a discharge to navigable waters demonstrate compliance with CWA §§ 301 – 303, 306 and 307 and 6 NYCRR §§ 751.2 (prohibited discharges) and 754.1 (effluent prohibitions; effluent limitations and water quality-related effluent limitations; pretreatment standards; standards of performance for new sources.)	Sections 608.6(a) and 608.9(a) are potential relevant and appropriate chemical-specific ARARs for purposes of on-site response.
	6 NYCRR Part 701	Part 701 establishes classifications for surface waters and groundwater.	Part 701 classifications of waters of the State, as well as a general prohibition on any discharge that impairs the receiving water for its assigned best usages are potential relevant and appropriate chemical-specific ARARs for purposes of on-site response.
	6 NYCRR Part 703	Part 703 establishes surface water and groundwater quality standards and groundwater effluent limitations.	Part 703 includes general and chemical-specific water quality standards that are potential relevant and appropriate chemical-specific ARARs.
	6 NYCRR Part 704	Part 704 establishes criteria for thermal discharges.	Part 704 is a potential relevant and appropriate chemical-specific ARARs for alternatives involving dredging and dewatering at elevated temperatures and discharge to the river or Lake Erie at elevated temperatures.
International Joint Commission – United States and Canada	Great Lakes Water Quality Agreement of 1978, as amended	The concentration of total PCBs in fish tissue (whole fish, wet weight basis) should not exceed 0.1 µg/g for the protection of birds and animals that consume fish. Criterion for mercury is 0.5 µg/g mercury in whole fish [wet weight basis].	TBC

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
NOAA – Damage Assessment Center	Reproductive, Developmental and Immunotoxic Effects of PCBs in Fish: A Summary of Laboratory and Field Studies, March 1999 (Monosson, E.)	<p>The effective concentrations for reproductive and developmental toxicity fall within the ranges of the PCB concentrations found in some of the most contaminated fish. There are currently an insufficient number of studies to estimate the immunotoxicity of PCBs in fish.</p> <p>Improper functioning of the reproductive system and adverse effects on development may result from adult fish liver concentrations of 25 to 71 ppm Aroclor 1254.</p> <p>PCB Congener BZ #77: 0.3 to 5 ppm (wet wt) in adult fish livers reduces egg deposition, pituitary gonadotropin, and gonadosomatic index, alters retinoid concentration (Vitamin A), and reduces larval survival. 1.3 ppm in eggs reduces larval survival.</p>	TBC
EPA Office of Emergency and Remedial Response	Guidance on Remedial Actions for Superfund Sites with PCB Contamination, EPA/540/G-90/007, August 1990 (OSWER Dir. No. 9355.4-01).	Provides guidance in the investigation and remedy selection process for PCB-contaminated Superfund sites. Provides preliminary remediation goals for various contaminated media, including sediment (pp. 34-36) and identifies other considerations important to protection of human health and the environment.	TBC
NOAA (compilation of other literature sources for Sediment Quality Guidelines [SQGs])	Screening Quick Reference Tables for Organics (SQRTs)	Tables with screening concentrations for inorganic and organic contaminants.	TBC
EPA Great Lakes National Program Office, Assessment and Remediation of Contaminated Sediments (ARCS) Program	Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod <i>Hyaletta azteca</i> and the midge <i>Chironomus riparius</i> , EPA 905- R96-008, September 1996	Provides sediment effect concentrations (SECs), which are defined as the concentrations of a contaminant in sediment below which toxicity is rarely observed and above which toxicity is frequently observed.	TBC
DEC Division of Fish, Wildlife and Marine Resources	Technical Guidance for Screening Contaminated Sediment, January 1999	Includes a methodology to establish sediment criteria for the purpose of identifying contaminated sediments. Provides sediment quality screening values for non-polar organic compounds, such as PCBs, and metals to determine whether sediments are contaminated (above screening criteria) or clean (below screening criteria). Screening values are not cleanup goals. Also discusses the use of sediment criteria in risk management decisions.	TBC
DEC Division of Fish, Wildlife and Marine Resources	Draft Technical Memorandum, Numerical Guidance Values for Assessing Risk to Aquatic Life from Contaminants in Sediment, June 2007	Provides sediment guidance values for the protection of benthic organisms and other varieties of aquatic or marine life, and is intended to provide only one component for evaluation, assessment, and management of contaminated sediment in New York State. Guidance values are not clean up goals.	TBC
DEC-Division of Environmental Remediation	Technical Administrative Guidance Memorandum No. 94- Remediation HWR-4046	Recommended Soil Cleanup Objectives	TBC
USEPA	USEPA Safe Drinking Water Act	MCLPs	TBC
USEPA	USEPA Federal Register, Volume 57, No. 246, December 22, 1992	Ambient Water Quality Criteria	TBC
DEC	DEC TOGS 1.1.2	New York State Groundwater Effluent Limitations	TBC

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
LOCATION-SPECIFIC ARARS AND TBCS			
Fish and Wildlife Coordination Act	16 USC § 662	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.	Substantive portions of Section 662 are potential relevant and appropriate location-specific ARARs for purposes of on-site response.
Endangered Species Act	16 USC § 1531 et. seq.	Federal statute establishing programmatic protection for endangered and threatened species.	Substantive provisions in Sections 1538 is a potential applicable location-specific ARAR for on-site response. Substantive provisions in Sections 1539 is a potential relevant and appropriate location-specific ARAR for on-site response.
Section 404 of the Clean Water Act [Federal Water Pollution Control Act, as amended], 33 USC § 1344	33 CFR Parts 320-330	Includes requirements for issuing permits for the discharge of dredged or fill material into navigable waters of the United States.	Substantive portions of Parts 320 – 330 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.
National Historic Preservation Act, 16 USC § 470 <u>et seq.</u>	36 CFR Part 800	Proposed remedial actions must take into account effect on properties in or eligible for inclusion in the National Registry of Historic Places. Federal agencies undertaking a project having an effect on a listed or eligible property must provide the Advisory Council on Historic Preservation a reasonable opportunity to comment pursuant to section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended. While the Advisory Council comments must be taken into account and integrated into the decision-making process, program decisions rest with the agency implementing the undertaking. A Stage 1A cultural resource survey may be necessary for any active remediation to identify historic properties along the lakeshore to determine if any areas should be the subject of further consideration under NHPA.	Substantive portions of Part 800 are a potential applicable location-specific ARAR for purposes of on-site response.
Fish and Wildlife Coordination Act	40 CFR 6.302	Modification to Waterways that Affect Fish or Wildlife	A potential applicable or relevant and appropriate location-specific ARAR for purposes of on-site response.
Clean Water Act Section 401, 33 USC 1341	40 CFR Part 121	State Water Quality Certification Program	Substantive portions of Part 121 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.
Clean Water Act	40 CFR Parts 122, 125 and 401	Wastewater Discharge Permits; Effluent Guidelines, Best Available Technology and BMPPT	Substantive portions of Parts 121, 125 and 401 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.
Clean Water Act, Section 404, 33 USC § 1344	40 CFR Parts 230 and 231	No activity which adversely affects an aquatic ecosystem, including wetlands, shall be permitted if a practicable alternative that has less adverse impact is available. If there is no other practical alternative, impacts must be minimized.	Substantive portions of Parts 230 and 231 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
Clean Water Act	40 CFR § 403.5	Discharge to Publicly-Owned Treatment Works	Substantive portions of Section 403.5 are a potential relevant and appropriate location-specific ARAR for purposes of on-site response.
Toxic Substances Control Act (TSCA), Title 1, 15 USC § 2601	40 CFR §§ 761.65 – 761.75	TSCA facility requirements: Establishes siting guidance and criteria for storage (761.65), chemical waste landfills (761.75), and incinerators (761.70).	Substantive portions of Sections 761.65 – 761.75 are potential relevant and appropriate location-specific ARAR for purposes of on-site response.
New York State ECL Article 24, Title 7 Freshwater Wetlands Law	6 NYCRR Parts 662-665	Defines procedural requirements for undertaking different activities in and adjacent to freshwater wetlands, and establishes standards governing the issuance of permits to alter or fill freshwater wetlands.	Substantive portions of Parts 662-664 are a potential relevant and appropriate location-specific ARAR for purposes of on-site response.
EPA Office of Solid Waste and Emergency Response	Policy on Floodplains and Waste and Wetland Assessments for CERCLA Actions, August 1985	Superfund actions must meet the substantive requirements of the Floodplain Management Emergency Executive Order (E.O. 11988) and the Protection of Response 1985 Wetlands Executive Order (E.O. 11990) (see Table 9-3: Location-Specific ARARs). This memorandum discusses situations that require preparation of a floodplain or wetlands assessment and the factors that should be considered in preparing an assessment for response actions taken pursuant to Section 104 or 106 of CERCLA. For remedial actions, a floodplain/wetlands assessment must be incorporated into the analysis conducted during the planning of the remedial action.	TBC
Executive Order No. 11988, 42 Fed. Reg. 26951 (May 25, 1977)	Floodplain Management	Executive Order describes the circumstances where federal agencies should manage floodplains.	TBC
Executive Order No. 11990, 42 Fed. Reg. 26961 (May 25, 1977)	Protection of Wetlands	Executive Order describes the circumstances where federal agencies should manage wetlands.	TBC
ACTION-SPECIFIC ARARS AND TBCS			
Section 10, Rivers and Harbors Act, 33 USC § 403	32 CFR Parts 320, 323, 325, 329 and 330	U.S. Army Corps of Engineers approval is generally required to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States.	Substantive portions of 33 CFR Parts 320, 323 325, 329 and 330 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Section 404(c) of the Clean Water Act, 33 USC § 1344	33 CFR Parts 320, 323, 325, 329 and 330	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. Includes special policies, practices, and procedures to be followed by the U.S. Army Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act.	Substantive portions of 33 CFR Parts 320, 323 325, 329 and 330 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Clean Air Act, 42 USC s/s 7401 et seq. (1970)	40 CFR Part 60	Standards of Performance for New Stationary Sources	Substantive portions of 40 CFR Part 60 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Clean Air Act, 42 USC s/s 7401 et seq. (1970)	40 CFR Parts 61 and 63	Part 61- National Emission Standards for Hazardous Air Pollutants. Part 63 - National Emission Standards for Hazardous Air Pollutants for Source Categories.	Substantive portions of 40 CFR Parts 61 and 63 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
Section 402 of the Clean Water Act	40 CFR Parts 121, 122, 125, 401 and 403.5	Provisions related to the implementation of the National pollutant Discharge Elimination System (NPDES) program	Substantive portions of 40 CFR Parts 121, 122, 125, 401 and 403.5 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Section 404(b) of the Clean Water Act	40 CFR Part 230	Guidelines for Specification of Disposal Sites for Dredged or Fill Material. Except as otherwise provided under Clean Water Act Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Includes criteria for evaluating whether a particular discharge site may be specified.	Substantive portions of 40 CFR Part 230 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act	40 CFR Part 257	Criteria for Classification of Waste Disposal Facilities	Substantive portions of 40 CFR Part 257 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976)	40 CFR Part 261	Identification and listing of hazardous waste	Substantive portions of 40 CFR Parts 261 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976)	40 CFR Part 262	Standards applicable to generators of hazardous waste	Substantive portions of 40 CFR Part 262 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act 42 USC s/s 6901 et seq. (1976)	40 CFR § 262.11	Hazardous waste determination	Substantive portions of 40 CFR § 262.11 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 262.34	Standards for Hazardous Waste Generators, 90-Day Accumulation Rule	Substantive portions of 40 CFR § 262.34 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 264 and 265, Subparts B-264.10 - .19 F-264.90 - .101 G-264.110 - .120 J-264.190 - .200 S-264.550 - .555 X-264.600 - .603	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. B- General Facility Standards F- Releases from Solid Waste Management Units G- Closure and Post Closure J- Tank Systems S- Special Provisions for Cleanup X- Miscellaneous Units	Substantive portions of the referenced Subparts of Parts 264 and 265 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Section 3004 of the Resource Conservation and Recovery Act (Solid Waste Disposal Act, as amended), 42 USC § 6924	40 CFR § 264.13(b)	Owner or operator of a facility that treats, stores or disposes of hazardous wastes must develop and follow a written waste analysis plan.	Substantive portions of 40 CFR § 264.13(b) are potential relevant and appropriate action-specific ARARs for purposes of on-site response.

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Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 264 and 265, Subparts K-264.220 - .232 L-264.250 - .259 N – 264.300 - .317	Standards for Owners/Operators of Hazardous Waste Treatment, Storage and Disposal Facilities. K- Surface Impounds L- Waste Piles N- Landfills, Subtitle C	Substantive portions of the referenced Subparts of Parts 264 and 265 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Section 3004 of the Resource Conservation and Recovery Act, as amended, 42 USC § 6924	40 CFR § 264.232	Owners and operators shall manage all hazardous waste placed in a surface impoundment in accordance with 40 CFR Subparts BB (Air Emission Standards for Equipment Leaks) and CC (Air Emission Standards for Tanks, Surface Impoundments and Containers).	Substantive portions of 40 CFR § 264.232 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Resource Conservation and Recovery Act, 42 USC s/s 6901 et seq. (1976)	40 CFR Part 268	Land disposal restrictions C- Prohibitions on Land Disposal	Substantive portions of 40 CFR Part 268 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Toxic Substances Control Act (TSCA), Title 1, 15 USC § 2605	40 CFR Part 761	Polychlorinated biphenyls (PCBs) manufacturing, processing, distribution in commerce, and use prohibitions	Substantive portions of 40 CFR Part 761 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Hazardous Materials Transportation Act, as amended, 49 USC §§ 5101 – 5127	49 CFR Part 170	Transport of hazardous materials program procedures.	Substantive portions of 49 CFR Part 170 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Hazardous Materials Transportation Act, as amended, 49 USC §§ 5101 – 5127	49 CFR Part 171	Department of Transportation Rules for Transportation of Hazardous Materials, including procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	Substantive portions of 49 CFR Part 171 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Occupational Safety and Health Act	29CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations, including training and construction safety requirements.	Substantive portions of 29 CFR 1904, 1940, and 1926 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 17, Title 5	_____	It shall be unlawful for any person, directly or indirectly, to throw, drain, run or otherwise discharge into such waters organic or inorganic matter that shall cause or contribute to a condition in contravention of applicable standards identified at 6 NYCRR § 701.1.	Substantive portions of 17-0501, 17-0503, 17-0505, 17-0507, 17-0509 and 17-0511 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 11, Title 5	NY ECL § 11-0503	Fish & Wildlife Law against water pollution. No deleterious or poisonous substances shall be thrown or allowed to run into any public or private waters in quantities injurious to fish life, protected wildlife, or waterfowl inhabiting those waters, or injurious to the propagation of fish, protected wildlife, or waterfowl therein.	Substantive portions of 11-0503 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 27, Title 3	6 NYCRR Part 364	Standards for Waste Transportation Regulations governing the collection, transport and delivery of regulated wastes, including hazardous wastes.	Substantive portions of 6 NYCRR Part 364 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 27, Title 9	6 NYCRR Parts 370 and 371	New York State regulations for activities associated with hazardous waste management.	Substantive portions of 6 NYCRR Parts 370 and 371 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 3, Title 3; Article 27, Titles 7 and 9	6 NYCRR Part 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities. Includes Hazardous Waste Manifest System requirements for generators, transporters, and treatment, storage or disposal facilities, and other requirements applicable to generators and transporters of hazardous waste.	Substantive portions of 6 NYCRR Part 372 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
New York State ECL Article 27 Title 13	6 NYCRR Part 375	Inactive Hazardous Waste Disposal Sites. Establishes standards for the development and implementation of inactive hazardous waste disposal site remedial programs.	Substantive portions of 6 NYCRR Part 375 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 27, Title 9	6 NYCRR Part 376	Land Disposal Restrictions. PCB wastes including dredge spoils containing PCBs greater than 50 ppm must be disposed of in accordance with federal regulations at 40 CFR Part 761.	Substantive portions of 6 NYCRR Part 376 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL, Article 1, Title 1, Article 3 Title 3, Article 15 Title 3, Article 17 Title 1, 3, 8	6 NYCRR Part 700-706	New York limitations on discharges of sewage, industrial waste or other wastes.	Substantive portions of 6 NYCRR Parts 701 and 703 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL Article 17, Title 8	6 NYCRR Parts 750 – 758	New York State Pollutant Discharge Elimination System (SPDES) Requirements Standards for Storm Water Runoff, Surface Water, and Groundwater Discharges, In general, no person shall discharge or cause a discharge to NY State waters of any pollutant without a permit under the New York State Pollutant Discharge Elimination System (SPDES) program.	Substantive portions of 6 NYCRR Parts 750 - 758 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
New York State ECL, Article 8	6 NYCRR Part 617	State Environmental Quality Review, which provides general rules and actions for agencies to determine whether the actions they directly undertake, and appropriate action-specific ARARs for purposes of on-site fund or approve may have a significant impact on the environment, and, if it is response. determined that the action may have a significant adverse impact, prepare or request an environmental impact statement.	Substantive portions of 6 NYCRR Parts 617 are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
Local County or Municipality Pretreatment Requirements	Local regulations	Local regulations	Local pretreatment requirements are potential relevant and appropriate action-specific ARARs for purposes of on-site response.
USEPA	Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97- 013, August 1997)	Describes key principles and expectations, as well as "best practices" based on program experience for the remedy selection process under Superfund. Major policy areas covered are risk assessment and risk management, developing remedial alternatives, and groundwater response actions.	TBC
USEPA	Land Use in the CERCLA Remedy Selection Process (OSWER Directive No. 9355.7-04, May 1995)	Presents information for considering land use in making remedy selection decisions at NPL sites.	TBC
USEPA	Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (OSWER Directive 9285.6-08, February 2002)	Presents risk management principles that site managers should consider when making risk management decisions at contaminated sediment sites.	TBC
USEPA	Contaminated Sediment Strategy (EPA-823-R-98- 001, April 1998)	Establishes an Agency-wide strategy for contaminated sediments, with the following four goals: 1) prevent the volume of contaminated sediments from increasing; 2) reduce the volume of existing contaminated sediment; 3) ensure that sediment dredging and dredged material disposal are managed in an environmentally sound manner; and 4) develop scientifically sound sediment management tools for use in pollution prevention, source control, remediation, and dredged material management.	TBC
USEPA	Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA-540-R-05-012, December 2005)	Provides technical and policy guidance for addressing contaminated sediment sites nationwide primarily associated with CERCLA actions.	TBC

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
USEPA	Structure and Components of Five-Year Reviews (OSWER Directive 9355.7-02, May 1991) Supplemental Five-Year Review Guidance (OSWER Directive 9355.7-02A, July 1994) Second Supplemental Five-Year Review Guidance (OSWER 9355.7-03A, December 1995)	Provides guidance on conducting Five-Year Reviews for sites at which hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unrestricted use and unlimited exposure. The purpose of the Five-Year Review is to evaluate whether the selected response action continues to be protective of public health and the environment and is functioning as designed:	TBC
USEPA	40 CFR Part 50	Clean Air Act, National Ambient Air Quality Standards	TBC
USACE	Notice on Issuance of Nationwide Permits, new general conditions and 13 new definitions, 72FR11092, Mar 12, 2007.	Reissuance of Nationwide Permits, new general conditions and 13 new definitions	TBC
USACE	Notice Announcing NWP Final Regional Conditions, July 28, 2008	New regional conditions for NWP regional conditions for the Buffalo District	TBC
DEC	New York Guidelines for Soil Erosion and Sediment Control		TBC
DEC	Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water	Provides guidance for ambient water quality standards and guidance values for pollutants	TBC
DEC	Technical and Operational Guidance Series (TOGS) 1.2.1 Industrial SPDES Permit Drafting Strategy for Surface Waters	Provides guidance for writing permits for discharges of wastewater from industrial facilities and for writing requirements equivalent to SPDES permits for discharges from remediation sites.	TBC
DEC	Technical and Operational Guidance Series (TOGS) 1.3.1 Waste Assimilative Capacity Analysis & Allocation for Setting	Provides guidance to water quality control engineers in determining whether discharges to water bodies have a reasonable potential to violate water quality standards and guidance values.	TBC
DEC	Technical and Operational Guidance Series (TOGS) 1.3.2 Toxicity Testing in the SPDES Permit Program	Describes the criteria for deciding when toxicity testing will be required in a permit and the procedures which should be followed when including toxicity testing requirements in a permit.	TBC
DEC, Division of Environmental Remediation	Technical and Administrative Guidance Memorandum (TAGM) 4031 Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	Provides guidance on fugitive dust suppression and particulate monitoring for inactive hazardous waste sites.	TBC
DEC	Interim Guidance on Freshwater Navigational Dredging, October 1994	Provides guidance for navigational dredging activities in freshwater areas.	TBC
DEC Division of Fish, Wildlife and Marine Resources	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA), October 1994	Provides rationale and methods for sampling and evaluating impacts of a site on fish and wildlife during the remedial investigation and other stages of the remedial process	TBC

Table 6-5
Draft ARARs for the Buffalo River Sediment Site
Buffalo, NY

Medium/Authority	Citation	Requirement Synopsis	Status for Buffalo River
DEC TAGM 3028	"Contained-In" Criteria for Environmental Media (November 30, 1992).	Provides "contained-in" concentrations/ action levels for environmental media and the basis for these criteria.	TBC

ARAR Applicable or relevant and appropriate requirement
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
DEC Department of Environmental Conservation
ECL Environmental Conservation Law
NOAA National Oceanic and Atmospheric Administration
NYCRR New York Codes Rules and Regulations
OSWER Office of Solid Waste and Emergency Response
TAGM Technical and Administrative Guidance Memorandum
TBC To be considered
TOGS Technical and Operational Guidance Series
USACE United States Army Corps of Engineers
USC United States Code
USEPA United States Environmental Protection Agency

Table 8-1
SAV Beds Impacted by Remedy Alternative 5
Buffalo River

Species Name	Common Name	SAV-3	SAV-4	SAV-5	SAV-6	SAV-15	SAV-17	SAV-18	Impacted by Dredging							Total	Impacted by Capping		
									SAV-19	SAV-20	SAV-25	SAV-26	SAV-27	SAV-28	SAV-29		SAV-8	SAV-9	Total
<i>Ceratophyllum demersum</i>	coontail			X	X	X	X	X	X	X	X				X		X	X	
<i>Elodea canadensis</i>	Canadian waterweed		X		X	X							X				X		
<i>Justicia americana</i>	American waterwillow				X														
<i>Myriophyllum spicatum</i>	Eurasian watermilfoil		X	X	X	X		X	X	X	X	X	X	X	X		X	X	
<i>Potamogeton crispus</i>	curlyleaf pondweed	X	X			X		X	X			X	X		X		X	X	
<i>Potamogeton nodosus</i>	American pondweed	X				X	X	X	X	X		X	X	X	X				
<i>Potamogeton pectinatus</i>	sago pondweed	X	X	X		X	X	X	X	X	X	X	X	X	X		X	X	
<i>Vallisneria americana</i>	wild celery	X	X	X	X	X	X	X			X	X	X	X	X		X	X	
Water Depth (ft)		3	3.5	3	4.5	8	3	3	4.5	4	4.5	8	10	4	4		9	7	
Approximate Bed Width (ft)		18	10	10	7	10	5	12	10	12	7	8	8	10	14		7	6	
Approximate bed length disturbed by Remedy 5 (ft)		323	247	906	80	581	93	4,767	437	162	117	149	57	8	357	8,284	1,750	824	2,574
Approximate bed area disturbed by Remedy 5 (sq ft)		5,808	2,469	9,058	561	5,805	467	57,199	4,368	1,942	819	1,192	458	85	5,003	95,234	12,253	4,943	17,197

Notes:

AOC - Area of Concern

ft - feet

SAV - Submerged aquatic vegetation

Table 8-2
Emergent Vegetation Impacted by Remedy Alternative 5
Buffalo River, NY

Species Name	Common Name	Impacted by Dredging										Total
		EV-1	EV-2	EV-3	EV-4	EV-7	EV-9	EV-10	EV-11	EV-12	EV-13	
<i>Lythrum salicaria</i>	purple loosestrife	X	X	X	X		X			X	X	
<i>Phragmites australis</i>	common reed	X	X	X	X		X			X		
<i>Polygonum cuspidatum</i>	Japanese knotweed		X			X	X	X			X	
<i>Sagittaria latifolia</i>	broadleaf arrowhead										X	
<i>Scirpus validus</i>	softstem bulrush		X						X		X	
<i>Typha latifolia</i>	broadleaf cattail	X	X								X	
<i>Pontederia cordata</i>	pickerelweed										X	
Water Depth (ft)		1	1	0.5	0.5	0.5	0.5	0.5	1	0.5	1	
Approximate Bed Width (ft)		7.5	11	7	10	7.5	12	10	7	9	8.5	
Approximate bed length disturbed by Remedy 5 (ft)		67	38	28	587	570	507	51	79	77	125	2131
Approximate bed area disturbed by Remedy 5 (sq ft)		506	416	199	5872	4279	6089	510	552	694	1063	20178

Notes:

AOC - Area of Concern

EV - Emergent vegetation

ft - feet