Table 3.1

Contaminants Used in Mean PEC Quotient Calculation

	PEC
Metals (mg/kg)	
Mercury	2.2
Organic Compounds	
BTEX Compounds (µg/kg)	
Ethylbenzene	176
Xylenes	560.8
Chlorinated Benzenes (µg/kg)	
Chlorobenzene	428
Dichlorobenzenes	239
Trichlorobenzenes	347
PAH Compounds (µg/kg)	
Acenaphthene	861
Acenaphthylene	1301
Anthracene	207
Benz[a]anthracene	192
Benzo[a]pyrene	146
Benzo[b]fluoranthene	908
Benzo[ghi]perylene	780
Benzo[k]fluoranthene	203
Chrysene	253
Dibenz[a,h]anthracene	157
Fluoranthene	1436
Fluorene	264
Indeno[1,2,3-cd]pyrene	183
Naphthalene	917
Phenanthrene	543
Pyrene	344
Polychlorinated Biphenyls (µg/kg)	
Total PCBs	295

The PECQ for a given contaminant is calculated as the concentration of that contaminant in a given location within the lake divided by the PEC value associated with that contaminant. The PECQ is first calculated for the first five chemical parameter of interest (CPOI) groups (mercury, ethylbenzene and xylenes, chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) using detections. These values are then averaged to get the final mean PECQ for the station. For example, in a simplified hypothetical case where all contaminants for the five CPOI groups are detected at a station and PECQs of 1.0, 2.0, 3.0, 4.0 and 5.0 were calculated for the five groups, the mean PECQ for the station would be the average of the five PECQ values (i.e., (1.0+2.0+3.0+4.0+5.0)/5 = 3), resulting in a mean PECQ of 3.0 (i.e., 15/5) for the overall station.

Table 4.1
Sediment Cap Mixing Observations

			Atterberg Limits						Mixing Information	
Site	**Moisture Content**	**Percent Solids**	**LL**	**PI**	**Undrained Shear Strength (psf)**	**Water depth (feet)**	**Cap Design**	**Method of Placement**	**Measured (in)**	**Observed/General**
KPC Ward Cove Sediment Remediation Ketchikan, AK (1)	Avg 415%	Avg 19%	--	--	3 to 100	40 to 120	6 to 12 inches of clean, fine to medium sand	Mechanical bucket	--	Clear cap/sediment boundary; minimal to no mixing noted
University of New Hampshire Contaminated Sediment Center - Pilot Cap, NH (2)	--	--	--	--	--	<10 (small pond)	4 inch Phosfil reactive cap	Mechanical bucket	1.5	
Gasco Site Removal Action, WA	--	Avg 62%	--	--	--	0 to 30	12 inches of sand overlain by 6 inches armor	Mechanical bucket	0.74 avg	
USACE - Los Angeles -Capping Project - Dredge Material Placement in Harbor Cells, CA (3)	140 to 183% Avg 161%	35 to 41% Avg 38%	53 to 76 Avg 66	22 to 41 Avg 33	7.5 to 13 Avg 11	60	2.5 to 3.0 feet of Los Angeles River Estuary material	Stagnant bottom dump barge	--	Mud waves created in some locations. Other areas performed as anticipated.
Silver Lake Pilot Study, MA (4)	--	--	--	--	--	0 to ~25	~6 inches of sand	Hydraulic spreader box	Max ~2	--
USACE - Los Angeles - Aquatic Capping Project Cap Material Placement Los Angeles Harbor, CA (3)	98 to 134% Avg 111%	43 to 51% Avg 47%	38 to 51 Avg 44	7 to 20 Avg 13	5 to 22 Avg 11	52	5 feet of fine to medium sand	Bottom dump barge moving and rehandling with bucket	--	Confirmation cores indicate little mixing of the cap and underlying contaminated sediment
Port of Olympia, WA	Avg 245%	Avg 28%	--	--	--	40	min 3 inches nominal 6 inches of sand	Mechanical bucket	0.4 avg	
Matsushima Bay Japan (5)	200 to 375% Avg 275%	21 to 33% Avg 27%	160 to 175	115 to 130	5 to 35	10	12 inches of fine sand	Unknown	--	Deemed successful
Hudson Run Reservoir Barberton, OH	51 to 287% Avg 211%	26 to 66% Avg 34%	54 to 93 Avg 79	17 to 51 Avg 39	10 to 76 psf Avg 24 psf	5	12 inches of medium to coarse sand	Hydraulic with surface diffuser barge	--	Successful; minimal mixing noted in cores
Soda Lake Capping Casper, WY (6)	161 to 455% Avg 200%	18 to 38% Avg 33%	91 to 155	>50	Less than 280	0.5 to 12	3 feet of medium clean sand	Hydraulic with surface diffuser barge	--	Clear cap/sediment boundary; minimal mixing noted
Lower Fox River Phase 1, WI (7)	78 to 346% Avg 238%	22 to 56% Avg 32%	99 to 210	61 to 163	--	4 to 8 feet	6 inches of sand	Hydraulic with surface diffuser barge	0.4 avg	
Anacostia River, DC (8)	--	--	--	--	~40	--	--	--	1.6 avg	--
Lower Canal, S. of the South Closure, Bypass Canal Lake Charles, LA (9)	40 to 500% Avg 150%	15 to 70% Avg 40%	-	-	17 to 46 Typ 21	4 to 6	12 inches of fine to medium sand overlain by 6 inches of gravel	--	--	Minimal
Hiroshima Bay Sediments Japan (5)	80 to 100% Avg 88%	50 to 56% Avg 53%	60 to 75 Avg 68	22 to 38 Avg 31	20 to 85	65 to 70	12 to 20 inches of sand	Unknown	--	Deemed Successful
Lake Biwa Japan (5)	95 to 150% Avg 125%	40 to 51% Avg 44%	70 to 135 Avg 105	40 to 70 Avg 55	20 to 190	5	8 inches of medium sand	Unknown	--	Deemed Successful
G-P Log Pond Bellingham, WA (10)	97 to 175% Avg 142%	36 to 51% Avg 41%	65 to 175 Avg 105	36 to 79 Avg 61	65 to 277 Avg 144	3 to 15	6 inches to 8 feet of fine to medium sand	Mechanical bucket	--	Clear cap/sediment boundary
West Waterway CAD Seattle, WA (11)	Avg 91%	Avg 52%	Avg 73	Avg 39	Not measured	55 to 65	2 feet of uniformly-graded sand	Bottom dump barge	--	Clear cap/sediment boundary

Table 4.1
Sediment Cap Mixing Observations

			Atterberg Limits						Mixing Information	
Site	**Moisture Content**	**Percent Solids**	**LL**	**PI**	**Undrained Shear Strength (psf)**	**Water depth (feet)**	**Cap Design**	**Method of Placement**	**Measured (in)**	**Observed/General**
Stryker Bay, MN (12)	Avg 84.3%	--	Avg 62	Avg 37	15 to 264 Avg 69	<5	36 inches of sand with GAC mat / 12 inches of sand	Hydraulic with surface diffuser barge	2 to 4 (undredged areas) 0 to 2 (dredged areas)	
New London Disposal Site, CT (13)	--	--	--	--	--	~60	Dredged material	dump barge	--	No physical mixing noted
Grasse River - Capping Pilot Study, NY (14)	--	--	--	--	--	average 16	various	various	<2	
Massachusetts Bay Disposal Site, MA (15)	--	--	--	--	--	~275	Dredged material	dump barge	--	Little to no sediment mixing noted
Central Long Island Sound disposal operations , NY (16)	--	--	--	--	--	~60	Dredged material	dump barge	--	Very clear chemical and visual boundaries; minimal mixing

Notes:
LL - liquid limit
PI - plasticity index (LL minus the plastic limit)
psf - pounds per square foot
-- - Data not available

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(7) Lower Fox River Phase 1 Remedial Action Draft Summary Report 2007. Shaw et al. 2008
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(11) Dredged Material is not Spoil: A Report on the Use of Dredged Material in Puget Sound to Isolate Contaminated Sediments. Sumeri 1996
(12) Personal communication with McGann. April 13, 2009
(13) Monitoring Survey at the New London Disposal Site. SAIC 2004
(14) Documentation Report - Grasse River Capping Pilot Study. BBL 2002
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Table 4.2
Summary of Cap Thicknesses (feet)

REMEDIATION AREA A AND NINEMILE CREEK SPITS

		Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
Water Depth/ Habitat Module	**Mixing Layer(5) (ft)**	**pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Non-pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**
0 to 3 ft of water depth																	
6A (Cap Area A-2) (+1-1 ft) 5A (Cap Area A-2) (0.5-2 ft) 3A (Cap Area A-2) (2-3 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.0	1.375	topsoil	1.0	1.25	2.0	2.625	3.25	4.375
6A (+1-1 ft) NMC Spits (A-2) 9B (A-2)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'B'	0.375	0.75	topsoil	1.625	1.875	2.0	2.625	3.25	4.375
6A (Cap Area A-1) (+1-1 ft) 5A (Cap Area A-1) (0.5-2 ft) 4A (Cap Area A-1) (1-3 ft) 3A (Cap Area A-1) (2-3 ft)	0.25	n/a	n/a	1.0	1.25	1.0	1.25	coarse gravel 'A'	1.0	1.375	topsoil	1.0	1.25	2.0	2.625	3.25	4.125
3 to 7 ft of water depth																	
3B (3-7 ft) NMC Channel (A-2)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.5	1.88	n/a	n/a	n/a	1.5	1.88	2.75	3.63
3A (Cap Area A-2) (3-7 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.75	2.75	3.5
3A (Cap Area A-1) (3-7 ft)	0.25	n/a	n/a	1.0	1.25	1.0	1.25	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.75	2.75	3.25
7 to 10 ft of water depth																	
2B (7-10 ft) NMC Channel (A-2)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.5	1.88	n/a	n/a	n/a	1.5	1.88	2.75	3.63
2A (Cap Area A-2) (7-10 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.75	2.75	3.5
2A (Cap Area A-1) (7-10 ft)	0.25	n/a	n/a	1.0	1.25	1.0	1.25	fine gravel	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	2.75
10 to 20 ft of water depth																	
2A (Cap Area A-2) (10-20 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	3.0
2A (Cap Area A-1) (10-20 ft)	0.25	n/a	n/a	1.0	1.0	1.0	1.0 (6)	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	2.5
20 to 30 ft of water depth																	
1 (Cap Area A-1) (20-30 ft)	0.25	n/a	n/a	0.5	0.5	0.5	0.5 (6)	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	1.75	2.0

Table 4.2
Summary of Cap Thicknesses (feet)

REMEDIATION AREA B AND WASTE BEDS 1-8 CONNECTED WETLAND

		Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
Habitat Module	**Mixing Layer(5) (ft)**	**pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Non-pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**
0 to 4 ft of water depth																	
3A (2-3) (WB 1-8)																	
5A (0.5 to 2) (WB 1-8)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'B'	0.375	0.75	topsoil	1.625	1.875	2.0	2.625	3.25	4.375
6A (+1 to -1) (WB 1-8)																	
5A (0.5 to 2)																	
3A (2-4 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.0	1.375	fine gravel	1.0	1.25	2.0	2.625	2.25	4.375
4 to 7 ft of water depth																	
3A (4-7 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.750	2.75	3.5
7 to 10 ft of water depth																	
2A (7-10 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.0	1.75	2.75	3.5
10 to 30 ft of water depth																	
2A (10-20 ft)																	
1 (20-30 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	3.0

REMEDIATION AREA C

		Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
Habitat Module	**Mixing Layer(5) (ft)**	**pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Non-pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**
0 to 4 ft of water depth																	
8A shoreline upland																	
5B (0.5-2 ft) (max)(7)	0.25	0.25	0.75	0.75	1.25	1.0	2.0	coarse gravel 'A'	1.0	1.75	fine gravel	1.0	1.5	2.0	3.25	3.25	5.5
5B boat launch	0.25	0.25	0.5	0.75	1.00	1.0	1.5	coarse gravel 'A'	2.0	2.38	n/a	n/a	n.a	2.0	2.38	3.25	4.125
5B (0.5 to 2)																	
3B (2-4ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.0	1.375	fine gravel	1.0	1.25	2.0	2.625	3.25	4.375
4 to 10 ft of water depth																	
3B boat launch (-5 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.5	1.875	n/a	n/a	n/a	1.5	1.875	2.75	3.625
3B (4-7 ft)																	
2A (7-10 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.75	2.75	3.5
10 to 30 ft of water depth																	
2A (10-20 ft)																	
1 (20-30 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	3.0

Table 4.2
Summary of Cap Thicknesses (feet)

REMEDIATION AREA D

		Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
Habitat Module	**Mixing Layer(5) (ft)**	**pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Non-pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**
0 to 4 ft of water depth 6A (+1-1 ft) max cap (7) 5A (0.5-2 ft) max cap (7)	0.25	0.25	0.75	0.75	1.25	1.0	2.0	coarse gravel 'A'	1.0	1.75	medium sand	1.0	1.5	2.0	3.25	3.25	5.5
5A (0.5-2 ft) (8) 6A (+1-1 ft) 3B (2-4 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'A'	1.0	1.375	medium sand	1.0	1.25	2.0	2.625	3.25	4.375
4 to 7 ft of water depth 3B (4-7 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.5	1.75	n/a	n/a	n/a	1.5	1.75	2.75	3.5
7 to 10 ft of water depth 2A (7-10 ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	fine gravel	1.0	1.25	n/a	n/a	n/a	1.0	1.3	2.25	3.0
10 to 30 ft of water depth 2A (10-20 ft) 1 (20-30 ft) 1 (30+ ft)	0.25	0.25	0.5	0.75	1.0	1.0	1.5	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	3.0

Table 4.2
Summary of Cap Thicknesses (feet)

REMEDIATION AREA E

		Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
Habitat Module	**Mixing Layer(5) (ft)**	**pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Non-pH Amended Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Grainsize**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**	**Minimum (ft)**	**Assumed Mean With Over Placement (ft)**
0 to 3 ft of water depth 6B (+1-1 ft) 5B (0.5-2 ft) 3B (2-3 ft) 6B (+1-1 ft) GAC 5B (0.5-2 ft) GAC (8) 3B (2-3 ft) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	Gravely Cobbles	1.0	1.5	coarse gravel	1.0	1.375	2.0	2.875	3.25	4.375
3 to 7 ft of water depth 3B (3-7 ft) 3B (3-7 ft) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	Gravely Cobbles	1.5	2.0	n/a	n/a	n/a	1.5	2.0	2.75	3.5
7 to 10 ft of water depth 2B (7-10 ft) 2B (7-10 ft) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	coarse gravel 'B'	1.0	1.375	n/a	n/a	n/a	1.0	1.375	2.25	2.875
10 to 20 ft of water depth 2A (10-20 ft) 2A (10-20 ft) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	fine gravel	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.25	2.75
2A (Navigation Channel) 2A (Navigation Channel) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	Gravely Cobbles	1.0	1.5	n/a	n/a	n/a	1.0	1.5	2.25	3.0
20 to 30 ft of water depth																	
1 E2 (20-30 ft) GAC	0.25	n/a	n/a	1.0	1.25	1.0	1.25	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.50	2.75
1 E3 (20 to 30) GAC	0.25	n/a	n/a	0.5	0.75	0.5	0.75	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	2.00	2.25
1 E1 (20-30 ft)	0.25	n/a	n/a	0.5	0.5	0.5	0.5 (6)	medium sand	1.0	1.25	n/a	n/a	n/a	1.0	1.25	1.75	2.0

Table 4.2
Summary of Cap Thicknesses (feet)

WASTE BED B OUTBOARD AREA

Habitat Module	Mixing Layer(5) (ft)	Chemical Isolation Layer(1)(2)(3)						Habitat/Erosion Protection Layer			Additional Habitat Layer			Total Habitat Layer(4)		Total Isolation Cap	
		pH Amended Minimum (ft)	Assumed Mean With Over Placement (ft)	Non-pH Amended Minimum (ft)	Assumed Mean With Over Placement (ft)	Minimum (ft)	Assumed Mean With Over Placement (ft)	Grainsize	Minimum (ft)	Assumed Mean With Over Placement (ft)	Grainsize	Minimum (ft)	Assumed Mean With Over Placement (ft)	Minimum (ft)	Assumed Mean With Over Placement (ft)	Minimum (ft)	Assumed Mean With Over Placement (ft)
+1 to 2 ft of water depth 9B (+1-+0.5 ft) west/center 8A west/center 6A (+1 -1 ft) west/center 5A (0.5-2 ft) west/center	0.25	0.25	0.50	0.75	1.0	1.0	1.5	coarse gravel 'B'	0.375	0.75	topsoil	1.625	1.875	2.0	2.625	3.25	4.375
8A east 6A (+1 -1 ft) east 5A (0.5-2 ft) east	0.25	n/a	n/a	1.0	1.25	1.0	1.25	coarse gravel 'B'	0.375	0.75	topsoil	1.625	1.875	2.0	2.625	3.25	4.125
2 to 5 ft of water depth 3A (2-5 ft) west/center	0.25	0.25	0.5	0.75	1.0	1.0	1.5	coarse gravel 'B'	0.375	0.75	topsoil	1.625	1.875	2.0	2.625	3.25	4.375

	Total Thin Layer Cap	
	Minimum Thickness (ft)	Assumed Mean With Over Placement (ft)
SMU 8 Thin Layer Cap	0.16	0.42

(1) Mixing and Chemical Isolation Layers grainsize are medium sand in all areas except Remediation Area E where gravely sand will be used underlying gravelly cobbles Erosion .
(2) Details of how the buffer layer is incorporated into the design are provided in Section 4.1.5.
(3) Non pH amended Chemical Isolation Layer and associated over placement contains GAC as needed. GAC is required in cap areas except in model areas A-1, E-1 and the SMU 8 thin layer cap.
(4) Total Habitat Layer is the sum of the Habitat/Erosion Protection Layer and the Additional Habitat Layer
(5) Mixing layer includes pH amendment in all areas except Model Areas A-1, E-1, E-2 , E-3 and Waste Bed B Outboard East.
(6) The substrate for the Chemical Isolation Layer and Habitat/Erosion Protection Layer are the same, therefore, an over placement allowance in the Chemical Isolation Layer is not required.
(7) Maximum anticipated capping overplacement was assumed for each layer within habitat modules 5 and 6 for the 2012 capping operations. These areas will be used to demonstrate the remedial contractor's cap placement abilities during the first capping season. Mean overplacement was assumed for each layer for subsequent seasons.
(8) Habitat substrate from the shoreline to 25 ft. offshore will be topsoil along the Remediation Area D and Wastebed B outboard area..

Table 4.3
Summary of Wind/Wave Erosion Protection Particle Grain Size

	Remediation Area A Ninemile Creek Spits		Remediation Area B and Waste Beds 1-8 Connected Wetlands		Remediation Area C And Remediation Area D		Remediation Area E		Waste Bed B Outboard	
Water Depth (ft)	Particle Size	Minimum Thickness (inches)	Particle Size	Minimum Thickness (inches)	Particle Size	Minimum Thickness (inches)	Particle Size	Minimum Thickness (inches)	Particle Size	Minimum Thickness (inches)
20’ to 30’	Fine sand	3	Fine sand	3	Fine sand	3	Medium sand	3	n/a	n/a
15’ to 20’	Fine sand	3	Fine sand	3	Medium sand	3	Fine gravel	3	n/a	n/a
10’ to 15’	Fine sand	3	Medium sand	3	Medium sand	3	Fine gravel	3	n/a	n/a
8’ to 10’	Medium sand	3	Coarse sand	3	Fine gravel	3	Coarse gravel	3	n/a	n/a
6’ to 8’	Coarse sand	3	Fine gravel	3	Fine gravel	3	Coarse gravel	3	n/a	n/a
Surf zone to 6’	Fine gravel	3	Fine gravel	3	Fine gravel	3	Cobbles	6	n/a	n/a
Within surf zone	Coarse gravel	3	Coarse gravel	3.5	Coarse gravel	4	Cobbles	6	coarse gravel	4.5

Notes:

1. The breaking wave depth is approximately 3.5 ft in Areas A and B, 4 ft in Areas C and D, and 7 ft in Area E.

2. The erosion protection layer thickness will be the greater of either 1.5 times the largest particle diameter, or 2 times the median particle diameter. For practical application considerations for construction and integration with the habitat layer, the minimum erosion protection layer thickness for lake habitat modules will be 12 inches (1.0 ft). In adjacent wetland habitat modules, the minimum erosion protection layer will be set at 4.5 inches (0.375 ft).

Table 4.4
Estimated Cap Material Volumes

	Cap Area (acre)	Topsoil (CY)	Medium Sand (CY)	Medium Sand with GAC (CY)	Medium Sand with Siderite (CY)	Fine Gravel (CY)	Coarse Gravel (CY)	Graded Gravel (CY)	Gravely Cobble (CY)	Total by Remediation Area (CY)
Remediation Area A	85.8	45,400	226,900	26,900	20,200	46,800	40,400	0	0	406,600
Remediation Area B	19.4	0	26,600	31,600	23,500	17,100	12,000	0	0	110,800
Shoreline Enhancement	25.6	0	0	0	0	0	16,200	22,900	0	39,100
Remediation Area C	24.0	0	31,500	40,500	29,800	13,600	21,900	0	0	137,300
Remediation Area D	98.5	6,300	143,400	159,400	119,700	64,600	17,900	0	0	511,300
Remediation Area D Addendum	5.6	0	11,300	9,000	6,800	0	0	0	0	27,100
Remediation Area E	182.8	0	253,000	222,600	0	78,000	89,300	0	312,800	955,700
Remediation Area F	0.6	0	2,500	0	0	30	0	0	0	2,530
NMC Spits	1.9	6,400	0	3,500	2,300	0	3,600	0	0	15,800
Wastebed 1-8	2.4	9,200	0	4,800	3,000	0	7,400	0	0	24,400
Wastebed B outboard	16.3	49,400	0	31,200	12,500	0	19,300	0	0	112,400
SMU 8 thin layer cap	26.8	0	17,800	0	0	0	0	0	0	17,800
Total by mat'l type		116,700	713,000	529,500	217,800	220,130	228,000	22,900	312,800	

Total Topsoil (CY)	Total Sand (CY)	Total Gravel (CY)
116,700	1,460,300	783,800

-Remediation Area E acreage and volumes include an estimated 9.3 acres in the CSX shoreline area
- Assumes habit thickness within 6" of design elevation in 0-2 ft water depth
- Over placements are consistent with Capping, Dredging and Habitat Draft Final Design, table 4.2
- Shoreline Enhancement includes the acreage for SMU 3 and SMU 4 shoreline stabilization

Table 5.1
Estimated Dredge Volumes

Dredge Area	Dredge Areas				
	Dredge Area (sf)	Dredge Area (acre)	Appendix F Dredge Volume (cy)	Over Dredge Volume (cy)	Total Dredge Volume (cy)
RA-A	975,000	22.4	93,900	18,100	112,000
RA-B	208,300	4.8	25,700	3,900	29,600
RA-C	209,000	4.8	31,100	3,900	35,000
RA-D[1] [2]	3,980,600	91.4	1,182,000	2,200	1,184,200
RA-E	2,667,700	61.2	308,700	49,400	358,100
RA-E (CSX)[3]	405,000	9.3	58,100	7,500	65,600
Remediation Area Total	8,445,600	193.9	1,699,500	85,000	1,784,500
Ninemile Creek Spits	84,900	1.9	16,700	0	16,700
WB 1-8 Connected Wetland	103,700	2.4	41,500	0	41,500
WB B Outboard[4]	711,300	16.3	192,800[4]	0	192,800[4]
Adjacents Total	899,900	20.7	251,000	0	251,000
				Contingency Volume, 10%	203,600
				Total Estimated Volume	2,240,000

1. Overdredge volume in RA-D is based on overdredging in nearshore habitat modules only (0 to 2 ft. water depth).
2. Includes the following

2M average in SMU 2	74,000 CY
2M average in SMU 1	888,300 CY
2M average in SMU 7	92,400 CY
Hot Spots	129,100 CY
Total	1,183,800 CY

3. Stability of the nearshore region of RA-E is currently being evaluated due to the close proximity of the CSX railroad tracks to the dredge area. Dredge volumes in the table are conservatively assumed to be an average of 3.875 ft. in this area, to account for the amount of sediments that would be dredged including mean overplacements for each layer if there were no stability limitations.
4. Wastebed B outboard volume includes an estimated 35,000 cy that may be mechanically removed.

TABLE 6.1
MONITORING AND CONTINGENCY SCHEDULE
FOR IMPLEMENTING MNR IN ONONDAGA LAKE

Project Phase	Year	Planned Sampling		Data Eval. And Decisions		Conduct Contingencies		Implementation Notes
		Number of Surface Sediment Locations	Sampling to Assess Sedimentation Rate[a]	Track MNR[b]	Evaluate Contingency Actions[c]	Monitoring or Modeling	Thin-Layer Capping or Other Construction	
Design	2007	26						
	2008	7	High-Resolution Cores					
	2009		Markers deployed					
	2010	70	Cores	Yes	Yes			
	2011	~20	Cores	Yes	Yes			
Construction	2012					If Needed		Start Dredging
	2013					If Needed	If Needed	Start Capping
	2014	~20-30	Cores	Yes	Yes			
	2015					If Needed		Revise TLC Area
	2016					If Needed	If Needed	Complete Cap+TLC
	2017	~20-30	Cores	Yes	Yes			MNR Baseline
MNR Period	2018					If Needed		
	2019					If Needed	If Needed	
	2020	~20-30	Cores	Yes	Yes			
	2021					If Needed		
	2022					If Needed	If Needed	
	2023	~20-30	Cores	Yes	Yes			
	2024					If Needed		
	2025					If Needed	If Needed	
	2026	~20-30	Cores	Yes	Yes			
	2027					If Needed	If Needed	TLC any remainder

Notes:

[a] Sampling may include high resolution cores as well as marker cores.

[b] Tracking MNR will involve updating the MNR model and other projections as warranted based on new data.

[c] Contingency actions may include additional monitoring, modeling, and/or additional thin-layer capping (TLC).

TABLE 6.2

SUMMARY OF FINAL PREDICTED MERCURY SEDIMENT CONCENTRATIONS FOR ONONDAGA LAKE SEDIMENT (YEAR 2027)

Portion of Profundal Zone	Number of Locations Modeled	Final Predicted Area-Weighted Average Mercury Sediment Concentration in Profundal Zone (mg/kg)	Area-Weighted Average Mercury Sediment Concentration Throughout Onondaga Lake (littoral and profundal zones) (mg/kg)
North Basin	14	0.48 to 0.51	0.61
Ninemile Creek Outlet	11	0.51 to 0.53	0.38
Saddle	3	0.51 to 0.52	0.49
South Basin	20	0.51 to 0.53	0.49
South Corner	48	0.54 to 0.58	0.34

Note: Results presented in this table are developed in detail in Appendix N.

TABLE 6.3

PECQ DATA AVAILABLE FOR SMU 8 SEDIMENT

Sampling Year	Sample Depths (cm)	Number of Locations	Comments
1992	0 to 2	43	33 locations(2) without PAH data
2000	0 to 15 (one sample per location)	5	Two locations without BTEX data (S302 and S303)
2006	0 to 15 (one sample per location)	29	Adjacent to southwest shoreline
2007	0 to 15 as one sample per location for all but two locations(1)	19	--
May 2010	0 to 4 and 4 to 15	41	Included eight locations sampled during 1992(3) and one location sampled during 2000 (S355). Also included 12 locations sampled during 2006 and three locations sampled during 2007.
August 2010	0 to 4 and 4 to 15	26	Included 14 locations sampled during 1992(4) and two locations sampled during 2000 (S303 and S354). Also included eight locations sampled during 2006(5) and five locations sampled during 2007(6). Three of these locations had been sampled at least twice previously.
2011	0 to 4	1	1992 location S57 was resampled.

(1) For the other two locations (OL-STA-80070 and 80079), PECQ data are available for 0 to 2, 2 to 4, 4 to 10, and 10 to 15 cm sediment depths.

(2) These 33 locations sampled during 1992 were S30 through S33, S41 through S44, S49, S50, S52, S57 through S60, S63 through S65, S69, S78 through S80, S85, S88, S89, S91, S96 through S99, S102, S106, and S107.

(3) These eight locations sampled during 1992 were S25, S27, S31, S32, S40, S56, S63, and S85.

(4) These 14 locations sampled during 1992 were S24, S30, S50, S52, S58, S60, S69, S86, S89, S96 through S98, S102, and S103.

(5) These eight locations sampled during 2006 were OL-VC-80027, OL-VC-80028, OL-VC-80032, OL-VC-80033, OL-VC-80034, OL-VC-80037, OL-VC-80039, and OL-VC-80049.

(6) These five locations sampled during 2007 were OL-STA-80070, OL-VC-80057, OL-VC-80064, OL-VC-80065, and OL-VC-80070.

TABLE 6.4
BASIS FOR FOCUSING ON MOST RECENT SMU 8 PECQ RESULTS FOR SEDIMENT FROM THE SAME LOCATION

Sample ID / Depth Interval (cm) / Year (and mean PECQ)	Most Recent Sample ID / Year at Same Location (and mean PECQ for 0 to 4 cm)	Basis for Focusing Analysis on Most Recent Results for Mean PECQ
North Basin		
S103 / 0 to 2 / 1992 (0.69)	OL-VC-80198 / 2010 (0.27)	More recent result
S102 / 0 to 2 / 1992 (0.86)	OL-VC-80199 / 2010 (0.22)	More recent result with all PECQ parameters measured
S98 / 0 to 2 / 1992 (0.63)	OL-VC-80200 / 2010 (0.34)	More recent result with all PECQ parameters measured
S97/0 to 2 / 1992 (1.6) OL-VC-80023 / 0 to 15 / 2006 (0.55) OL-STA-80070 / 0 to 2 / 2007 (1.2)	OL-VC-80201 / 2010 (0.27)	More recent result from more representative sediment depth
Ninemile Creek Outlet Area (NMC Outlet)		
OL-VC-80046 / 0 to 15 / 2006 (1.4)	OL-VC-80162 / 2010 (0.75)	More recent result from more representative sediment depth
S303 / 0 to 15 / 2000 (0.79)	OL-VC-80205 / 2010 (0.24)	More recent result with all PECQ parameters measured
OL-VC-80048 / 0 to 15 / 2006 (0.77)	OL-VC-80164 / 2010 (0.3)	More recent result from more representative sediment depth with all PECQ parameters measured
Saddle		
S69 / 0 to 2 / 1992 (0.76)	OL-VC-80206 / 2010 (0.28)	More recent result with all PECQ parameters measured
South Basin		
S63 / 0 to 2 / 1992 (0.81)	OL-VC-80166 / 2010 (0.28)	More recent result with all PECQ parameters measured
OL-VC-80045 / 0 to 15 / 2006 (7.4)	OL-VC-80167 / 2010 (0.33)	More recent result from more representative sediment depth
S58 / 0 to 2 / 1992 (0.84)	OL-VC-80208 / 2010 (0.36)	More recent result with all PECQ parameters measured
S60 / 0 to 2 / 1992 (0.85)	OL-VC-80207 / 2010 (0.27)	More recent result with all PECQ parameters measured
S56 / 0 to 2 / 1992 (1.1) OL-VC-80024 / 0 to 15 / 2006 (0.85)	OL-VC-80169 / 2010 (0.26)	More recent result from more representative sediment depth with all PECQ parameters measured

TABLE 6.4
BASIS FOR FOCUSING ON MOST RECENT SMU 8 PECQ RESULTS FOR SEDIMENT FROM THE SAME LOCATION

Sample ID / Depth Interval (cm) / Year (and mean PECQ)	Most Recent Sample ID / Year at Same Location (and mean PECQ for 0 to 4 cm)	Basis for Focusing Analysis on Most Recent Results for Mean PECQ
South Basin (Continued)		
S57 / 0 to 2 / 1992 (1.1)	OL-STA-80224 / 2011 / (0.49)	More recent result with all PECQ parameters measured
S52 / 0 to 2 / 1992 (0.77)	OL-VC-80209 / 2010 (0.5)	More recent result with all PECQ parameters measured
S50 / 0 to 2 / 1992 (0.88)	OL-VC-80210 / 2010 (0.51)	More recent result with all PECQ parameters measured
South Corner		
S32 / 0 to 2 / 1992 (0.5)	OL-VC-80172 / 2010 (0.43)	More recent result with all PECQ parameters measured
S40 / 0 to 2 / 1992 (0.78)	OL-VC-80171 / 2010 (0.46)	More recent result
S31 / 0 to 2 / 1992 (0.68)	OL-VC-80177 / 2010 (0.51)	More recent result with all PECQ parameters measured
OL-VC-80037 / 0 to 15 / 2006 (1.2)	OL-VC-80211 / 2010 (1.27)	More recent result from more representative sediment depth
S27 / 0 to 2 / 1992 (1.1) S355 / 0 to 15 / 2000 (0.92) OL-VC-80020 / 0 to 15 / 2006 (1.3)	OL-VC-80178 / 2010 (0.40)	More recent result from more representative sediment depth with all PECQ parameters measured
OL-VC-80038 / 0 to 15 / 2006 (1.9)	OL-VC-80179 / 2010 (0.40)	More recent result from more representative sediment depth
OL-VC-80049 / 0 to 15 / 2006 (1.1)	OL-VC-80212 / 2010 (0.33)	More recent result from more representative sediment depth
OL-VC-80039 / 0 to 15 / 2006 (1.7)	OL-VC-80223 / 2010 (0.34)	More recent result from more representative sediment depth
S30 / 0 to 2 / 1992 (0.7) S354 / 0 to 15 / 2000 (0.87)	OL-VC-80214 / 2010 (0.32)	More recent result from more representative sediment depth with all PECQ parameters measured
OL-VC-80050 / 0 to 15 / 2006 (1.1)	OL-VC-80186 / 2010 (0.68)	More recent result from more representative sediment depth
OL-VC-80068 / 0 to 15 / 2007 (1.2)	OL-VC-80187 / 2010 (0.41)	More recent result from more representative sediment depth
OL-VC-80067 / 0 to 15 / 2007 (1.5)	OL-VC-80192 / 2010 (0.78)	More recent result from more representative sediment depth

TABLE 6.4
BASIS FOR FOCUSING ON MOST RECENT SMU 8 PECQ RESULTS FOR SEDIMENT FROM THE SAME LOCATION

Sample ID / Depth Interval (cm) / Year (and mean PECQ)	Most Recent Sample ID / Year at Same Location (and mean PECQ for 0 to 4 cm)	Basis for Focusing Analysis on Most Recent Results for Mean PECQ
South Corner (Continued)		
OL-VC-80051 / 0 to 15 / 2006 (1.6)	OL-VC-80193 / 2010 (0.79)	More recent result from more representative sediment depth
OL-VC-80040 / 0 to 15 / 2006 (1.6)	OL-VC-80194 / 2010 (0.50)	More recent result from more representative sediment depth
OL-VC-80065 / 0 to 15 / 2007 (1.5)	OL-VC-80213 / 2010 (0.42)	More recent result from more representative sediment depth
OL-VC-80057 / 0 to 15 / 2007 (1.1)	OL-VC-80217 / 2010 (0.26)	More recent result from more representative sediment depth
OL-VC-80070 / 0 to 15 / 2007 (1.1)	OL-VC-80219 / 2010 (0.49)	More recent result from more representative sediment depth
OL-VC-80064 / 0 to 15 / 2007 (1.6)	OL-VC-80221 / 2010 (0.51)	More recent result from more representative sediment depth
OL-VC-80028 /0 to 15 / 2006 (1.3)	OL-VC-80215 / 2010 (0.33)	More recent result from more representative sediment depth
OL-VC-80033 / 0 to 15 / 2006 (0.99)	OL-VC-80216 / 2010 (0.43)	More recent result from more representative sediment depth
OL-VC-80034 / 0 to 15 / 2006 (1.5)	OL-VC-80218 / 2010 (0.38)	More recent result from more representative sediment depth
OL-VC-80035 / 0 to 15 / 2006 (1.6)	OL-VC-80195 / 2010 (0.63)	More recent result from more representative sediment depth
OL-VC-80036 / 0 to 15 / 2006 (1.6)	OL-VC-80196 / 2010 (0.59)	More recent result from more representative sediment depth
S24 / 0 to 2 / 1992 (1.1) OL-VC-80027 / 0 to 15 / 2006 (1.7)	OL-VC-80220 / 2010 (0.54)	More recent result from more representative sediment depth
OL-VC-80032 / 0 to 15 / 2006 (1.8)	OL-VC-80222 / 2010 (0.59)	More recent result from more representative sediment depth
OL-VC-80071 / 0 to 15 / 2007 (2.2)	OL-VC-80197 / 2010 (0.77)	More recent result from more representative sediment depth

Table 7.1
Summary of Debris/Utility Targets Identified in 2012 Remedial Action Areas

Target ID	Side-Scan Sonar Survey Data				Planned Remedial Action	Notes	Management Strategy
	Height (ft)	Length (ft)	Width (ft)	General Description			
117	0.3	35	5.5	Low profile, man-made debris	Dredge-and-Cap		Remove
198	3.0	51	16	Textural anomaly	Dredge-and-Cap		Remove
207	3.3	5.4	2.1	Debris	Dredge-and-Cap		Remove
211	0.4	20	2.0	Angular, man-made debris	Dredge-and-Cap		Remove
233	3.3	77	29	Man-made debris	Dredge-and-Cap	Debris structure close to shoreline	Remove if encountered within the dredge area; May actually be behind barrier wall
245	0.6	20	3.1	Debris	Dredge-and-Cap		Remove
333	2.2	14	4.5	Man-made debris	Dredge-and-Cap	Automobile	Remove
N/A	N/A			Bulkhead/baffle wall	Dredge-and-Cap	Historic wooden structure	Remove or cut close to post-dredge surface prior to cap placement
N/A	N/A			Pile field	Dredge-and-Cap	Associated with former yacht club	Remove or cut close to post-dredge surface prior to cap placement
N/A	N/A			Pipeline	Dredge-and-Cap	Inactive Allied Chemical water inlet pipes (3)	Utility strucutres below dredge elevations; Dredge and cap in-place
196	0.2	109	0.5	Low profile, man-made debris	Cap-only	Cable or narrow pipeline	Cap in-place
202	0.5	9.0	1.1	Low profile debris	Cap-only		Cap in-place
227	0.0	35.5	30.8	Depression	Cap-only		Cap in-place
234	0.0	26.1	5.5	Low profile debris	Cap-only		Cap in-place
235 [a]	7.0	19	3.9	Debris	Cap-only	Not found in 2011 underwater visual survey -- Assumed to be vegitation that has detoriated or been transported elsewhere since the 2005 survey	Cap in-place
236 [a]	5.5	11	11	Man-made debris	Cap-only	Valve Structure associated with Solvay Process cooling water intakes	Cap in-place with modified cap design

Table 7.1
Summary of Debris/Utility Targets Identified in 2012 Remedial Action Areas

Target ID	Side-Scan Sonar Survey Data				Planned Remedial Action	Notes	Management Strategy
	Height (ft)	Length (ft)	Width (ft)	General Description			
294 [a]	6.3	8.6	5.9	Not present	Cap-only	Not found in 2011 underwater visual survey -- Assumed to be vegitation that has detoriated or been transported elsewhere since the 2005 survey	Cap in-place
295 [a]	8.6	13	3.5	Not present	Cap-only	Not found in 2011 underwater visual survey -- Assumed to be vegitation that has detoriated or been transported elsewhere since the 2005 survey	Cap in-place
302 [a]	3.0	54	3.9	Not present	Cap-only	Not found in 2011 underwater visual survey -- Assumed to be vegitation that has detoriated or been transported elsewhere since the 2005 survey	Cap in-place
N/A	N/A			Pipeline	Cap-only	Inactive Solvay Process water intakes (2)	Utility strucutres below dredge elevations; Cap in-place

a. Targets visually inspected with underwater video in July 2011.
N/A = not applicable

Table 7.2
Lake Utilities Summary

Rem Area	Utility	Owner	Diam. (in)	Construction	Length from shore	Status
A	Pipeline (Western)	Honeywell	10?	Cast Iron	Unknown	Abandoned
A	Pipeline (Eastern)	Honeywell	10?	Cast Iron	Unknown	Abandoned
C	Westside Pumping Station Outlet	Metro	42	Reinforced Concrete Pipe	Unknown	Active
C	Tributary 5A Outlet	Honeywell	60	Steel with Concrete Headwall Structure	Approximately 40 ft	Active
C	NYDOT (I-690) Outfall	NYDOT	24	Ductile Steel Encased in Concrete	Approximately 20 ft	Active
D	Cooling Water Intake - Solvay	Honeywell	84	Corrugated Iron	1175 ft	Abandoned
D	Cooling Water Intake - Solvay	Honeywell	72	Cast Iron	1275 ft	Abandoned
D	48" Stormwater Outfall	Honeywell	48	Steel with cathodic protection	terminates at barrier wall	Active
D	Water Inlet Pipes (West) - Allied Chemical	Honeywell	42	Cast Iron	1230 ft	Abandoned
D	Water Inlet Pipes (Middle) - Allied Chemical	Honeywell	30	Cast Iron	1145 ft	Abandoned
D	Water Inlet Pipes (East) - Allied Chemical	Honeywell	16	Cast Iron	890 ft	Abandoned
D	Diffuser Pipeline from East Flume Pump Station	Honeywell	60	Coal Tar-lined Steel	825 ft from flowmeter	Abandoned
D/E	Sun Oil Pipeline	Sun Oil	8	Cast Iron	N/A	Abandoned
E	Metro Stormwater Drain	Metro	42	RCP	82 ft	Active
E	Metro Shoreline Outfall	Metro	96	RCP	75 ft	Active
E	Metro Deepwater Outfall	Metro	60	RCP	1640 ft	Not Currently Active