APPENDIX A

Standard Operating Procedures (SOPs)

Calculation of Baseline and Test Values for the Benthic Diversity Indices and Opportunists at the MWRA Outfall Nearfield.

Calculation of the Annual Threshold Value for Redox Potential Discontinuity Depth in Sediment

Calculation of the Annual Threshold Values for Sediment Toxic Contamination

Standard Operating Procedure (SOP) for the Calculation of Baseline and Test Values for the Benthic Diversity Indices and Opportunists at the MWRA Outfall Nearfield.

Revision History:

Revision 1: October 13, 2004 -

a) Reduced station sets for even and odd year used in revised monitoring program (MWRA, 2004), are now used to calculate baseline and post-discharge results.
b) Modified the merge list to reflect the recent species consolidation implemented in the database and the new merges per Ken Keay, Nancy Maciolek, Jim Blake, and Isabelle Williams.

The contingency plan threshold comparisons for the nearfield benthic diversity indices and percent opportunists are performed each year. The diversity indices include total species, log-series alpha, Shannon-Wiener H', and Pielou's J'. The nearfield averages of the benthic diversity indices and benthic opportunists are compared to the thresholds to determine if there is an exceedance. The table below shows the caution thresholds for the benthic diversity indices and benthic opportunists for testing on even and odd years.

Table 1: Benthic diversity indices and percent opportunist thresholds.

	Parameter	Threshold ID	Caution Level	Warning Level	Baseline Years	Baseline Method
Even Years	Total species	SBDTOTMAXE	82.00	-	1992-2000	Central 95th percentile of annual means.
		SBDTOTMINE	48.41	-		
	Fisher's log-series alpha	SBDLOGMAXE	16.47	-		
		SBDLOGMINE	9.99	-		
	Pielou's J'	SBDPJMAXE	0.68	-		
		SBDPJMINE	0.58	-		
	Shannon-Wiener H'	SBDSWHMAXE	4.14	-		
		SBDSWHMINE	3.37	-		
Odd Years	Total species	SBDTOTMAXO	79.95	-	1992-2000	Central 95th percentile of annual means.
		SBDTOTMINO	46.52	-		
	Fisher's log-series alpha	SBDLOGMAXO	15.17	-		
		SBDLOGMINO	9.95	-		
	Pielou's J'	SBDPJMAXO	0.66	-		
		SBDPJMINO	0.56	-		
	Shannon-Wiener H'	SBDSWHMAXO	3.91	-		
		SBDSWHMINO	3.30	-		
All years	Benthic Opportunists	SBO	10%	25%	NA	NA

Data Source (Data from EM&MS database):

- The benthic infaunal data and sample information are obtained from the ABUNDANCE and SAMPLE tables.
- Taxa are classified as "good" (GOOD_BAD = 'G', generally, identified to species), "bad" (GOOD_BAD = 'B', identified only to a higher taxonomic level) or "worse" (GOOD_BAD = 'W', non-infaunal taxa) in the INFAUNA_REF table. Species classified as "worse" are excluded from calculation. "Worse" refers to pelagic, epifaunal, or colonial species.

Data To Be Used In The Analysis:

- For even year thresholds, the following stations are used for baseline calculations and threshold testing: NF12, NF17, FF10, FF13, NF05, NF07, NF08, NF09, NF16, NF18, NF19, NF22, NF23, NF01, NF03, NF06, NF11. (Note NF01, NF03, NF06, and NF11 were sampled only in 1992.)
- For odd year thresholds, the following stations are used for baseline calculations and threshold testing: NF01, NF02, NF03, NF04, NF06, NF10, NF11, NF12, NF13, NF14, NF15, NF17, NF20, NF21, FF12, NF24. (Note NF01, NF03, NF06, and NF11 were sampled only in 1992.)
- There is one survey event in August each year, except that there are surveys in May and August 1992. Survey S9202 in May 1992 is excluded from the baseline calculations because the time of data collection and the sampling method are inconsistent with all other surveys.
- Data qualified as suspect/invalid (VAL_QUAL contains 's') and investigation pending (VAL_QUAL contains 'q') are not used.
- Include only "good" species for benthic diversity index calculations, as defined in INFAUNA_REF table, with the following exceptions:
    1. Treat *Turbellaria* spp. 3901SPP as good
    2. Treat *Micrura* spp. 43030205SPP as good
- Include both "good" and "bad" species for calculating the percent benthic opportunists.
- Do not merge taxa in each sample with the following exceptions:
    1. Merge *Turbellaria sp. 1* (3901SP01) with *Turbellaria spp.* (3901SPP)
    2. Merge *Turbellaria sp. 2* (3901SP02) with *Turbellaria spp.* (3901SPP)
    3. Merge *Pholoe tecta* (50020601TECT) with *Pholoe minuta* (5001060101)
    4. Merge *Apistobranchus tullbergi* (5001420101) with *Apistobranchus typicus* (5001420103)
    5. Merge *Maldane glebifex* (5001630302) with *Maldane sarsi* (5001630301)
    6. Merge *Euclymene cf. collaris* (5001631102CF) with *Euclymene collaris* (5001631102)
    7. Merge *Clymenura polaris* (5001631202) with *Clymenura sp.* A (50016312SP01)
    8. Merge *Proclea sp. 1* (50016817SP01) with *Proclea graffi* (5001681702)
    9. Merge Ascidacea (8401SPP) and *Molgula* spp. (84060301SPP) with *Molgula manhattensis* (8406030108)
    10. Merge *Ampharete baltica* (5001670216) with *Ampharete acutifrons* (5001670208)
    11. Merge *Nereis* spp. (50012404SPP) with *Nereis grayi* (5001240409)
    12. Merge Scaphopoda (56SPP) with *Dentalium entale* (5601010201)

13. Merge *Chaetozone* spp. (50015004SPP), *Chaetozone* sp. 4 (500150043SP04), and *Chaetozone* sp. 5 (50015004SP05) with *Chaetozone setosa* (50015004MB).

- Do not merge genus spp. and species just because there is only one species found in that genus.

- The list of benthic opportunists includes the following:

Species	Species Code
Polydora cornuta	5001430448
Capitella capitata complex	5001600101
Capitella spp.	50016001SPP
Streblospio benedicti	5001431801
Mulinia lateralis	5515250301
Ampelisca macrocephala	6169020101
Ampelisca abdita	6169020108
Ampelisca vadorum	6169020109

Data Aggregation:

- Calculate the benthic diversity indices and percent opportunists for each sample. These are defined as follows:

S = total distinct "good" species in the sample
N = total number of "good" individuals in the sample
N(*i*) = total number of "good" individuals in *i*th species
Sa = total distinct opportunist species in the sample
Na = total number of individuals (include "good" and "bad" species) in the sample

1. Total species = S
2. Log series alpha = N * (1-x))/x
   where:
   x is defined by (x-1)/x*ln(1-x) = S/N,
   and is determined numerically with a look up table in which x varies from 0 to 1 in increments of 0.000001
3. Shannon-Wiener $H' = -\sum_{i=1}^{S} [(N(i)/N)*\log_2(N(i)/N)]$
4. Pielous $J' = H'/\log_2(S)$
5. Benthic opportunists = (Sa/Na)*100%

- All samples within a station are treated as independent measurements so there is no data aggregation within a station.

- Calculate the yearly means of benthic diversity indices and percent opportunists using all samples from each year.

Baseline Calculation:

- The distribution of the nine yearly means for each benthic diversity index was determined to be normal using Kolmogorov-Smirnov (Lilliefors Significance Correction) and Shapiro-Wilk tests for normality.
- The central 95th percentiles for these thresholds were calculated using:
  Upper threshold = baseline mean + 1.96*(baseline standard deviation)
  Lower threshold = baseline mean - 1.96*(baseline standard deviation)
- Benthic opportunist threshold is not based on baseline values.

Threshold Testing:

- For each post-discharge even year, the average for the one (August) survey from the even year station set is compared against the caution and/or warning thresholds for even years in table 1. Likewise, for each post-discharge odd year, the average from the odd year station set is compared against the caution and/or warning thresholds for odd years in table 1. If the average of any benthic diversity index is greater than the upper threshold or smaller than the lower threshold, there is an exceedance for that year. If the average of benthic opportunists is greater than the threshold, there is an exceedance for that year.

References:
MWRA. 2004. Massachusetts Water Resources Authority effluent outfall ambient monitoring plan Revision 1, March 2004. Boston: Massachusetts Water Resources Authority. Report ms-092. 65 p.

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Standard Operating Procedure (SOP) for the Calculation of the Annual Threshold Value for Redox Potential Discontinuity Depth in Sediment

The methods used to calculate the baseline value of redox potential discontinuity (RPD) depth in sediment are described in this SOP.

Table 1: Sediment RPD Thresholds.

Param_code	Threshold ID	Testing area	Caution Level (cm)	Warning Level (cm)	Baseline Years	Baseline Method
AVG_RPD	SRPD	Nearfield	1.18	-	1992-2000 (data available only in 1992, 1995, 1997, 1998 through 2000)	Arithmetic mean

Data Source (Data from EM&MS database):

- Apparent RPD data are obtained from the SED_PROF_PARAM and SED_PROF_IMAGE table.
- Nearfield stations are specified as station IDs beginning with 'N', plus stations FF10, FF12, and FF13.
- There is one survey event each year. All events were conducted in August, except that the event S9702 in 1997 was done in August and October.

Data To Be Used In The Analysis:

- Baseline calculations and threshold testing are performed on all nearfield.
- All RPD data from all baseline years are included. Exceptions are specified in the following:
  1. Data qualified as suspect/invalid (VAL_QUAL contains 's'), investigation pending (VAL_QUAL contains ‘q’), and (VAL_QUAL contains ‘e’) are not used. There are no ‘s’ or ‘q’ qualified data in the current data set.
  2. For data qualified as above maximum detection limit (VAL_QUAL=’A’), the prism penetration value (PARAM_CODE=’AVG_PEN’) is used as a surrogate for RPD value.

Data Aggregation:

- All RPD measurements within a station are treated as independent measurements so there is no data aggregation within station. This is consistent with how the faunal data are analyzed and thresholds calculated.
- The yearly mean is calculated using all nearfield measurements from each year.

Baseline Calculation:

- The average of the six yearly means is the baseline mean.
- Caution threshold is 0.5* baseline mean.

Threshold Testing:

- For each post-discharge year, the annual average is compared against the caution threshold in table 1. If the annual average is smaller than the threshold, there is an exceedance for that year.

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Standard Operating Procedure (SOP) for the Calculation of the Annual Threshold Values for Sediment Toxic Contamination

The methods used to calculate the baseline values of sediment contaminants and to compare the nearfield average to the threshold are described in this SOP.

There are 26 thresholds related to toxic contaminants in sediments, based on NOAA Effects Range-Median sediment guidelines. The thresholds for DDT, PCB, LMWPAH, HMWPAH, and total PAH are based on the sum of concentrations of several chemicals.

Parameter	Threshold ID	Testing area	Caution Level	Warning Level	Units	Baseline Years	Averaging Method
acenaphthene	STNANP	Nearfield	-	500	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
acenaphthylene	STNAPTH	Nearfield	-	640	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
anthracene	STNARC	Nearfield	-	1100	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
benz(a)-anthracene	STNBAA	Nearfield	-	1600	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
benzo(a)pyrene	STNBAP	Nearfield	-	1600	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
chrysene	STNCHR	Nearfield	-	2800	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
dibenzo(a,h)-anthracene	STNDBA	Nearfield	-	260	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
fluoranthene	STNFLT	Nearfield	-	5100	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
fluorene	STNFLU	Nearfield	-	540	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
naphthalene	STNNAP	Nearfield	-	2100	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
phenanthrene	STNPHN	Nearfield	-	1500	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
pyrene	STNPYR	Nearfield	-	2600	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
sum HMWPAH	STNHPAH	Nearfield	-	9600	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
sum LMWPAH	STNLPAH	Nearfield	-	3160	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
total PAH	STNTPAH	Nearfield	-	44792	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
p,p'-DDE	STNDDE	Nearfield	-	27	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
total DDT	STNTDDT	Nearfield	-	46.1	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
total PCB	STNTPCB	Nearfield	-	180	ng/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean

Table 1: Sediment Contamination Thresholds (continued on next page).

Parameter	Threshold ID	Testing area	Caution Level	Warning Level	Units	Baseline Years	Baseline Method
cadmium	STNCD	Nearfield	-	9.6	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
chromium	STNCR	Nearfield	-	370	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
copper	STNCU	Nearfield	-	270	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
lead	STNPB	Nearfield	-	218	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
mercury	STNHG	Nearfield	-	0.71	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
nickel	STNNI	Nearfield	-	51.6	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
silver	STNAG	Nearfield	-	3.7	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean
zinc	STNZN	Nearfield	-	410	ug/g dry	1992-2000 (data avail. only in 1992-1995, 1999)	Arithmetic mean

Table 1: Sediment Contamination Thresholds (continued).

Data Source (Data from EM&MS database):

- Laboratory data from the Massachusetts Bay Soft Bottom Monitoring study for the parameters shown in table 2 for the various groups are used. These data are stored in the ANALYTICAL_RESULTS table with supporting data in the BOTTLE and SAMPLE tables.
- Nearfield stations are specified as station IDs beginning with 'N', plus stations FF10, FF12, and FF13.
- There is one survey event each year, in August.

Threshold	**Group (Group Code)**	**Parameter Code**	**Parameter Description**	**Parameter Abbreviation**
acenaphthene	STNANP	83-32-9	ACENAPHTHENE	
acenaphthylene	STNAPTH	208-96-8	ACENAPHTHYLENE	
anthracene	STNARC	120-12-7	ANTHRACENE	
benz(a)anthracene	STNBAA	56-55-3	BENZ(A)ANTHRACENE	
benzo(a)pyrene	STNBAP	50-32-8	BENZO(A)PYRENE	
chrysene	STNCHR	218-01-9	CHRYSENE	
dibenzo(a,h)anthracene	STNDBA	53-70-3	DIBENZO(A,H)ANTHRACENE	
fluoranthene	STNFLT	206-44-0	FLUORANTHENE	
fluorene	STNFLU	86-73-7	FLUORENE	
naphthalene	STNNAP	91-20-3	NAPHTHALENE	
phenanthrene	STNPHN	85-0108	PHENANTHRENE	
pyrene	STNPYR	129-00-0	PYRENE	

Table 2: Sediment Contaminants included in each Threshold (continued on next page).

Threshold	Group (Group Code)	Parameter Code	Parameter Description	Parameter Abbreviation
sum HMWPAH	STNHPAH	56-55-3	BENZ(A)ANTHRACENE	
		50-32-8	BENZO(A)PYRENE	
		MWRA86	BENZO(B)/BENZO(K)FLUORANTHENE	
		205-99-2	BENZO(B)FLUORANTHENE	
		192-97-2	BENZO(E)PYRENE	
		191-24-2	BENZO(G,H,I)PERYLENE	
		207-08-9	BENZO(K)FLUORANTHENE	
		MWRA70	C1-CHRYSENES	
		MWRA69	C1-FLUORANTHRENES/PYRENES	
		MWRA4	C2-CHRYSENES	
		MWRA83	C2-FLUORANTHENES/PYRENES	
		MWRA71	C3-CHRYSENES	
		MWRA84	C3-FLUORANTHENES/PYRENES	
		MWRA72	C4-CHRYSENES	
		218-01-9	CHRYSENE	
		53-70-3	DIBENZO(A,H)ANTHRACENE	
		206-44-0	FLUORANTHENE	
		193-39-5	INDENO(1,2,3-C,D)PYRENE	
		198-55-0	PERYLENE	
		129-00-0	PYRENE	
sum LMWPAH	STNLPAH	83-32-9	ACENAPHTHENE	
		208-96-8	ACENAPHTHYLENE	
		120-12-7	ANTHRACENE	
		92-52-4	BIPHENYL	
		MWRA68	C1-DIBENZOTHIOPHENES	
		MWRA65	C1-FLUORENES	
		MWRA64	C1-NAPHTHALENES	
		MWRA67	C1-PHENANTHRENES/ANTHRACENES	
		MWRA5	C2-DIBENZOTHIOPHENES	
		MWRA6	C2-FLUORENES	
		MWRA7	C2-NAPHTHALENES	
		MWRA57	C2-PHENANTHRENES/ANTHRACENES	
		MWRA9	C3-DIBENZOTHIOPHENES	
		MWRA66	C3-FLUORENES	
		MWRA10	C3-NAPHTHALENES	
		MWRA52	C3-PHENANTHRENES/ANTHRACENES	
		MWRA11	C4-NAPHTHALENES	
		MWRA54	C4-PHENANTHRENES/ANTHRACENES	
		132-64-9	DIBENZOFURAN	
		127330-66-9	DIBENZOTHIOPHENE	
		86-73-7	FLUORENE	
		91-20-3	NAPHTHALENE	
		85-0108	PHENANTHRENE	

Table 2: Sediment Contaminants included in each Threshold (continued on next page).

Threshold	Group (Group Code)	Parameter Code	Parameter Description	Parameter Abbreviation
total PAH	STNTPAH	83-32-9	ACENAPHTHENE	
		208-96-8	ACENAPHTHYLENE	
		120-12-7	ANTHRACENE	
		56-55-3	BENZ(A)ANTHRACENE	
		50-32-8	BENZO(A)PYRENE	
		MWRA86	BENZO(B)/BENZO(K)FLUORANTHENE	
		205-99-2	BENZO(B)FLUORANTHENE	
		192-97-2	BENZO(E)PYRENE	
		191-24-2	BENZO(G,H,I)PERYLENE	
		207-08-9	BENZO(K)FLUORANTHENE	
		92-52-4	BIPHENYL	
		MWRA70	C1-CHRYSENES	
		MWRA68	C1-DIBENZOTHIOPHENES	
		MWRA69	C1-FLUORANTHRENES/PYRENES	
		MWRA65	C1-FLUORENES	
		MWRA64	C1-NAPHTHALENES	
		MWRA67	C1-PHENANTHRENES/ANTHRACENES	
		MWRA4	C2-CHRYSENES	
		MWRA5	C2-DIBENZOTHIOPHENES	
		MWRA83	C2-FLUORANTHENES/PYRENES	
		MWRA6	C2-FLUORENES	
		MWRA7	C2-NAPHTHALENES	
		MWRA57	C2-PHENANTHRENES/ANTHRACENES	
		MWRA71	C3-CHRYSENES	
		MWRA9	C3-DIBENZOTHIOPHENES	
		MWRA84	C3-FLUORANTHENES/PYRENES	
		MWRA66	C3-FLUORENES	
		MWRA10	C3-NAPHTHALENES	
		MWRA52	C3-PHENANTHRENES/ANTHRACENES	
		MWRA72	C4-CHRYSENES	
		MWRA11	C4-NAPHTHALENES	
		MWRA54	C4-PHENANTHRENES/ANTHRACENES	
		218-01-9	CHRYSENE	
		53-70-3	DIBENZO(A,H)ANTHRACENE	
		132-64-9	DIBENZOFURAN	
		127330-66-9	DIBENZOTHIOPHENE	
		206-44-0	FLUORANTHENE	
		86-73-7	FLUORENE	
		193-39-5	INDENO(1,2,3-C,D)PYRENE	
		91-20-3	NAPHTHALENE	
		198-55-0	PERYLENE	
		85-0108	PHENANTHRENE	
		129-00-0	PYRENE	
p,p'-DDE	STNDDE	75-55-9	P,P-DDE	4,4'-DDE
total DDT	STNTDDT	MWRA33	O,P-DDD	2,4'-DDD
		MWRA34	O,P-DDE	2,4'-DDE
		789-02-6	O,P-DDT	2,4'-DDT
		72-54-8	P,P-DDD	4,4'-DDD
		75-55-9	P,P-DDE	4,4'-DDE
		50-29-3	P,P-DDT	4,4'-DDT

Table 2: Sediment Contaminants included in each Threshold (continued on next page).

Threshold	Group (Group Code)	Parameter Code	Parameter Description	Parameter Abbreviation
total PCB	STNTPCB	34883-43-7	2,4'-DICHLOROBIPHENYL	CL2(8)
		37680-65-2	2,2',5-TRICHLOROBIPHENYL	CL3(18)
		7012-37-5	2,4,4'-TRICHLOROBIPHENYL	CL3(28)
		41464-39-5	2,2',3,5'-TETRACHLOROBIPHENYL	CL4(44)
		35693-99-3	2,2',5,5'-TETRACHLOROBIPHENYL	CL4(52)
		32598-10-0	2,3',4,4'-TETRACHLOROBIPHENYL	CL4(66)
		32598-13-3	3,3',4,4'-TETRACHLOROBIPHENYL	CL4(77)
		37680-73-2	2,2',4,5,5'-PENTACHLOROBIPHENYL	CL5(101)
		32598-14-4	2,3,3',4,4'-PENTACHLOROBIPHENYL	CL5(105)
		31508-00-6	2,3',4,4',5-PENTACHLOROBIPHENYL	CL5(118)
		57465-28-8	3,3',4,4',5-PENTACHLOROBIPHENYL	CL5(126)
		38380-07-3	2,2',3,3',4,4'-HEXACHLOROBIPHENYL	CL6(128)
		35065-28-2	2,2',3,4,4',5'-HEXACHLOROBIPHENYL	CL6(138)
		35065-27-1	2,2',4,4',5,5'-HEXACHLOROBIPHENYL	CL6(153)
		35065-30-6	2,2',3,3',4,4',5-HEPTACHLOROBIPHENYL	CL7(170)
		35065-29-3	2,2',3,4,4',5,5'-HEPTACHLOROBIPHENYL	CL7(180)
		52663-68-0	2,2',3,4',5,5',6-HEPTACHLOROBIPHENYL	CL7(187)
		52663-78-2	2,2',3,3',4,4',5,6-OCTACHLOROBIPHENYL	CL8(195)
		40186-72-9	2,2',3,3',4,4',5,5',6-NONACHLOROBIPHENYL	CL9(206)
		2051-24-3	DECACHLOROBIPHENYL	CL10(209)
cadmium	STNCD	7440-43-9	CADMIUM	Cd
chromium	STNCR	7440-47-3	CHROMIUM	Cr
copper	STNCU	7440-50-8	COPPER	Cu
lead	STNPB	7439-92-1	LEAD	Pb
mercury	STNHG	7439-97-6	MERCURY	Hg
nickel	STNNI	7440-02-0	NICKEL	Ni
silver	STNAG	7440-22-4	SILVER	Ag
zinc	STNZN	7440-66-6	ZINC	Zn

Table 2: Sediment Contaminants included in each Threshold (continued).

Data To Be Used In The Analysis:

- Baseline calculations and threshold testing are performed on the entire nearfield.
- All data from years in which all stations were sampled are included. Exceptions are specified in the following:
    3. Data qualified as suspect/invalid (VAL_QUAL contains 's'), investigation pending (VAL_QUAL contains ‘q’), and (VAL_QUAL contains ‘e’), above maximum detection limit (VAL_QUAL=’A’) are not used. There are no ‘s’ or ‘q’ qualified data in the current data set.
    4. Data qualified as below detection limit ('a' qualifier) are treated as zero values.

Data Aggregation:

- Laboratory analytical replicates, if any, are first averaged (bottle averages).
- All sediment chemical measurements within a station are treated as independent measurements so there is no data aggregation within a station. This is consistent with how the faunal data are analyzed and thresholds calculated.

- Annual averages for each parameter are calculated by averaging across all nearfield samples (or bottles) for a given year for each parameter.
- The annual values for DDT, PCB, and LMWPAH, HMWPAH, and total PAH are calculated by summing the annual averages of the parameters listed in table 2.

Baseline Calculation:

- The threshold is based on NOAA sediment guidelines, rather than baseline values. However, the threshold testing script can be run for any year in which the nearfield was sampled. Note that in August 2000 only a subset of nearfield stations were sampled for contaminants, so those data are not included in the baseline computations and caution must be used if comparing them to baseline or discharge averages of all nearfield data.

Threshold Testing (STN.SQL):

- For each post-discharge year, the nearfield average is compared against the caution threshold in table 1. If the nearfield average is greater than the threshold, there is an exceedance for that year.

Written by:	_____	_____
	Wendy Leo	Date
Data Group Manager:	_____	_____
	Wendy Leo	Date
MWRA Scientist Responsible for sediment contaminant threshold	_____	_____
	Kenneth Keay	Date

APPENDIX B

Data Forms

Barbara Hecker/
Hecker Environmental

Roll #:		**Station:T - WP**	**Date**:
Frame #	**Time**	**Depth (ft)**	**Comments**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
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22			
23			
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34			
35			
36			

Diaz and Daughters

Diaz and Daughters
Sediment Profile Image Analysis
Spreadsheet

Client_____
Project Name_____

Study Site_____
Sampling Date_____

		PEN.	PEN.	PEN	Sur		RPD	RPD	RPD		MAX	SURFACE	AMPHIPOD	WORM
STATION	Rep	Min	Max	ave	Rel	Qual	Max	Qual	ave	GRAIN SIZE	GRAIN SIZE	FEATURES	TUBES	TUBES

Diaz and Daughters
Sediment Profile Image Analysis
Spreadsheet

Client_____ Study Site_____
Project Name_____ Sampling Date_____

		SURFACE FAUNA	SUB. FAUNA		OXIC	ANAEROBIC	GAS	SUCC.			
STATION	Rep	OTHER	WORMS	BURROWS	VOIDS	VOIDS	VOIDS	STAGE		OSI	REMARKS

Cove Corporation

Cove Corporation Sorting QC Sheet Page ___ of ___

Client: MWRA (HOM5 Project)	**Study Site:**	**Sampling Date:**
QC Sample:	**Lab. Serial No.:**	**Sample Id.:**
Sorter:		**Batch No.:**

I. Number of Organisms Found in QC Inspection

1.0 Taxon	2.0 Count	3.0 Taxon	4.0 Count

II. Evaluation of QC Sample

Total number of organisms present in sample:	Total number of organisms found in QC audit:
Percent error calculation:	Pass ☐ Fail ☐
Date & initials of sorter performing the QC resort:	
Date & initials of taxonomist recording the number of organisms missed:	
Has this batch previously failed a QC check? Yes ☐ No ☐	
Was the sample residue properly labeled with internal and external labels? Yes ☐ No ☐	
Were all specimen vials of the QC sample properly labeled? Yes ☐ No ☐	

Sample Batch Listing Sheet Page ___ of ___

Client & Project Name: MWRA (HOM5 Project)	**Study Site:**
Taxonomist:	**Sampling Date:**

5.0 I. BATCHES OF SAMPLES

Batch No.	Batch No.	Batch No.	Batch No.
1)	1)	1)	1)
2)	2)	2)	2)
3)	3)	3)	3)
4)	4)	4)	4)
5)	5)	5)	5)
6)	6)	6)	6)
7)	7)	7)	7)
8)	8)	8)	8)
9)	9)	9)	9)
10)	10)	10)	10)

II. QC EVALUATION

QC Results	Batch No.	Batch No.	Batch No.	Batch No.
QC Sample				
Serial No.				
QC Date				
QC Inspector				
Percent Error				

III. COMMENTS CONCERNING SAMPLE PROCESSING

(initialize & date all entries -- continue on back if necessary)

Necessary Remedial Action:
Comments:

Chain of Custody Record Page ___ of ___

Cove Corporation, 10200 Breeden Road, Lusby, MD 20657
TEL 410-326-4577, FAX 410-326-4767

Client & Project Name: MWRA (HOM5 Project)	**Destination:**
Study Site & Sampling Date:	
Project Description: macrobenthic sample processing	

Rep.	No. of Vials	Serial No.	Survey Date	Sta. – Rep.	No. of Vials	Serial No.	Survey Date

Total Number of Samples

Relinquished by (Signature)	Date	Method of Shipment	Received By (Signature)	Date	Method of Shipment
Relinquished by (Signature)	Date	Method of Shipment	Received By (Signature)	Date	Method of Shipment

Species Abundance Data Sheet **Page ___ of ___**

Client: MWRA	**Project Name:** HOM5 Project	**Study Site:**
Taxonomist & Id. Date:		**Sampling Date:**

Station:		Sample Id.	Sample Id.	Sample Id.
Species	Code	Lab. Ser. No.	Lab. Ser. No.	Lab. Ser. No.
		Rep. 1	Rep. 2	Rep. 3

Cove Corporation Identification QC Sheet Page ___ of ___

Client: MWRA (HOM5 Project)	**Study Site:**	**Sampling Date:**
QC Sample:	**Lab. Serial No.:**	**Sample Id.:**
Taxonomist:		**Batch No.:**

I. TYPE I ERRORS (taxa incorrectly enumerated)

Taxon	QC Count	Original Count	Taxon	QC Count	Original Count
Total number of enumeration errors					

II. TYPE II ERRORS (taxa incorrectly identified)

III. TYPE III ERRORS (taxa not recorded or recorded on the wrong line of the data sheet)

Taxon	Number	Taxon	Number
Total number of recording errors			

IV. EVALUATION OF QC SAMPLE

Total number of organisms present in sample:	Total number of errors detected in QC audit:
Identification QC error:	Pass ☐ Fail ☐
Reidentified by:	Date Reidentified:
Necessary Remedial Action:	
Comments:	

ENSR Marine and Coastal Center

SPECIES ABUNDANCE DATA SHEET **Page __ of __**

Client: MWRA (HOM5) **Study Site:** Mass Bay **Sampling Date:**

Taxonomist:

Station:		Sample ID	Sample ID	Sample ID
Species	Code	cc#	cc#	cc#
		Rep. 1	rep. 2	rep. 3

APPENDIX C

Draft EPA Guideline for Preparation of Survey Plans