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RCRA Facility Investigation - Remedial Investigation/ Corrective Measures Study - Feasibility Study Report for the Rocky Flats Environmental Technology Site Appendix A - Comprehensive Risk Assessment

Volume 15B2 of 15
(Book 2 of 2 - Attachments)

Risk Assessment for the Aquatic Exposure Units:
North Walnut Creek Aquatic Exposure Unit,
South Walnut Creek Aquatic Exposure Unit,
and Woman Creek Aquatic Exposure Unit

October 2005

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

VOLUME 15B2: ATTACHMENT 1

Detection Limit Screen

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ACRONYMS AND ABBREVIATIONS

μg/kg	micrograms per kilogram
AEU	Aquatic Exposure Unit
bgs	below ground surface
CD	compact disc
CRA	Comprehensive Risk Assessment
ERA	Ecological Risk Assessment
ESL	ecological screening level
mg/kg	milligram per kilogram
mg/L	milligrams per liter
NW AEU	North Walnut Creek Aquatic Exposure Unit
SW AEU	South Walnut Creek Aquatic Exposure Unit
TIC	tentatively identified compound
WC AEU	Woman Creek Aquatic Exposure Unit

1.0 EVALUATION OF DETECTION LIMITS FOR NONDETECTED ANALYTES AND ANALYTES DETECTED IN LESS THAN 5 PERCENT OF SAMPLES IN THE AQUATIC EXPOSURE UNIT

The detection limits for analytes that are either not detected or detected in less than 5 percent of the samples collected from the media used in the Ecological Risk Assessment (ERA) are reviewed in this attachment. The detection limits for surface water and sediment samples are compared to the minimum ecological screening level (ESL) for a variety of aquatic ecological receptors. The results of these comparisons are presented in the Attachment 1 tables.

Nondetects, analytes detected in less than 5 percent of samples, and the reported detection limits (referred to as "reported result" in the following sections of this attachment) are listed in these tables for each medium in the North Walnut Creek Aquatic Exposure Unit (AEU), South Walnut Creek AEU, and Woman Creek AEU and compared to medium-specific ESLs for a variety of aquatic ecological receptors. Maximum reported results that exceed the respective ESLs are noted and discussed.

Analytes that were not detected in any samples collected in each media are referred to as nondetected analytes. The nondetected chemicals are reported in this attachment at the lowest level at which the chemical may be accurately and reproducibly quantified, taking into account the sample characteristics, sample collection, sample preparation, and analytical adjustments.

1.1 Comparison of Maximum Reported Results for Nondetected Analytes and Analytes Detected in Less than 5 percent of Samples to Ecological Screening Levels

1.1.1 North Walnut Creek Aquatic Exposure Unit (NW AEU)

Surface Water

The maximum reported results for 20 nondetected analytes and 21 analytes detected in less than 5 percent of samples in surface water are greater than their respective ESLs (Table A1.2.NWAEU.1). Therefore, there is some uncertainty associated with the reported results for these analytes in the NW AEU.

The maximum reported result for two analytes (4,4'-DDT and benzo(a)pyrene) exceeded the ESLs by three orders of magnitude. For 10 analytes, the maximum reported results exceeded the ESLs by two orders of magnitude. For the remaining analytes, the maximum reported results exceeded the ESLs by one order of magnitude or less.

ESLs were not available for several nondetected analytes and analytes detected in less than 5 percent of samples in surface water (Table A1.2.NWAEU.1). However, the maximum reported results for other similar analytes were much lower than their

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respective ESLs. This, combined with the fact that no identified source exists for these analytes in the surface water at the NW AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

Sediment

The maximum reported results for 29 nondetected analytes and eight analytes detected in less than 5 percent of samples in sediment are greater than their respective ESLs (Table A1.2.NWAEU.2). Therefore, there is some uncertainty associated with the reported results for these analytes in the NW AEU.

The maximum reported result for benzyl alcohol is three orders of magnitude greater than the ESL. For 10 analytes the maximum reported results exceed the ESLs by two orders of magnitude. For the remaining analytes, the maximum reported results exceed the ESLs by one order of magnitude or less.

ESLs were not available for several nondetect analytes and analytes detected in less than 5 percent of samples in sediment (Table A1.2.NWAEU.2). However, the maximum reported results for other similar analytes were much lower than their respective ESLs. This, combined with the fact that no identified source exists for these analytes in the sediment at the NW AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

1.1.2 South Walnut Creek Aquatic Exposure Unit (SW AEU)

Surface Water

The maximum reported results for 25 nondetected analytes and 16 analytes detected in less than 5 percent of samples in surface water are greater than their respective ESLs (Table A1.2.SWAEU.1). Therefore, there is some uncertainty associated with the reported results for these analytes in the SW AEU.

The maximum reported results for three analytes (benzo(a)anthracene, benzo(a)pyrene, and pyrene) exceed the ESLs by three orders of magnitude. For seven analytes, the maximum reported result exceeds the ESL by two orders of magnitude. For the remaining analytes, the maximum reported results exceed the ESL by one order of magnitude or less.

ESLs were not available for several nondetect analytes and analytes detected in less than 5 percent of samples in surface water (Table A1.2.SWAEU.1). However, the maximum reported results for other similar analytes were much lower than their respective ESLs. This, combined with the fact that no identified source exists for these analytes in the surface water at the SW AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

Sediment

The maximum reported results for 24 nondetected analytes and 16 analytes detected in less than 5 percent of samples in sediment are greater than their respective ESLs (Table A1.2.SWAEU.2). Therefore, there is some uncertainty associated with the reported results for these analytes in the SW AEU.

The maximum reported result for benzyl alcohol exceeded the ESL by three orders of magnitude. For five analytes (2-methylnaphthalene, 4-methylphenol, acenaphthylene, heptachlor, and hexachlorobutadiene) the maximum reported result exceeded the ESL by two orders of magnitude. The remaining analytes, exceeded the ESLs by one order of magnitude or less.

ESLs were not available for several nondetect analytes and analytes detected in less than 5 percent of samples in sediment (Table A1.2.SWAEU.2). However, the maximum reported results for other similar analytes were much lower than their ESLs. This, combined with the fact that no identified source exists for these analytes in the sediment at the SW AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

1.1.3 Woman Creek Aquatic Exposure Unit (WC AEU)

Surface Water

The maximum reported results for 29 nondetected analytes and 12 analytes detected in less than 5 percent of samples in surface water are greater than their respective ESLs (Table A1.2.WCAEU.1). Therefore, there is some uncertainty associated with the reported results for these analytes in the WC AEU.

The maximum reported result for benzo(a)pyrene exceeded the ESL by three orders of magnitude. For 12 analytes, the maximum reported results exceed the ESLs by two orders of magnitude. For the remaining analytes, the maximum reported results exceed the ESLs by one order of magnitude or less.

ESLs were not available for several nondetect analytes and analytes detected in less than 5 percent of samples in surface water (Table A1.2.WCAEU.1). However, the maximum reported results for other similar analytes were much lower than their ESLs. This, combined with the fact that no identified source exists for these analytes in the surface water at the WC AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

Sediment

The maximum reported results for 24 nondetected analytes and 16 analytes detected in less than 5 percent of samples in sediment are greater than their respective ESLs (Table A1.2.WCAEU.2). Therefore, there is some uncertainty associated with the reported results for these analytes in the WC AEU.

The maximum reported result for benzyl alcohol exceeded the ESL by three orders of magnitude. For seven analytes, the maximum reported results exceed the ESLs by two orders of magnitude. For the remaining analytes, the maximum reported results exceed the ESLs by one order of magnitude or less.

ESLs were not available for several nondetect analytes and analytes detected in less than 5 percent of samples in sediment (Table A1.2.WCAEU.2). However, the maximum reported results for other similar analytes were much lower than their respective ESLs. This, combined with the fact that no identified source exists for these analytes in the sediment at the WC AEU, suggests there is an acceptable level of uncertainty associated with the reported results for these analytes.

TABLES

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganic Total (mg/L)				
Beryllium[b]	**1.0E-05 - 0.01**	**518**	**0.00240**	**Yes**
Hydrogen Sulfide	1	1	N/A	UT
Thallium[b]	**2.4E-05 - 0.294**	**627**	**0.0150**	**Yes**
Total Petroleum Hydrocarbons	1 - 1	2	N/A	UT
Inorganic Dissolved (mg/L)				
Beryllium[b]	**1.5E-05 - 0.01**	**234**	**0.00240**	**Yes**
Thallium[b]	**5.0E-06 - 0.191**	**235**	**0.0150**	**Yes**
Organic Total (µg/L)				
1,1,1,2-Tetrachloroethane	0.1 - 10	154	N/A	UT
1,1,1-Trichloroethane[b]	0.1 - 10	325	89	No
1,1,2,2-Tetrachloroethane[b]	0.1 - 10	337	2,400	No
1,1,2-Trichlorobenzene	1 - 1	1	N/A	UT
1,1,2-Trichloroethane	0.1 - 10	339	940	No
1,1-Dichloroethane[b]	0.1 - 10	336	740	No
1,1-Dichloroethene[b]	0.2 - 10	334	65	No
1,1-Dichloropropene	0.1 - 5	158	N/A	UT
1,2,3-Trichlorobenzene[b]	0.1 - 5	156	8	No
1,2,3-Trichloropropane	0.1 - 10	158	N/A	UT
1,2,4,5-Tetrachlorobenzene	10 - 10	2	N/A	UT
1,2,4-Trichlorobenzene	0.1 - 18	255	50	No
1,2,4-Trimethylbenzene[b]	0.1 - 5	156	17	No
1,2-Dibromo-3-chloropropane	0.16 - 100	149	N/A	UT
1,2-Dibromoethane	0.2 - 20	158	N/A	UT
1,2-Dichlorobenzene	**0.1 - 18**	**275**	**13**	**Yes**
1,2-Dichloroethane	0.1 - 10	331	20,000	No
1,2-Dichloroethene[b]	5 - 10	186	1,100	No
1,2-Dichloropropane[b]	0.1 - 10	338	5,700	No
1,3,5-Trimethylbenzene	0.1 - 5	157	45	No
1,3,5-Trinitrobenzene	10 - 50	2	N/A	UT
1,3-Dichlorobenzene[b]	0.1 - 18	274	28	No
1,3-Dichloropropane	0.1 - 5	158	N/A	UT
1,3-Dinitrobenzene	10 - 20	2	N/A	UT
1,4-Dichlorobenzene[b]	**0.1 - 18**	**271**	**16**	**Yes**
1,4-Naphthoquinone	10 - 10	2	N/A	UT
1,4-Phenylenediamine	10 - 100	2	N/A	UT
1-Naphthylamine	10 - 10	2	N/A	UT
2,2-Dichloropropane	0.1 - 5	154	N/A	UT
2,3,4,6-Tetrachlorophenol	10 - 10	2	N/A	UT
2,4,5-T	0.1 - 10	29	N/A	UT
2,4,5-TP (Silvex)	0.1 - 10	62	N/A	UT
2,4,5-Trichlorophenol	10 - 90	205	N/A	UT
2,4,6-Trichlorophenol	**1 - 18**	**205**	**5**	**Yes**
2,4-D	0.45 - 13	62	N/A	UT

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
2,4-DB	0.91 - 10	25	N/A	UT
2,4-Dichlorophenol	5 - 18	205	365	No
2,4-Dimethylphenol	5 - 18	205	212	No
2,4-Dinitrophenol	23 - 90	197	N/A	UT
2,4-Dinitrotoluene	5 - 18	207	N/A	UT
2,6-Dichlorophenol	10 - 10	2	N/A	UT
2,6-Dinitrotoluene	5 - 18	206	N/A	UT
2378-TCDD	0.0001 - 0.014	25	N/A	UT
2-Acetylaminofluorene	10 - 20	2	N/A	UT
2-Butanone[b]	5 - 10	204	2,200	No
2-Chloroethyl vinyl ether	0 - 10	30	N/A	UT
2-Chloronaphthalene	5 - 18	207	630	No
2-Chlorophenol	5 - 18	205	N/A	UT
2-Chlorotoluene	0.2 - 5	157	N/A	UT
2-Hexanone[b]	1 - 10	223	99	No
2-Methylnaphthalene	5 - 18	207	N/A	UT
2-Methylphenol	5 - 18	204	82	No
2-Naphthylamine	10 - 10	2	N/A	UT
2-Nitroaniline	23 - 90	207	N/A	UT
2-Nitrophenol	5 - 18	205	N/A	UT
2-Picoline	10 - 20	2	N/A	UT
3 & 4-methyl phenol	10.4 - 11.2	4	N/A	UT
3,3'-Dichlorobenzidine	9 - 36	205	N/A	UT
3,3'-Dimethylbenzidine	10 - 10	2	N/A	UT
3-Methylcholanthrene	10 - 10	2	N/A	UT
3-Nitroaniline	23 - 90	203	N/A	UT
4,4'-DDD	**0.02 - 1**	**123**	**0.0600**	**Yes**
4,4'-DDE[b]	0.02 - 1	122	105	No
4,4'-DDT[b]	**0.02 - 1**	**122**	**0.00100**	**Yes**
4,6-Dinitro-2-methylphenol	23 - 90	204	N/A	UT
4-Aminobiphenyl	10 - 20	2	N/A	UT
4-Bromophenyl-phenylether	5 - 18	207	N/A	UT
4-Chloro-3-methylphenol	5 - 22.5	205	N/A	UT
4-Chloroaniline	5 - 22.5	204	N/A	UT
4-Chlorophenyl-phenyl ether	5 - 18	207	N/A	UT
4-Chlorotoluene	0.2 - 5	157	N/A	UT
4-Isopropyltoluene	0.2 - 5	157	N/A	UT
4-Methyl-2-pentanone[b]	1 - 10	224	170	No
4-Methylphenol	5 - 18	200	25	No
4-Nitroaniline[b]	5 - 59	202	N/A	UT
4-Nitrophenol	23 - 90	205	N/A	UT
5-Nitro-o-toluidine	10 - 10	2	N/A	UT
7,12-Dimethylbenz(a)-anthracene	10 - 10	2	N/A	UT
a,a-Dimethylphenethylamine	10 - 10	2	N/A	UT
Acenaphthene[b]	1 - 18	205	520	No

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Acenaphthylene	1 - 18	207	N/A	UT
Acetophenone	10	1	N/A	UT
Acrolein	500	1	N/A	UT
Acrylonitrile	10 - 100	17	N/A	UT
Aldrin	**0.01 - 0.52**	**123**	**0.150**	**Yes**
Allyl Chloride	10	1	N/A	UT
alpha-BHC[b]	0.01 - 0.52	122	2.20	No
alpha-Chlordane[b]	0.01 - 5.2	116	N/A	UT
Ametryne	0.18 - 0.76	76	N/A	UT
Aniline	10	1	N/A	UT
Anthracene[b]	**0.0288 - 18**	**206**	**0.730**	**Yes**
Aramite	21	1	N/A	UT
Aroclor-1016	**0.2 - 2.6**	**119**	**0.0140**	**Yes**
Aroclor-1221	**0.4 - 5**	**119**	**0.0140**	**Yes**
Aroclor-1232	**0.2 - 2.6**	**119**	**0.0140**	**Yes**
Aroclor-1242	**0.2 - 2.6**	**119**	**0.0140**	**Yes**
Aroclor-1248	**0.2 - 2.6**	**119**	**0.0140**	**Yes**
Aroclor-1260	**0.2 - 5.2**	**119**	**0.0140**	**Yes**
Atraton[b]	0.52 - 0.76	59	N/A	UT
Azinphos-methyl	4	1	N/A	UT
Benzene[b]	0.1 - 10	337	530	No
Benzidine	10 - 10	6	N/A	UT
Benzo(a)anthracene[b]	**0.13 - 18**	**206**	**0.0270**	**Yes**
Benzo(a)pyrene[b]	**0.134 - 18**	**206**	**0.0140**	**Yes**
Benzo(b)fluoranthene[b]	0.144 - 18	205	N/A	UT
Benzo(g,h,i)perylene[b]	0.588 - 18	205	N/A	UT
Benzo(k)fluoranthene[b]	0.0768 - 18	204	N/A	UT
Benzoic Acid[b]	**25 - 90**	**166**	**42**	**Yes**
Benzyl Alcohol[b]	**5 - 22.5**	**177**	**8.60**	**Yes**
beta-BHC[b]	0.01 - 0.52	118	2.20	No
beta-Chlordane	0.049 - 5.2	67	N/A	UT
bis(2-Chloroethoxy) methane	5 - 18	206	N/A	UT
bis(2-Chloroethyl) ether	5 - 18	206	N/A	UT
bis(2-Chloroisopropyl) ether	5 - 18	202	29	No
Bladex	0.3 - 0.3	16	N/A	UT
Bromobenzene	0.2 - 5	157	N/A	UT
Bromochloromethane[b]	0.2 - 5	151	N/A	UT
Bromodichloromethane[b]	0.2 - 10	317	1,100	No
Bromoform	0.2 - 10	339	320	No
Bromomethane	0.2 - 10	334	35	No
Carbazole[b]	**9 - 12**	**24**	**4**	**Yes**
Carbon Disulfide[b]	**0.2 - 10**	**228**	**0.920**	**Yes**
Chlordane (NOS)	0.14 - 0.5	6	N/A	UT

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Chlorobenzene[b]	0.1 - 10	338	47	No
Chlorobenzilate	10 - 10	2	N/A	UT
Chloroethane	0.2 - 10	339	N/A	UT
Chloromethane	0.2 - 10	335	N/A	UT
Chloroprene	100	1	N/A	UT
Chlorpyriphos	1	1	N/A	UT
Chrysene[b]	0.499 - 18	205	N/A	UT
cis-1,3-Dichloropropene	0.1 - 10	337	244	No
Coumaphos	4	1	N/A	UT
Dalapon[b]	5.8 - 10.53	24	N/A	UT
delta-BHC	0.01 - 0.52	123	2.20	No
Demeton	2	1	N/A	UT
Diallate (cis or trans)	10	1	N/A	UT
Diazinon	1	1	N/A	UT
Dibenz(a,h)anthracene[b]	0.3 - 18	206	N/A	UT
Dibenzofuran	**5 - 18**	**207**	**4**	**Yes**
Dibromochloromethane[b]	0.2 - 10	338	N/A	UT
Dibromomethane	0.2 - 20	158	N/A	UT
Dichlorodifluoromethane[b]	0.2 - 20	176	N/A	UT
Dichlorovos	2	1	N/A	UT
Dieldrin	**0.02 - 1**	**123**	**0.0560**	**Yes**
Diesel fuel	1,000	1	N/A	UT
Dimethylaminoazobenzene	10 - 10	2	N/A	UT
Dimethylphthalate[b]	5 - 18	205	N/A	UT
Di-n-octylphthalate[b]	5 - 18	206	N/A	UT
Dinoseb[b]	**0.07 - 10**	**25**	**0.480**	**Yes**
Diphenylamine	10 - 11.2	7	N/A	UT
Disulfoton	0.52 - 10	3	N/A	UT
Endosulfan I[b]	**0.01 - 0.52**	**121**	**0.0560**	**Yes**
Endosulfan II	**0.02 - 1**	**123**	**0.0560**	**Yes**
Endosulfan sulfate	**0.02 - 1**	**123**	**0.0560**	**Yes**
Endrin[b]	**0.02 - 1**	**122**	**0.0360**	**Yes**
Endrin aldehyde	**0.02 - 1**	**46**	**0.0360**	**Yes**
Endrin ketone	**0.05 - 1**	**112**	**0.0360**	**Yes**
Ethoprop	1	1	N/A	UT
Ethyl Methacrylate	5	1	N/A	UT
Ethyl methanesulfonate	10 - 20	2	N/A	UT
Ethylbenzene[b]	0.2 - 10	338	3,200	No
Famphur	1.3 - 50	2	N/A	UT
Fensulfothion	2	1	N/A	UT
Fenthion	1	1	N/A	UT
Fluoranthene[b]	0.595 - 18	205	398	No
Fluorene[b]	**0.294 - 18**	**206**	**12**	**Yes**
gamma-BHC (Lindane)	**0.01 - 0.52**	**123**	**0.0800**	**Yes**

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
gamma-Chlordane[b]	0.01 - 2.6	49	N/A	UT
Gasoline	30	1	N/A	UT
Heptachlor	**0.01 - 0.52**	**123**	**0.00380**	**Yes**
Heptachlor epoxide[b]	**0.01 - 0.83**	**122**	**0.00380**	**Yes**
Hexachlorobenzene	1 - 18	207	N/A	UT
Hexachlorobutadiene[b]	**0.1 - 18**	**254**	**9.30**	**Yes**
Hexachlorocyclopentadiene	5 - 18	204	N/A	UT
Hexachlorodibenzofuran	0.0096	1	N/A	UT
Hexachlorodibenzo-p-dioxin	0.0074	1	N/A	UT
Hexachloroethane	1 - 18	207	540	No
Hexachlorophene	100 - 100	2	N/A	UT
Hexachloropropene	10 - 10	2	N/A	UT
Indeno(1,2,3-cd)pyrene[b]	0.294 - 18	206	N/A	UT
Iodomethane	10	1	N/A	UT
Isodrin	0.1 - 20	2	N/A	UT
Isophorone[b]	5 - 18	206	1,300	No
Isopropylbenzene[b]	0.2 - 5	156	N/A	UT
Isosafrole	10 - 10	2	N/A	UT
Kepone	0.5 - 50	2	N/A	UT
m,p-Xylene	0.2 - 2	56	35	No
Malathion	1	1	N/A	UT
MCPA	10 - 10,000	25	N/A	UT
MCPP	10 - 10,000	25	N/A	UT
Merphos	5	1	N/A	UT
Methapyrilene	10 - 100	2	N/A	UT
Methoxychlor	0.05 - 5.2	118	N/A	UT
Methyl Acrylonitrile	100	1	N/A	UT
methyl methacrylate	5	1	N/A	UT
Methyl methanesulfonate	10 - 10	2	N/A	UT
Methyl parathion	0.52 - 10	3	N/A	UT
Mevinphos	2	1	N/A	UT
Naled	5	1	N/A	UT
Naphthalene[b]	0.2 - 18	251	620	No
n-Butylbenzene[b]	0.2 - 5	156	N/A	UT
Nitrobenzene	5 - 18	207	N/A	UT
Nitroquinoline-1-oxide	21 - 40	2	N/A	UT
N-Nitrosodiethylamine	5 - 20	8	N/A	UT
N-Nitrosodimethylamine	5 - 10	8	N/A	UT
N-Nitrosodi-n-butylamine	5 - 10	8	N/A	UT
N-Nitroso-di-n-propylamine	5 - 18	207	N/A	UT
N-nitrosodiphenylamine	5 - 18	201	N/A	UT
N-Nitrosomethylethylamine	10 - 10	2	N/A	UT
N-Nitrosomorpholine	10 - 10	2	N/A	UT
N-Nitrosopiperidine	20 - 52	2	N/A	UT
N-Nitrosopyrrolidine	10 - 40	8	N/A	UT

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
n-Propylbenzene	0.2 - 5	157	N/A	UT
O,O,O-Triethyl phosphorothioate	0.52 - 20	2	N/A	UT
o-Toluidine	10 - 10	2	N/A	UT
o-Xylene	0.2 - 1	118	35	No
Parathion	0.52 - 10	2	N/A	UT
Pentachlorobenzene	10 - 10	2	N/A	UT
Pentachlorodibenzofuran	0.011	1	N/A	UT
Pentachlorodibenzo-p-dioxin	0.01	1	N/A	UT
Pentachloroethane	10	1	N/A	UT
Pentachloronitrobenzene	20	1	N/A	UT
Pentachlorophenol	**23 - 90**	**205**	**6.73**	**Yes**
Phenacetin	10 - 20	2	N/A	UT
Phenanthrene[b]	**0.672 - 18**	**205**	**2.40**	**Yes**
Phenol	**5 - 2,700**	**205**	**2,560**	**Yes**
Phorate	0.52 - 10	3	N/A	UT
Prometon	0.09 - 0.38	76	N/A	UT
Prometryn	0.18 - 0.76	76	N/A	UT
Pronamide	10 - 20	2	N/A	UT
Propazine[b]	0.09 - 0.38	75	N/A	UT
Propionitrile	100	1	N/A	UT
Prothiophos	5	1	N/A	UT
Pyrene[b]	**0.588 - 18**	**199**	**0.0250**	**Yes**
Pyridine	10	1	N/A	UT
Ronnel	1	1	N/A	UT
Safrole	10 - 10	2	N/A	UT
sec-Butylbenzene	0.2 - 5	157	N/A	UT
Simazine[b]	0.18 - 1	92	10	No
Simetryn	0.21 - 730	76	N/A	UT
Styrene	0.1 - 10	319	160	No
Sulprofos	1	1	N/A	UT
TCDF	0.0086	1	N/A	UT
Terbutryn	0.5 - 0.63	52	N/A	UT
Terbutylazine	0.09 - 0.38	76	N/A	UT
tert-Butylbenzene	0.2 - 5	157	N/A	UT
Tetrachlorodibenzo-p-dioxin	0.027	1	N/A	UT
Tetrachloroethane	1	1	N/A	UT
Tetrachloroethene[b]	0.04 - 10	323	840	No
Tetrachlorvinphos	2	1	N/A	UT
Tetraethyl dithiopyrophosphate	0.52 - 40	2	N/A	UT
Thionazine	0.52 - 20	2	N/A	UT
Toluene[b]	0.1 - 10	328	1,750	No
Toxaphene	0.99 - 10	123	N/A	UT
trans-1,2-Dichloroethene	0.1 - 5	178	1,500	No
trans-1,3-Dichloropropene	0.1 - 10	336	244	No
trans-1,4-Dichlorobutene-2	100	1	N/A	UT
Tributyl phosphate	102 - 112	6	N/A	UT

Table A1.2.NWAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Trichlorofluoromethane[b]	0.2 - 20	172	N/A	UT
Trichloronate	1	1	N/A	UT
Vinyl acetate	10 - 10	154	N/A	UT
Vinyl Chloride[b]	0.2 - 10	338	930	No
Xylene[b,c]	0.5 - 10	282	35	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5 percent.

[c] The value for total xylene is used.

N/A = Not available or not applicable.

ESL = Ecological screening level.

UT = Uncertain toxicity.

Table A1.2.NWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Organic (µg/kg)				
1,1,1,2-Tetrachloroethane	1.324 - 23	12	N/A	UT
1,1,1-Trichloroethane	**1.175 - 1,600**	**79**	**159**	**Yes**
1,1,2,2-Tetrachloroethane[b]	1.216 - 1,600	78	1,900	No
1,1,2-Trichloro-1,2,2-trifluoroethane	2 - 23	12	N/A	UT
1,1,2-Trichloroethane	0.995 - 1,600	79	N/A	UT
1,1-Dichloroethane	1.056 - 1,600	79	N/A	UT
1,1-Dichloroethene	1.587 - 1,600	79	N/A	UT
1,1-Dichloropropene	1.347 - 23	12	N/A	UT
1,2,3-Trichlorobenzene	1.526 - 23	12	58.6	No
1,2,3-Trichloropropane	1.11 - 23	12	N/A	UT
1,2,4-Trichlorobenzene	**1.539 - 3,500**	**106**	**429**	**Yes**
1,2,4-Trimethylbenzene	1.092 - 23	12	122	No
1,2-Dibromo-3-chloropropane	2.852 - 23	12	N/A	UT
1,2-Dibromoethane	1.194 - 23	12	N/A	UT
1,2-Dichlorobenzene	1.374 - 2,700	90	N/A	UT
1,2-Dichloroethane[b]	1.204 - 1,600	74	N/A	UT
1,2-Dichloroethene[b]	5 - 1,600	66	N/A	UT
1,2-Dichloropropane	0.974 - 1,600	79	N/A	UT
1,3,5-Trimethylbenzene	0.755 - 23	12	316	No
1,3-Dichlorobenzene	**1.513 - 3,500**	**106**	**122**	**Yes**
1,3-Dichloropropane	0.845 - 23	12	N/A	UT
1,4-Dichlorobenzene	1.186 - 2,700	90	N/A	UT
2,2-Dichloropropane	1.116 - 23	12	N/A	UT
2,4,5-T	60	1	N/A	UT
2,4,5-TP (Silvex)	60	1	N/A	UT
2,4,5-Trichlorophenol	700 - 6,800	104	N/A	UT
2,4,6-Trichlorophenol	**350 - 3,500**	**104**	**59.3**	**Yes**
2,4-D	180	1	N/A	UT
2,4-DB	1,400	1	N/A	UT
2,4-Dichlorophenol	350 - 3,500	104	N/A	UT
2,4-Dimethylphenol	350 - 3,500	104	N/A	UT
2,4-Dinitrophenol	860 - 18,000	99	N/A	UT
2,4-Dinitrotoluene	350 - 3,500	104	N/A	UT
2,6-Dinitrotoluene	350 - 3,500	104	N/A	UT
2-Chloronaphthalene	350 - 3,500	104	N/A	UT
2-Chlorophenol	350 - 3,500	104	N/A	UT
2-Chlorotoluene	1.691 - 23	12	N/A	UT
2-Hexanone	2.68 - 3,100	79	N/A	UT
2-Methylphenol[b]	350 - 3,500	103	6,970	No
2-Nitroaniline	860 - 18,000	104	N/A	UT
2-Nitrophenol	350 - 3,500	104	N/A	UT
3,3'-Dichlorobenzidine	350 - 6,900	103	N/A	UT
3-Nitroaniline	860 - 18,000	98	N/A	UT
4,4'-DDD	**3.5 - 180**	**79**	**4.88**	**Yes**
4,4'-DDE	**3.5 - 180**	**79**	**3.16**	**Yes**
4,6-Dinitro-2-methylphenol	860 - 18,000	100	N/A	UT

Table A1.2.NWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
4-Bromophenyl-phenylether	**350 - 3,500**	**104**	**166**	**Yes**
4-Chloro-3-methylphenol	350 - 6,900	104	N/A	UT
4-Chloroaniline	350 - 6,900	102	N/A	UT
4-Chlorophenyl-phenyl ether	350 - 3,500	104	N/A	UT
4-Chlorotoluene	0.991 - 23	12	N/A	UT
4-Methyl-2-pentanone[b]	3.17 - 3,100	78	N/A	UT
4-Methylphenol	**350 - 3,500**	**104**	**12.3**	**Yes**
4-Nitroaniline	860 - 18,000	104	N/A	UT
4-Nitrophenol	860 - 18,000	104	N/A	UT
Acenaphthylene	**350 - 2,700**	**104**	**5.87**	**Yes**
Aldrin[b]	**1.8 - 89**	**77**	**8.25**	**Yes**
alpha-BHC	**1.8 - 89**	**79**	**43.9**	**Yes**
alpha-Chlordane	**1.8 - 890**	**79**	**3.24**	**Yes**
Ametryne	50	1	N/A	UT
Aroclor-1016	**35 - 890**	**121**	**40.0**	**Yes**
Aroclor-1221	**35 - 890**	**121**	**40.0**	**Yes**
Aroclor-1232	**35 - 890**	**121**	**40.0**	**Yes**
Aroclor-1242	**35 - 890**	**121**	**40.0**	**Yes**
Aroclor-1248	**35 - 890**	**121**	**40.0**	**Yes**
Aroclor-1260[b]	**35 - 1,800**	**119**	**40.0**	**Yes**
Atraton	50	1	N/A	UT
Benzene[b]	**0.918 - 1,600**	**78**	**260**	**Yes**
Benzyl Alcohol	**370 - 6,900**	**74**	**1.35**	**Yes**
beta-BHC	1.8 - 89	79	93.6	No
beta-Chlordane	**1.8 - 240**	**58**	**3.24**	**Yes**
bis(2-Chloroethoxy) methane	350 - 3,500	104	N/A	UT
bis(2-Chloroethyl) ether	350 - 3,500	104	N/A	UT
bis(2-Chloroisopropyl) ether	350 - 3,500	103	N/A	UT
Bromobenzene	1.392 - 23	12	N/A	UT
Bromochloromethane	1.334 - 23	12	N/A	UT
Bromodichloromethane	0.732 - 1,600	79	N/A	UT
Bromoform	1.188 - 1,600	79	N/A	UT
Bromomethane	**1.707 - 3,100**	**79**	**3.43**	**Yes**
Butylbenzylphthalate[b]	350 - 3,500	101	11,400	No
Carbon Disulfide	1.55 - 1,600	79	N/A	UT
Carbon Tetrachloride	1.256 - 1,600	79	7,890	No
Chlorobenzene	1.057 - 1,600	79	N/A	UT
Chloroethane	2.83 - 3,100	79	N/A	UT
Chloroform	0.957 - 1,600	79	N/A	UT
Chloromethane	1.493 - 3,100	79	N/A	UT
cis-1,2-Dichloroethene	1.336 - 12	12	N/A	UT
cis-1,3-Dichloropropene	0.932 - 1,600	79	N/A	UT
Dalapon	2,300	1	N/A	UT
delta-BHC[b]	**1.8 - 89**	**78**	**2.37**	**Yes**
Dibromochloromethane	1.069 - 1,600	79	N/A	UT
Dibromomethane	1.176 - 23	12	N/A	UT

Table A1.2.NWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Dicamba	96	1	N/A	UT
Dichlorodifluoromethane	2.885 - 23	12	N/A	UT
Dichloroprop	650	1	N/A	UT
Dieldrin	**3.5 - 180**	**79**	**5.94**	**Yes**
Diethylphthalate[b]	**350 - 3,500**	**103**	**108**	**Yes**
Dimethylphthalate	350 - 3,500	104	N/A	UT
Di-n-octylphthalate[b]	350 - 3,500	101	N/A	UT
Dinoseb	84	1	N/A	UT
Endosulfan I[b]	**1.8 - 89**	**78**	**0.690**	**Yes**
Endosulfan II	**3.5 - 180**	**79**	**0.690**	**Yes**
Endosulfan sulfate	**3.5 - 180**	**79**	**0.690**	**Yes**
Endrin	3.5 - 180	79	N/A	UT
Endrin aldehyde	3.5 - 27	30	N/A	UT
Endrin ketone	3.5 - 180	70	N/A	UT
Ethylbenzene	0.923 - 1,600	79	16,570	No
gamma-BHC (Lindane)	**1.8 - 89**	**79**	**2.37**	**Yes**
gamma-Chlordane	**3.7 - 890**	**21**	**3.24**	**Yes**
Gasoline	600 - 1,500	2	N/A	UT
Heptachlor	**1.8 - 89**	**79**	**0.132**	**Yes**
Heptachlor epoxide	**1.8 - 89**	**79**	**2.47**	**Yes**
Hexachlorobenzene	350 - 3,500	104	N/A	UT
Hexachlorobutadiene	**1.62 - 3,500**	**106**	**23.0**	**Yes**
Hexachlorocyclopentadiene	350 - 3,500	101	N/A	UT
Hexachloroethane	350 - 3,500	104	N/A	UT
Isophorone	350 - 3,500	104	N/A	UT
Isopropylbenzene	1.382 - 23	12	N/A	UT
MCPA	94,000	1	N/A	UT
MCPP	140,000	1	N/A	UT
Methoxychlor	**3.8 - 890**	**79**	**24.0**	**Yes**
n-Butylbenzene	1.102 - 23	12	N/A	UT
Nitrobenzene	350 - 3,500	104	N/A	UT
N-Nitroso-di-n-propylamine	350 - 3,500	104	N/A	UT
N-nitrosodiphenylamine	350 - 3,500	104	N/A	UT
n-Propylbenzene	1.226 - 23	12	N/A	UT
Pentachlorodibenzo-p-dioxin	0.00184 - 0.00474	4	N/A	UT
Pentachlorophenol[b]	**860 - 18,000**	**103**	**255**	**Yes**
Phenol[b]	**350 - 3,500**	**102**	**773**	**Yes**
Prometon	50	1	N/A	UT
Prometryn	50	1	N/A	UT
Propazine	50	1	N/A	UT
Pyridine	700 - 3,500	26	N/A	UT
sec-Butylbenzene	1.162 - 23	12	N/A	UT
Simazine	50	1	N/A	UT
Simetryn	50	1	N/A	UT
Styrene	1.115 - 1,600	79	N/A	UT
Terbutryn	50	1	N/A	UT

Table A1.2.NWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Terbutylazine	50	1	N/A	UT
tert-Butylbenzene	1.214 - 23	12	N/A	UT
Tetrachloroethene[b]	1.455 - 1,600	78	3,050	No
Toxaphene	180 - 1,800	79	N/A	UT
trans-1,2-Dichloroethene	1.485 - 12	12	657	No
trans-1,3-Dichloropropene	1.045 - 1,600	79	N/A	UT
Trichloroethene[b]	0.791 - 1,600	76	22,800	No
Trichlorofluoromethane	1.389 - 23	12	N/A	UT
Vinyl acetate	10 - 38	39	N/A	UT
Vinyl Chloride	2.87 - 3,100	79	N/A	UT
Xylene[c]	**2.784 - 1,600**	**79**	**91.0**	**Yes**

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5%.

[c] The value for total xylene is used.

N/A = Not available or not applicable.

ESL = Ecological screening level.

UT = Uncertain toxicity.

Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganic Total (mg/L)				
Beryllium[b]	**2.0E-05 - 0.005**	**1,374**	**0.00240**	**Yes**
Mercury[b]	**1.4E-05 - 0.009**	**1,417**	**7.70E-04**	**Yes**
Sulfide[b]	4.0E-04 - 1.2	84	N/A	UT
Thallium[b]	**2.7E-05 - 0.288**	**1,526**	**0.0150**	**Yes**
Tin[b]	**1.6E-04 - 0.2**	**1,029**	**0.0730**	**Yes**
Inorganic Dissolved (mg/L)				
Beryllium[b]	**2.0E-05 - 0.0034**	**823**	**0.00240**	**Yes**
Mercury[b]	2.3E-05 - 2.0E-04	811	7.70E-04	No
Thallium[b]	**4.0E-05 - 0.191**	**821**	**0.0150**	**Yes**
Tin[b]	**1.1E-04 - 0.2**	**577**	**0.0730**	**Yes**
Organic Total (µg/L)				
1,1,1,2-Tetrachloroethane	0.1 - 10	740	N/A	UT
1,1,2,2-Tetrachloroethane[b]	0.1 - 10	1,376	2,400	No
1,1,2-Trichlorobenzene	1 - 1	2	N/A	UT
1,1,2-Trichloroethane	0.1 - 10	1,376	940	No
1,1-Dichloropropene	0.1 - 10	747	N/A	UT
1,2,3-Trichlorobenzene[b]	**0.1 - 10**	**746**	**8**	**Yes**
1,2,3-Trichloropropane[b]	0.1 - 20	679	N/A	UT
1,2,4,5-Tetrachlorobenzene	10 - 33	2	N/A	UT
1,2,4-Trichlorobenzene[b]	0.1 - 11	833	50	No
1,2,4-Trimethylbenzene[b]	0.1 - 10	746	17	No
1,2-Dibromo-3-chloropropane[b]	0.16 - 20	259	N/A	UT
1,2-Dibromoethane	0.2 - 10	747	N/A	UT
1,2-Dichlorobenzene	0.1 - 11	915	13	No
1,2-Dichloroethane[b]	0.1 - 10	1,343	20,000	No
1,2-Dichloropropane	0.1 - 10	1,378	5,700	No
1,3 & 1,4-xylene	5 - 5	2	35	No
1,3,5-Trimethylbenzene[b]	0.1 - 10	746	45	No
1,3,5-Trinitrobenzene	10 - 33	2	N/A	UT
1,3-Dichlorobenzene[b]	0.1 - 11	913	28	No
1,3-Dichloropropane	0.1 - 10	745	N/A	UT
1,3-Dinitrobenzene	10 - 33	2	N/A	UT
1,4-Naphthoquinone	10 - 33	2	N/A	UT
1,4-Phenylenediamine	10 - 33	2	N/A	UT
1-Naphthylamine	10 - 33	2	N/A	UT
2,2-Dichloropropane	0.1 - 10	743	N/A	UT
2,3,4,6-Tetrachlorophenol	10 - 33	2	N/A	UT
2,4,5-T	0.2 - 10	9	N/A	UT
2,4,5-TP (Silvex)	0.17 - 10	37	N/A	UT
2,4,5-Trichlorophenol	9.8 - 84	154	N/A	UT
2,4,6-Trichlorophenol	**1 - 33**	**154**	**5**	**Yes**
2,4-D	0.45 - 10	37	N/A	UT

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Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] ≥ ESL?
2,4-DB	0.91 - 10	9	N/A	UT
2,4-Dichlorophenol	5 - 33	154	365	No
2,4-Dimethylphenol	5 - 33	154	212	No
2,4-Dinitrophenol	25 - 84	149	N/A	UT
2,4-Dinitrotoluene	5 - 33	153	N/A	UT
2,6-Dichlorophenol	10 - 33	2	N/A	UT
2,6-Dinitrotoluene	5 - 11	153	N/A	UT
2378-TCDD	1.4E-04 - 0.005	34	N/A	UT
2-Acetylaminofluorene	10 - 33	2	N/A	UT
2-Chloronaphthalene	5 - 33	155	630	No
2-Chlorophenol	5 - 33	154	N/A	UT
2-Chlorotoluene	0.2 - 10	747	N/A	UT
2-Hexanone[b]	1 - 50	654	99	No
2-Methylnaphthalene	5 - 33	150	N/A	UT
2-Methylphenol	5 - 11	152	82	No
2-Naphthylamine	10 - 33	2	N/A	UT
2-Nitroaniline	25 - 84	155	N/A	UT
2-Nitrophenol	5 - 33	154	N/A	UT
2-Picoline	10 - 33	2	N/A	UT
3 & 4-methyl phenol	9.8 - 11	11	N/A	UT
3,3'-Dichlorobenzidine	10 - 33	155	N/A	UT
3,3'-Dimethylbenzidine	10 - 33	2	N/A	UT
3-Methylcholanthrene	10 - 33	2	N/A	UT
3-Nitroaniline	25 - 84	154	N/A	UT
4,4'-DDD[b]	**0.099 - 0.52**	**71**	**0.0600**	**Yes**
4,4'-DDE[b]	0.099 - 0.52	71	105	No
4,6-Dinitro-2-methylphenol	25 - 84	151	N/A	UT
4-Aminobiphenyl	10 - 33	2	N/A	UT
4-Bromophenyl-phenylether	5 - 33	155	N/A	UT
4-Chloro-3-methylphenol	5 - 33	154	N/A	UT
4-Chloroaniline	5 - 33	154	N/A	UT
4-Chlorophenyl-phenyl ether	5 - 33	155	N/A	UT
4-Chlorotoluene	0.2 - 10	747	N/A	UT
4-Isopropyltoluene	0.2 - 10	747	N/A	UT
4-Methyl-2-pentanone[b]	1 - 50	659	170	No
4-Methylphenol[b]	5 - 11	140	25	No
4-Nitroaniline[b]	25 - 84	152	N/A	UT
4-Nitrophenol	25 - 84	154	N/A	UT
5-Nitro-o-toluidine	10 - 33	2	N/A	UT
7,12-Dimethylbenz(a)-anthracene	10 - 33	2	N/A	UT
a,a-Dimethylphenethylamine	10 - 33	2	N/A	UT
Acenaphthene	1 - 33	155	520	No
Acenaphthylene	1 - 33	155	N/A	UT
Acetophenone	10 - 33	2	N/A	UT
Acrylonitrile	10 - 10	15	N/A	UT
Aldrin	**0.05 - 0.26**	**72**	**0.150**	**Yes**

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Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
alpha-Chlordane[b]	0.05 - 2.6	65	N/A	UT
Ametryne	0.18 - 0.7	49	N/A	UT
Anthracene	**0.03 - 33**	**155**	**0.730**	**Yes**
Aramite	20 - 67	2	N/A	UT
Aroclor-1016	**0.5 - 2.6**	**70**	**0.0140**	**Yes**
Aroclor-1221	**0.5 - 2.6**	**70**	**0.0140**	**Yes**
Aroclor-1232	**0.5 - 2.6**	**70**	**0.0140**	**Yes**
Aroclor-1242	**0.5 - 2.6**	**70**	**0.0140**	**Yes**
Aroclor-1248	**0.5 - 2.6**	**70**	**0.0140**	**Yes**
Aroclor-1254[b]	**0.99 - 5.2**	**69**	**0.0140**	**Yes**
Aroclor-1260	**0.99 - 5.2**	**70**	**0.0140**	**Yes**
Atraton	0.52 - 0.7	35	N/A	UT
Benzene[b]	0.1 - 10	1,373	530	No
Benzidine	10 - 10	5	N/A	UT
Benzo(a)anthracene	**0.178 - 33**	**155**	**0.0270**	**Yes**
Benzo(a)pyrene	**0.14 - 33**	**155**	**0.0140**	**Yes**
Benzo(b)fluoranthene	0.15 - 33	155	N/A	UT
Benzo(g,h,i)perylene	0.594 - 33	144	N/A	UT
Benzo(k)fluoranthene	0.08 - 33	155	N/A	UT
Benzoic Acid	**25 - 56**	**136**	**42**	**Yes**
Benzyl Alcohol	**5 - 33**	**142**	**8.60**	**Yes**
beta-BHC[b]	0.05 - 0.26	69	2.20	No
beta-Chlordane	0.05 - 0.54	30	N/A	UT
bis(2-Chloroethoxy) methane	5 - 11	153	N/A	UT
bis(2-Chloroethyl) ether	5 - 11	153	N/A	UT
bis(2-Chloroisopropyl) ether	5 - 11	149	29	No
Bladex	0.3 - 0.3	14	N/A	UT
Bromobenzene	0.2 - 10	747	N/A	UT
Bromochloromethane	0.1 - 10	731	N/A	UT
Bromodichloromethane[b]	0.2 - 10	1,339	1,100	No
Bromoform[b]	0.2 - 10	1,352	320	No
Bromomethane[b]	0.2 - 20	1,366	35	No
Carbazole	**10 - 11**	**12**	**4**	**Yes**
Carbon Disulfide[b]	**0.2 - 10**	**665**	**0.920**	**Yes**
Chlordane (NOS)	0.5 - 0.5	5	N/A	UT
Chlorobenzene[b]	0.1 - 10	1,376	47	No
Chlorobenzilate	10 - 33	2	N/A	UT
Chloroethane	0.2 - 20	1,370	N/A	UT
Chloromethane[b]	0.2 - 20	1,372	N/A	UT
Chrysene[b]	0.52 - 33	154	N/A	UT
cis-1,3-Dichloropropene	0.1 - 10	1,272	244	No
Dalapon	5.8 - 10	9	N/A	UT
delta-BHC[b]	0.05 - 0.26	70	2.20	No
Diallate (cis or trans)	10 - 33	2	N/A	UT

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Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Dibenz(a,h)anthracene	1.01 - 33	146	N/A	UT
Dibenzofuran	**5 - 33**	**155**	**4**	**Yes**
Dibromochloromethane[b]	0.2 - 10	1,362	N/A	UT
Dibromomethane	0.2 - 10	747	N/A	UT
Dicamba	0.27 - 10	9	10	No
Dichlorodifluoromethane[b]	0.2 - 20	823	N/A	UT
Dichloroprop	0.65 - 10	9	N/A	UT
Dieldrin	**0.099 - 0.52**	**72**	**0.0560**	**Yes**
Diethylphthalate[b]	5 - 11	152	110	No
Dimethylaminoazobenzene	10 - 33	2	N/A	UT
Dimethylphthalate[b]	5 - 33	153	N/A	UT
Di-n-octylphthalate[b]	5 - 33	152	N/A	UT
Dinoseb	**0.07 - 10**	**9**	**0.480**	**Yes**
Diphenylamine	9.8 - 33	13	N/A	UT
Disulfoton	0.51 - 0.52	2	N/A	UT
Endosulfan I	**0.05 - 0.26**	**72**	**0.0560**	**Yes**
Endosulfan II	**0.099 - 0.52**	**72**	**0.0560**	**Yes**
Endosulfan sulfate	**0.099 - 0.52**	**72**	**0.0560**	**Yes**
Endrin	**0.099 - 0.52**	**72**	**0.0360**	**Yes**
Endrin aldehyde	**0.1 - 0.11**	**19**	**0.0360**	**Yes**
Endrin ketone	**0.099 - 0.52**	**67**	**0.0360**	**Yes**
Ethyl methanesulfonate	10 - 33	2	N/A	UT
Ethylbenzene	0.1 - 10	1,378	3,200	No
Famphur	1.3 - 1.3	2	N/A	UT
Fluoranthene	0.62 - 33	155	398	No
Fluorene[b]	**0.297 - 33**	**154**	**12**	**Yes**
gamma-BHC (Lindane)[b]	**0.05 - 0.26**	**70**	**0.0800**	**Yes**
Heptachlor[b]	**0.05 - 0.26**	**71**	**0.00380**	**Yes**
Heptachlor epoxide	**0.05 - 0.26**	**72**	**0.00380**	**Yes**
Hexachlorobenzene	1 - 33	155	N/A	UT
Hexachlorobutadiene[b]	**0.1 - 11**	**830**	**9.30**	**Yes**
Hexachlorocyclopentadiene	5 - 33	151	N/A	UT
Hexachloroethane	1 - 33	155	540	No
Hexachlorophene	100 - 330	2	N/A	UT
Hexachloropropene	10 - 33	2	N/A	UT
Indeno(1,2,3-cd)pyrene	0.297 - 33	144	N/A	UT
Isodrin	0.1 - 0.11	2	N/A	UT
Isophorone	5 - 33	155	1,300	No
Isopropylbenzene	0.2 - 10	747	N/A	UT
Isosafrole	10 - 33	2	N/A	UT
Kepone	0.5 - 0.55	2	N/A	UT
m,p-Xylene[b]	0.2 - 2	531	35	No
MCPA	250 - 10,000	9	N/A	UT
MCPP	190 - 10,000	9	N/A	UT
Methapyrilene	10 - 33	2	N/A	UT

Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Methoxychlor	0.5 - 2.6	67	N/A	UT
Methyl methanesulfonate	10 - 33	2	N/A	UT
Methyl parathion	0.51 - 0.52	2	N/A	UT
m-Xylene	0.5 - 0.5	3	35	No
Naphthalene[b]	0.2 - 11	830	620	No
n-Butylbenzene[b]	0.1 - 10	746	N/A	UT
Nitrobenzene	5 - 33	155	N/A	UT
Nitroquinoline-1-oxide	20 - 67	2	N/A	UT
N-Nitrosodiethylamine	5 - 33	7	N/A	UT
N-Nitrosodimethylamine	5 - 33	7	N/A	UT
N-Nitrosodi-n-butylamine	5 - 33	7	N/A	UT
N-Nitroso-di-n-propylamine	5 - 33	155	N/A	UT
N-nitrosodiphenylamine	5 - 33	144	N/A	UT
N-Nitrosomethylethylamine	10 - 33	2	N/A	UT
N-Nitrosopiperidine	51 - 170	2	N/A	UT
N-Nitrosopyrrolidine	10 - 33	7	N/A	UT
n-Propylbenzene	0.2 - 10	747	N/A	UT
O,O,O-Triethyl phosphorothioate	0.51 - 0.52	2	N/A	UT
o-Toluidine	10 - 33	2	N/A	UT
o-Xylene	0.2 - 5	584	35	No
Parathion	0.51 - 0.52	2	N/A	UT
Pentachlorobenzene	10 - 33	2	N/A	UT
Pentachloronitrobenzene	51	1	N/A	UT
Pentachlorophenol	25 - 84	154	6.73	Yes
Phenacetin	10 - 33	2	N/A	UT
Phenanthrene[b]	**0.7 - 33**	**154**	**2.40**	**Yes**
Phenol	5 - 33	154	2,560	No
Phorate	0.51 - 0.52	2	N/A	UT
Prometon	0.09 - 0.35	49	N/A	UT
Prometryn	0.18 - 0.7	49	N/A	UT
Pronamide	10 - 33	2	N/A	UT
p-Xylene	0.5	1	35	No
Pyrene	**0.594 - 33**	**155**	**0.0250**	**Yes**
Pyridine	10	1	N/A	UT
Safrole	10 - 33	2	N/A	UT
sec-Butylbenzene	0.1 - 10	747	N/A	UT
Simazine[b]	0.18 - 1	51	10	No
Simetryn	0.21 - 0.82	49	N/A	UT
Styrene[b]	0.1 - 10	1,294	160	No
Terbutryn	0.5 - 0.59	34	N/A	UT
Terbutylazine	0.09 - 0.35	49	N/A	UT
tert-Butylbenzene	0.2 - 10	747	N/A	UT
Tetrachloroethane	1 - 1	4	N/A	UT
Tetraethyl dithiopyrophosphate	0.51 - 0.52	2	N/A	UT
Thionazine	0.51 - 0.52	2	N/A	UT
Toxaphene	0.99 - 5.7	72	N/A	UT

Table A1.2.SWAEU.1
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
trans-1,2-Dichloroethene[b]	0.1 - 10	816	1,500	No
trans-1,3-Dichloropropene	0.1 - 10	1,270	244	No
Tributyl phosphate	98 - 110	11	N/A	UT
Trichlorofluoromethane[b]	0.1 - 10	823	N/A	UT
Vinyl acetate	10 - 10	415	N/A	UT
Xylene[b,c]	0.2 - 10	781	35	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5%.

[c] The value for total xylene is used.

N/A = Not available or not applicable.
ESL = Ecological screening level.
UT = Uncertain toxicity.

Table A1.2.SWAEU.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganic (mg/kg)				
Nitrite	0.02 - 2.5	13	N/A	UT
Uranium	0.96 - 20	54	N/A	UT
Organic (µg/kg)				
1,1,1,2-Tetrachloroethane	1.23 - 8	26	N/A	UT
1,1,1-Trichloroethane	**1.09 - 1,300**	**80**	**159**	**Yes**
1,1,2,2-Tetrachloroethane	0.958 - 1,300	80	1,900	No
1,1,2-Trichloro-1,2,2-trifluoroethane	0.97 - 8	26	N/A	UT
1,1,2-Trichloroethane	0.922 - 1,300	80	N/A	UT
1,1-Dichloroethane	0.773 - 1,300	80	N/A	UT
1,1-Dichloroethene[b]	1.47 - 1,300	78	N/A	UT
1,1-Dichloropropene	1.149 - 8	26	N/A	UT
1,2,3-Trichlorobenzene[b]	0.696 - 8	25	58.6	No
1,2,3-Trichloropropane	1.03 - 8	26	N/A	UT
1,2,4-Trichlorobenzene[b]	**0.963 - 3,600**	**102**	**429**	**Yes**
1,2,4-Trimethylbenzene	0.72 - 8	26	122	No
1,2-Dibromo-3-chloropropane	1.79 - 8	26	N/A	UT
1,2-Dibromoethane	0.816 - 8	26	N/A	UT
1,2-Dichlorobenzene	0.727 - 780	81	N/A	UT
1,2-Dichloroethane	0.991 - 1,300	80	N/A	UT
1,2-Dichloroethene	5 - 1,300	54	N/A	UT
1,2-Dichloropropane	0.851 - 1,300	80	N/A	UT
1,3,5-Trimethylbenzene	0.836 - 8	26	316	No
1,3-Dichlorobenzene	**1.01 - 3,600**	**103**	**122**	**Yes**
1,3-Dichloropropane	0.576 - 8	26	N/A	UT
1,4-Dichlorobenzene	1.1 - 780	81	N/A	UT
1,4-Dioxane	500	1	N/A	UT
2,2-Dichloropropane	1.01 - 8	26	N/A	UT
2,4,5-Trichlorophenol	330 - 3,800	84	N/A	UT
2,4,6-Trichlorophenol	**330 - 3,600**	**84**	**59.3**	**Yes**
2,4-Dichlorophenol	350 - 3,600	83	N/A	UT
2,4-Dimethylphenol	350 - 3,600	83	N/A	UT
2,4-Dinitrophenol	880 - 18,000	79	N/A	UT
2,4-Dinitrotoluene	330 - 3,600	84	N/A	UT
2,6-Dinitrotoluene	350 - 3,600	83	N/A	UT
2-Chloronaphthalene	350 - 3,600	83	N/A	UT
2-Chlorophenol	350 - 3,600	83	N/A	UT
2-Chlorotoluene	0.985 - 8	26	N/A	UT
2-Hexanone	7.93 - 1,300	75	N/A	UT
2-Methyl-1-propanol	100	1	N/A	UT
2-Methylnaphthalene[b]	**350 - 3,600**	**82**	**20.2**	**Yes**
2-Methylphenol	330 - 3,600	84	6,970	No
2-Nitroaniline	880 - 18,000	83	N/A	UT
2-Nitrophenol	350 - 3,600	83	N/A	UT
3,3'-Dichlorobenzidine	350 - 7,100	82	N/A	UT
3-Nitroaniline	880 - 18,000	76	N/A	UT

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Table A1.2.SWAEU.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
4,4'-DDD	**3.5 - 41**	**66**	**4.88**	**Yes**
4,4'-DDE[b]	**3.5 - 41**	**65**	**3.16**	**Yes**
4,4'-DDT	**3.5 - 41**	**66**	**4.16**	**Yes**
4,6-Dinitro-2-methylphenol	880 - 18,000	82	N/A	UT
4-Bromophenyl-phenylether	**350 - 3,600**	**83**	**166**	**Yes**
4-Chloro-3-methylphenol	350 - 7,100	83	N/A	UT
4-Chloroaniline	350 - 7,100	79	N/A	UT
4-Chlorophenyl-phenyl ether	350 - 3,600	83	N/A	UT
4-Chlorotoluene	0.918 - 8	26	N/A	UT
4-Isopropyltoluene	1.08 - 8	26	N/A	UT
4-Methyl-2-pentanone	6 - 1,300	80	N/A	UT
4-Methylphenol[b]	**330 - 3,600**	**83**	**12.3**	**Yes**
4-Nitroaniline	880 - 18,000	82	N/A	UT
4-Nitrophenol	880 - 18,000	83	N/A	UT
Acenaphthylene	**350 - 1,800**	**83**	**5.87**	**Yes**
Acetonitrile	100 - 100	1	N/A	UT
Aldrin	**1.8 - 23**	**65**	**8.25**	**Yes**
alpha-BHC	1.8 - 23	66	43.9	No
alpha-Chlordane	**1.8 - 200**	**64**	**3.24**	**Yes**
Ametryne	50	1	N/A	UT
Aroclor-1016	**35 - 520**	**97**	**40**	**Yes**
Aroclor-1221	**35 - 520**	**97**	**40**	**Yes**
Aroclor-1232	**35 - 520**	**97**	**40**	**Yes**
Aroclor-1242	**35 - 520**	**97**	**40**	**Yes**
Aroclor-1248	**35 - 520**	**97**	**40**	**Yes**
Atraton	50	1	N/A	UT
Atrazine	**50**	**1**	**16.8**	**Yes**
Benzene	**0.809 - 1,300**	**79**	**260**	**Yes**
Benzyl Alcohol[b]	**350 - 7,100**	**66**	**1.35**	**Yes**
beta-BHC[b]	1.8 - 23	65	93.6	No
beta-Chlordane	**1.8 - 200**	**61**	**3.24**	**Yes**
bis(2-Chloroethoxy) methane	350 - 3,600	83	N/A	UT
bis(2-Chloroethyl) ether	350 - 3,600	83	N/A	UT
bis(2-Chloroisopropyl) ether	350 - 3,600	83	N/A	UT
Bromobenzene	1.08 - 8	26	N/A	UT
Bromochloromethane	1.15 - 8	26	N/A	UT
Bromodichloromethane	0.678 - 1,300	80	N/A	UT
Bromoform	0.668 - 1,300	80	N/A	UT
Carbon Disulfide	2.74 - 1,300	80	N/A	UT
Carbon Tetrachloride[b]	1.074 - 21	78	7,890	No
Chlordane	**23 - 94**	**2**	**3.24**	**Yes**
Chlorobenzene	0.979 - 1,300	79	N/A	UT
Chloroethane	1.676 - 1,300	80	N/A	UT
Chloromethane	1.262 - 1,300	79	N/A	UT
cis-1,2-Dichloroethene[b]	1.05 - 8	25	N/A	UT
cis-1,3-Dichloropropene	0.814 - 1,300	80	N/A	UT

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Table A1.2.SWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
delta-BHC	**1.8 - 23**	**66**	**2.37**	**Yes**
Dibenzofuran[b]	**350 - 3,600**	**79**	**325**	**Yes**
Dibromochloromethane	0.72 - 1,300	80	N/A	UT
Dibromomethane	0.752 - 8	26	N/A	UT
Dichlorodifluoromethane	1.88 - 13	26	N/A	UT
Dieldrin[b]	**3.5 - 41**	**65**	**5.94**	**Yes**
Diethylphthalate[b]	**350 - 3,600**	**82**	**108**	**Yes**
Dimethylphthalate[b]	350 - 3,600	79	N/A	UT
Endosulfan I	**1.8 - 23**	**66**	**0.690**	**Yes**
Endosulfan II	**3.5 - 41**	**66**	**0.690**	**Yes**
Endosulfan sulfate	**3.5 - 41**	**66**	**0.690**	**Yes**
Endrin	3.5 - 41	66	N/A	UT
Endrin aldehyde	3.5 - 23	18	N/A	UT
Endrin ketone	3.5 - 41	65	N/A	UT
Ether	10	1	N/A	UT
ethyl acetate	10	1	N/A	UT
Ethylbenzene[b]	1.022 - 1,300	78	16,570	No
gamma-BHC (Lindane)[b]	**1.8 - 23**	**64**	**2.37**	**Yes**
gamma-Chlordane	**92 - 130**	**3**	**3.24**	**Yes**
Heptachlor	**1.8 - 23**	**66**	**0.132**	**Yes**
Heptachlor epoxide[b]	**1.8 - 89**	**65**	**2.47**	**Yes**
Hexachlorobenzene	330 - 3,600	84	N/A	UT
Hexachlorobutadiene[b]	**1.23 - 3,600**	**102**	**23**	**Yes**
Hexachlorocyclopentadiene	350 - 3,600	83	N/A	UT
Hexachloroethane	330 - 3,600	84	N/A	UT
Isophorone	350 - 3,600	83	N/A	UT
Isopropylbenzene	1.28 - 8	26	N/A	UT
Methoxychlor[b]	**18 - 200**	**65**	**24**	**Yes**
Naphthalene[b]	**0.815 - 3,600**	**98**	**176**	**Yes**
n-Butanol	100	1	N/A	UT
n-Butylbenzene	1.02 - 8	26	N/A	UT
Nitrobenzene	330 - 3,600	84	N/A	UT
N-Nitroso-di-n-propylamine	350 - 3,600	83	N/A	UT
N-nitrosodiphenylamine	350 - 3,600	83	N/A	UT
n-Propylbenzene	0.972 - 8	26	N/A	UT
Pentachlorophenol[b]	**330 - 18,000**	**81**	**255**	**Yes**
Phenol[b]	**350 - 3,600**	**82**	**773**	**Yes**
Prometon	50	1	N/A	UT
Prometryn	50	1	N/A	UT
Propazine	50	1	N/A	UT
Pyridine	370 - 3,600	29	N/A	UT
sec-Butylbenzene	1.08 - 8	26	N/A	UT
Simazine	50	1	N/A	UT
Simetryn	50	1	N/A	UT

Table A1.2.SWAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Styrene	0.874 - 1,300	80	N/A	UT
Terbutryn	50	1	N/A	UT
Terbutylazine	50	1	N/A	UT
tert-Butylbenzene	1.049 - 8	26	N/A	UT
Tetrachloroethene[b]	1.25 - 1,300	77	3,050	No
Toxaphene	170 - 2,300	66	N/A	UT
trans-1,2-Dichloroethene[b]	1.38 - 8	25	657	No
trans-1,3-Dichloropropene	0.923 - 1,300	80	N/A	UT
Trichloroethene[b]	0.655 - 1,300	78	22,800	No
Vinyl acetate	10 - 24	36	N/A	UT
Vinyl Chloride[b]	2.9 - 1,300	79	N/A	UT
Xylene[b,c]	**2.651 - 1,300**	**77**	**91**	**Yes**

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5%.

[c] The value for total xylene is used.

N/A = Not available or not applicable.
ESL = Ecological screening level.
UT = Uncertain toxicity.

Table A1.2.WCAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganic Total (mg/L)				
Bromide	0.5 - 0.5	3	N/A	UT
Cyanide[b]	**0 - 0.05**	**170**	**5.00E-04**	**Yes**
Phosphate	0.01 - 0.05	30	N/A	UT
Thallium[b]	**2.0E-05 - 5.2**	**561**	**0.0150**	**Yes**
Tin[b]	**4.8E-04 - 0.136**	**471**	**0.0730**	**Yes**
Total Petroleum Hydrocarbons	1	1	N/A	UT
Inorganic Dissolved (mg/L)				
Cerium	1.0E-04 - 1.0E-04	2	N/A	UT
Phosphate	0.02 - 0.02	12	N/A	UT
Thallium[b]	**5.0E-05 - 0.109**	**281**	**0.0150**	**Yes**
Tin[b]	**2.0E-04 - 0.136**	**240**	**0.0730**	**Yes**
Organic Total (µg/L)				
1,1,1,2-Tetrachloroethane	0.1 - 5	92	N/A	UT
1,1,1-Trichloroethane[b]	0.1 - 10	344	89	No
1,1,2,2-Tetrachloroethane	0.1 - 10	347	2,400	No
1,1,2-Trichloroethane	0.1 - 10	347	940	No
1,1-Dichloroethane	0.1 - 10	347	740	No
1,1-Dichloroethene[b]	0.1 - 10	346	65	No
1,1-Dichloropropene	0.1 - 5	95	N/A	UT
1,2,3-Trichlorobenzene	0.1 - 5	95	8	No
1,2,3-Trichloropropane	0.1 - 5	94	N/A	UT
1,2,4-Trichlorobenzene	0.1 - 16	208	50	No
1,2,4-Trimethylbenzene	0.1 - 5	95	17	No
1,2-Dibromo-3-chloropropane	0.16 - 5	84	N/A	UT
1,2-Dibromoethane	0.2 - 5	95	N/A	UT
1,2-Dichlorobenzene	**0.1 - 16**	**213**	**13**	**Yes**
1,2-Dichloroethane[b]	0.1 - 10	343	20,000	No
1,2-Dichloroethene[b]	5 - 10	253	1,100	No
1,2-Dichloropropane	0.1 - 10	347	5,700	No
1,3,5-Trimethylbenzene	0.1 - 5	95	45	No
1,3-Dichlorobenzene	0.1 - 16	213	28	No
1,3-Dichloropropane	0.1 - 5	95	N/A	UT
1,4-Dichlorobenzene[b]	0.1 - 16	210	16	No
2,2-Dichloropropane	0.1 - 5	94	N/A	UT
2,4,5-T	0.1 - 10	12	N/A	UT
2,4,5-TP (Silvex)	0.1 - 10	28	N/A	UT
2,4,5-Trichlorophenol	10 - 78	155	N/A	UT
2,4,6-Trichlorophenol	**1 - 16**	**155**	**5**	**Yes**
2,4-D	0.46 - 12	28	N/A	UT
2,4-DB	0.91 - 10	11	N/A	UT
2,4-Dichlorophenol	5 - 16	155	365	No
2,4-Dimethylphenol	5 - 16	155	212	No
2,4-Dinitrophenol	25 - 78	146	N/A	UT
2,4-Dinitrotoluene	5 - 16	155	N/A	UT

Table A1.2.WCAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
2,6-Dinitrotoluene	5 - 16	157	N/A	UT
2378-TCDD	2.7E-04 - 0.004	14	N/A	UT
2-Butanone[b]	5 - 100	232	2,200	No
2-Chloroethyl vinyl ether	0 - 10	17	N/A	UT
2-Chloronaphthalene	5 - 16	157	630	No
2-Chlorophenol	5 - 16	155	N/A	UT
2-Chlorotoluene	0.2 - 5	95	N/A	UT
2-Hexanone	1 - 50	277	99	No
2-Methylnaphthalene	5 - 16	157	N/A	UT
2-Methylphenol	5 - 16	155	82	No
2-Nitroaniline	25 - 78	157	N/A	UT
2-Nitrophenol	5 - 16	155	N/A	UT
3 & 4-methyl phenol	10 - 11	10	N/A	UT
3,3'-Dichlorobenzidine	10 - 31	145	N/A	UT
3-Nitroaniline	25 - 78	153	N/A	UT
4,4'-DDD[b]	**0.098 - 0.5**	**128**	**0.0600**	**Yes**
4,4'-DDE[b]	0.098 - 0.5	127	105	No
4,4'-DDT[b]	**0.098 - 0.5**	**124**	**0.00100**	**Yes**
4,6-Dinitro-2-methylphenol	25 - 78	152	N/A	UT
4-Bromophenyl-phenylether	5 - 16	157	N/A	UT
4-Chloro-3-methylphenol	5 - 22	155	N/A	UT
4-Chloroaniline	5 - 22	154	N/A	UT
4-Chlorophenyl-phenyl ether	5 - 16	157	N/A	UT
4-Chlorotoluene	0.2 - 5	95	N/A	UT
4-Isopropyltoluene	0.2 - 5	95	N/A	UT
4-Methyl-2-pentanone	1 - 50	274	170	No
4-Methylphenol	5 - 16	145	25	No
4-Nitroaniline	5 - 78	147	N/A	UT
4-Nitrophenol	25 - 78	150	N/A	UT
Acenaphthene	1 - 16	157	520	No
Acenaphthylene	1 - 16	157	N/A	UT
Acrylonitrile	10 - 10	14	N/A	UT
Aldrin	**0.049 - 0.25**	**129**	**0.150**	**Yes**
alpha-BHC	0.049 - 0.25	129	2.20	No
alpha-Chlordane	0.05 - 2.5	126	N/A	UT
Ametryne	0.18 - 0.67	35	N/A	UT
Anthracene	**0.0297 - 16**	**157**	**0.730**	**Yes**
Aroclor-1016	**0.49 - 2.5**	**127**	**0.0140**	**Yes**
Aroclor-1221	**0.49 - 2.5**	**127**	**0.0140**	**Yes**
Aroclor-1232	**0.49 - 2.5**	**127**	**0.0140**	**Yes**
Aroclor-1242	**0.49 - 2.5**	**127**	**0.0140**	**Yes**
Aroclor-1248	**0.49 - 2.5**	**127**	**0.0140**	**Yes**
Aroclor-1254	**0.5 - 5**	**127**	**0.0140**	**Yes**
Aroclor-1260	**0.5 - 5**	**127**	**0.0140**	**Yes**
Atraton	0.51 - 0.67	22	N/A	UT
Benzene[b]	0.1 - 10	345	530	No

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Table A1.2.WCAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Benzidine	10 - 10	4	N/A	UT
Benzo(a)anthracene	**0.178 - 16**	**157**	**0.0270**	**Yes**
Benzo(a)pyrene	**0.139 - 16**	**157**	**0.0140**	**Yes**
Benzo(b)fluoranthene	0.148 - 16	157	N/A	UT
Benzo(g,h,i)perylene	0.594 - 16	153	N/A	UT
Benzo(k)fluoranthene	0.0792 - 16	157	N/A	UT
Benzoic Acid[b]	**25 - 78**	**135**	**42**	**Yes**
Benzyl Alcohol[b]	**5 - 22**	**141**	**8.60**	**Yes**
beta-BHC[b]	0.049 - 0.25	125	2.20	No
beta-Chlordane	0.05 - 1	92	N/A	UT
bis(2-Chloroethoxy) methane	5 - 16	157	N/A	UT
bis(2-Chloroethyl) ether	5 - 16	157	N/A	UT
bis(2-Chloroisopropyl) ether	5 - 16	152	29	UT
Bladex	0.3 - 0.3	13	N/A	UT
Bromobenzene	0.1 - 5	95	N/A	UT
Bromochloromethane	0.2 - 5	92	N/A	UT
Bromodichloromethane[b]	0.2 - 10	346	1,100	No
Bromoform[b]	0.2 - 10	346	320	No
Bromomethane	0.1 - 10	338	35	No
Butylbenzylphthalate[b]	5 - 16	155	67	No
Carbazole	**10 - 11**	**14**	**4**	**Yes**
Carbon Disulfide[b]	**0.2 - 10**	**284**	**0.920**	**Yes**
Carbon Tetrachloride[b]	0.1 - 10	331	3,520	No
Chlordane (NOS)	0.5 - 0.5	3	N/A	UT
Chlorobenzene[b]	0.1 - 10	346	47	No
Chloroethane	0.1 - 10	339	N/A	UT
Chloromethane[b]	0.2 - 10	344	N/A	UT
Chrysene	0.515 - 16	157	N/A	UT
cis-1,3-Dichloropropene	0.1 - 10	344	244	No
Dalapon	1.1 - 10	11	N/A	UT
delta-BHC[b]	0.049 - 0.25	128	2.20	No
Dibenz(a,h)anthracene	1.01 - 16	156	N/A	UT
Dibenzofuran	**5 - 16**	**157**	**4**	**Yes**
Dibromochloromethane	0.2 - 10	347	N/A	UT
Dibromomethane	0.2 - 5	95	N/A	UT
Dicamba	0.1 - 10	11	10	No
Dichlorodifluoromethane[b]	0.2 - 5	99	N/A	UT
Dichloroprop	0.5 - 10	11	N/A	UT
Dieldrin	**0.098 - 0.5**	**129**	**0.0560**	**Yes**
Diesel Range Organics	250 - 340	2	N/A	UT
Diethylphthalate[b]	5 - 16	152	110	No
Dimethylphthalate	5 - 16	157	N/A	UT
Di-n-octylphthalate	5 - 16	157	N/A	UT
Dinoseb	**0.07 - 10**	**11**	**0.480**	**Yes**

Table A1.2.WCAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] ≥ ESL?
Diphenylamine	10 - 11	11	N/A	UT
Endosulfan I	**0.049 - 0.25**	**129**	**0.0560**	**Yes**
Endosulfan II	**0.098 - 0.5**	**129**	**0.0560**	**Yes**
Endosulfan sulfate	**0.098 - 0.5**	**129**	**0.0560**	**Yes**
Endrin	**0.098 - 0.5**	**129**	**0.0360**	**Yes**
Endrin aldehyde	**0.1 - 0.11**	**19**	**0.0360**	**Yes**
Endrin ketone	**0.098 - 0.5**	**126**	**0.0360**	**Yes**
Ethylbenzene	0.1 - 10	347	3,200	No
Fluoranthene	0.614 - 16	157	398	No
Fluorene	**0.297 - 16**	**157**	**12**	**Yes**
gamma-BHC (Lindane)	**0.049 - 0.25**	**129**	**0.0800**	**Yes**
gamma-Chlordane	0.49 - 2.5	34	N/A	UT
Heptachlor	**0.049 - 0.25**	**129**	**0.00380**	**Yes**
Heptachlor epoxide	**0.049 - 0.25**	**129**	**0.00380**	**Yes**
Hexachlorobenzene	1 - 16	157	N/A	UT
Hexachlorobutadiene	**0.1 - 16**	**208**	**9.30**	**Yes**
Hexachlorocyclopentadiene	5 - 16	153	N/A	UT
Hexachloroethane	1 - 16	157	540	No
Indeno(1,2,3-cd)pyrene	0.297 - 16	157	N/A	UT
Isophorone[b]	5 - 16	156	1,300	No
Isopropylbenzene	0.2 - 5	95	N/A	UT
m,p-Xylene	0.2 - 2	25	35	No
MCPA	100 - 10,000	11	N/A	UT
MCPP	100 - 10,000	11	N/A	UT
Methoxychlor	0.49 - 2.5	126	N/A	UT
Naphthalene[b]	0.2 - 16	206	620	No
n-Butylbenzene	0.1 - 5	95	N/A	UT
Nitrobenzene	5 - 16	157	N/A	UT
N-Nitrosodiethylamine	5 - 5	4	N/A	UT
N-Nitrosodimethylamine	5 - 5	4	N/A	UT
N-Nitrosodi-n-butylamine	5 - 5	4	N/A	UT
N-Nitroso-di-n-propylamine	5 - 16	157	N/A	UT
N-nitrosodiphenylamine	5 - 16	146	N/A	UT
N-Nitrosopyrrolidine	10 - 10	4	N/A	UT
n-Propylbenzene	0.2 - 5	95	N/A	UT
o-Xylene	0.2 - 1	43	35	No
Pentachlorophenol[b]	**25 - 78**	**154**	**6.73**	**Yes**
Phenanthrene	**0.693 - 16**	**157**	**2.40**	**Yes**
Phenol	5 - 16	155	2,560	No
Prometon[b]	0.09 - 0.33	34	N/A	UT
Prometryn	0.18 - 0.67	35	N/A	UT
Propazine	0.09 - 0.33	35	N/A	UT
Pyrene[b]	**0.594 - 16**	**155**	**0.0250**	**Yes**
sec-Butylbenzene	0.2 - 5	95	N/A	UT
Simazine	0.18 - 1.1	40	10	No
Simetryn	0.21 - 0.78	35	N/A	UT

Table A1.2.WCAEU.1

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Surface Water

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Styrene	0.1 - 10	342	160	No
Terbutryn	0.01 - 0.56	22	N/A	UT
Terbutylazine	0.09 - 0.33	35	N/A	UT
tert-Butylbenzene	0.2 - 5	95	N/A	UT
Toluene[b]	0.1 - 10	335	1,750	No
Toxaphene	0.98 - 5.7	129	N/A	UT
trans-1,2-Dichloroethene	0.1 - 5	100	1,500	No
trans-1,3-Dichloropropene	0.1 - 10	344	244	No
Tributyl phosphate	100 - 110	11	N/A	UT
Trichlorofluoromethane[b]	0.2 - 5	99	N/A	UT
Vinyl acetate	10 - 10	239	N/A	UT
Vinyl Chloride	0.2 - 10	347	930	No
Xylene[b,c]	0.5 - 10	325	35	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5%.

[c] The value for total xylene is used.

N/A = Not available or not applicable.

ESL = Ecological screening level.

UT = Uncertain toxicity.

Table A1.2.WCAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Inorganic (mg/kg)				
Chloride	25 - 25	2	N/A	UT
Nitrite	0.3 - 2.5	3	N/A	UT
Sulfate	25 - 25	2	N/A	UT
Uranium	2 - 18	15	N/A	UT
Organic (µg/kg)				
1,1,1,2-Tetrachloroethane	0.952	1	N/A	UT
1,1,1-Trichloroethane	0.841 - 16	54	159	No
1,1,2,2-Tetrachloroethane	0.928 - 16	54	1,900	No
1,1,2-Trichloro-1,2,2-trifluoroethane	0.84	1	N/A	UT
1,1,2-Trichloroethane	1.57 - 16	54	N/A	UT
1,1-Dichloroethane	0.782 - 16	54	N/A	UT
1,1-Dichloroethene	0.873 - 16	54	N/A	UT
1,1-Dichloropropene	0.606	1	N/A	UT
1,2,3-Trichlorobenzene	2.05	1	58.6	No
1,2,3-Trichloropropane	1.08	1	N/A	UT
1,2,4-Trichlorobenzene	**1.76 - 2,100**	**61**	**429**	**Yes**
1,2,4-Trimethylbenzene	1.2	1	122	No
1,2-Dibromo-3-chloropropane	2.21	1	N/A	UT
1,2-Dibromoethane	1.34	1	N/A	UT
1,2-Dichlorobenzene	1.08 - 2,100	55	N/A	UT
1,2-Dichloroethane	1.17 - 16	54	N/A	UT
1,2-Dichloroethene	5 - 16	53	N/A	UT
1,2-Dichloropropane	0.747 - 16	54	N/A	UT
1,3,5-Trimethylbenzene	0.942	1	316	No
1,3-Dichlorobenzene	**0.911 - 2,100**	**61**	**122**	**Yes**
1,3-Dichloropropane	0.85	1	N/A	UT
1,4-Dichlorobenzene	1.32 - 2,100	55	N/A	UT
1234789-HpCDF	0.00226 - 0.00271	2	N/A	UT
123478-HxCDD	0.00226 - 0.00271	2	N/A	UT
123678-HxCDD	0.00226 - 0.00271	2	N/A	UT
123789-HxCDD	0.00226 - 0.00271	2	N/A	UT
123789-HxCDF	0.00226 - 0.00271	2	N/A	UT
12378-PeCDF	0.00226 - 0.00271	2	N/A	UT
2,2-Dichloropropane	0.667	1	N/A	UT
2,4,5-Trichlorophenol	410 - 10,000	61	N/A	UT
2,4,6-Trichlorophenol	**350 - 2,100**	**61**	**59.3**	**Yes**
2,4-Dichlorophenol	350 - 2,100	61	N/A	UT
2,4-Dimethylphenol	350 - 2,100	61	N/A	UT
2,4-Dinitrophenol[b]	960 - 10,000	56	N/A	UT
2,4-Dinitrotoluene	350 - 2,100	61	N/A	UT
2,6-Dinitrotoluene	350 - 2,100	61	N/A	UT
2378-TCDD	9.04E-04 - 0.00108	2	0.00850	No
2378-TCDF	9.04E-04 - 0.00108	2	N/A	UT
2-Chloronaphthalene	350 - 2,100	61	N/A	UT
2-Chlorophenol	350 - 2,100	61	N/A	UT
2-Chlorotoluene	0.68	1	N/A	UT

Table A1.2.WCAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
2-Hexanone	2.2 - 32	52	N/A	UT
2-Methylnaphthalene[b]	**350 - 2,100**	**60**	**20.2**	**Yes**
2-Methylphenol	350 - 2,100	61	6,970	No
2-Nitroaniline	960 - 10,000	61	N/A	UT
2-Nitrophenol	270 - 2,100	61	N/A	UT
3,3'-Dichlorobenzidine	380 - 4,100	60	N/A	UT
3-Nitroaniline	960 - 10,000	61	N/A	UT
4,4'-DDD	**3.8 - 200**	**59**	**4.88**	**Yes**
4,4'-DDE	**3.8 - 200**	**59**	**3.16**	**Yes**
4,4'-DDT[b]	**3.8 - 200**	**58**	**4.16**	**Yes**
4,6-Dinitro-2-methylphenol[b]	960 - 10,000	58	N/A	UT
4-Bromophenyl-phenylether	**350 - 2,100**	**61**	**166**	**Yes**
4-Chloro-3-methylphenol	350 - 3,100	61	N/A	UT
4-Chloroaniline	350 - 3,100	61	N/A	UT
4-Chlorophenyl-phenyl ether	350 - 2,100	61	N/A	UT
4-Chlorotoluene	0.891	1	N/A	UT
4-Isopropyltoluene	0.99	1	N/A	UT
4-Methyl-2-pentanone[b]	2.78 - 32	53	N/A	UT
4-Nitroaniline	960 - 10,000	57	N/A	UT
4-Nitrophenol	960 - 10,000	61	N/A	UT
Acenaphthylene	**350 - 2,100**	**61**	**5.87**	**Yes**
Aldrin[b]	**1.9 - 99**	**57**	**8.25**	**Yes**
alpha-BHC	**1.9 - 99**	**59**	**43.9**	**Yes**
alpha-Chlordane[b]	**1.9 - 990**	**57**	**3.24**	**Yes**
Ametryne	50 - 50	2	N/A	UT
Aroclor-1016	**36 - 990**	**68**	**40**	**Yes**
Aroclor-1221	**36 - 990**	**68**	**40**	**Yes**
Aroclor-1232	**36 - 990**	**68**	**40**	**Yes**
Aroclor-1242	**36 - 990**	**68**	**40**	**Yes**
Aroclor-1248	**36 - 990**	**68**	**40**	**Yes**
Aroclor-1260	**38 - 2,000**	**66**	**40**	**Yes**
Atraton	50 - 50	2	N/A	UT
Atrazine	**50 - 410**	**3**	**16.8**	**Yes**
Benzene	0.9 - 16	54	260	No
Benzyl Alcohol	**350 - 3,100**	**58**	**1.35**	**Yes**
beta-BHC[b]	**1.9 - 99**	**57**	**93.6**	**Yes**
beta-Chlordane	**1.9 - 330**	**29**	**3.24**	**Yes**
bis(2-Chloroethoxy) methane	350 - 2,100	61	N/A	UT
bis(2-Chloroethyl) ether	350 - 2,100	61	N/A	UT
bis(2-Chloroisopropyl) ether	350 - 2,100	59	N/A	UT
Bromobenzene	0.954	1	N/A	UT
Bromochloromethane	1.03	1	N/A	UT
Bromodichloromethane	1.08 - 16	54	N/A	UT
Bromoform	1.18 - 16	54	N/A	UT
Bromomethane	**4.43 - 32**	**54**	**3.43**	**Yes**

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Table A1.2.WCAEU.2
Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Butylbenzylphthalate[b]	350 - 2,100	59	11,400	No
Carbazole	**380 - 480**	**3**	**25.2**	**Yes**
Carbon Disulfide	0.898 - 16	54	N/A	UT
Carbon Tetrachloride	0.823 - 16	54	7,890	No
Chlorobenzene	0.717 - 16	54	N/A	UT
Chloroethane	2.23 - 32	54	N/A	UT
Chloroform	0.777 - 16	54	N/A	UT
Chloromethane	2.51 - 32	51	N/A	UT
cis-1,2-Dichloroethene	1.13	1	N/A	UT
cis-1,3-Dichloropropene	1.13 - 16	54	N/A	UT
delta-BHC[b]	**1.9 - 99**	**57**	**2.37**	**Yes**
Dibenz(a,h)anthracene[b]	**350 - 2,100**	**58**	**33**	**Yes**
Dibenzofuran[b]	**350 - 2,100**	**60**	**325**	**Yes**
Dibromochloromethane	1.17 - 16	54	N/A	UT
Dibromomethane	1.12	1	N/A	UT
Dichlorodifluoromethane	2.76	1	N/A	UT
Dieldrin	**3.8 - 200**	**59**	**5.94**	**Yes**
Diethylphthalate[b]	**350 - 2,100**	**61**	**108**	**Yes**
Dimethylphthalate	350 - 2,100	61	N/A	UT
Di-n-octylphthalate[b]	350 - 2,100	59	N/A	UT
Endosulfan I[b]	**1.9 - 99**	**57**	**0.690**	**Yes**
Endosulfan II	**3.8 - 200**	**59**	**0.690**	**Yes**
Endosulfan sulfate	**3.8 - 200**	**59**	**0.690**	**Yes**
Endrin	3.8 - 200	59	N/A	UT
Endrin aldehyde	3.8 - 11	4	N/A	UT
Endrin ketone	3.8 - 200	59	N/A	UT
Ethylbenzene	0.657 - 16	54	16,570	No
Fluorene[b]	**350 - 2,100**	**60**	**77.4**	**Yes**
gamma-BHC (Lindane)[b]	**1.9 - 99**	**58**	**2.37**	**Yes**
Heptachlor epoxide[b]	**1.9 - 99**	**57**	**2.47**	**Yes**
Hexachlorobenzene	350 - 2,100	61	N/A	UT
Hexachlorobutadiene	**1.13 - 2,100**	**61**	**23**	**Yes**
Hexachlorocyclopentadiene	350 - 2,100	60	N/A	UT
Hexachloroethane	350 - 2,100	61	N/A	UT
Isophorone	270 - 2,100	61	N/A	UT
Isopropylbenzene	0.516	1	N/A	UT
Methoxychlor	**19 - 990**	**59**	**24**	**Yes**
Naphthalene[b]	**350 - 2,100**	**59**	**176**	**Yes**
n-Butylbenzene	1.34	1	N/A	UT
Nitrobenzene	350 - 2,100	61	N/A	UT
N-Nitroso-di-n-propylamine	350 - 2,100	61	N/A	UT
N-nitrosodiphenylamine	350 - 2,100	61	N/A	UT
n-Propylbenzene	0.828	1	N/A	UT
Pentachlorophenol[b]	**960 - 10,000**	**60**	**255**	**Yes**

Table A1.2.WCAEU.2

Evaluation of Maximum Reported Results for Nondetected Analytes and Analytes with a Detection Frequency of less than 5 Percent in Sediment

Analyte	Range of Reported Results	Total Number of Results	Lowest ESL	Maximum Reported Result[a] > ESL?
Phenol[b]	**350 - 2,100**	**60**	**773**	**Yes**
Prometon	50 - 50	2	N/A	UT
Prometryn	50 - 50	2	N/A	UT
Propazine	50 - 50	2	N/A	UT
Pyridine	820 - 1,600	6	N/A	UT
sec-Butylbenzene	0.786	1	N/A	UT
Simazine	50 - 50	2	N/A	UT
Simetryn	50 - 50	2	N/A	UT
Styrene	0.9 - 16	54	N/A	UT
Terbutryn	50 - 50	2	N/A	UT
Terbutylazine	50 - 50	2	N/A	UT
tert-Butylbenzene	1.06	1	N/A	UT
Tetrachloroethene[b]	5 - 16	52	3,050	No
Toxaphene	85 - 2,000	59	N/A	UT
trans-1,2-Dichloroethene	1.09	1	657	No
trans-1,3-Dichloropropene	1.09 - 16	54	N/A	UT
Trichloroethene[b]	0.715 - 16	54	22,800	No
Trichlorofluoromethane	0.935	1	N/A	UT
Vinyl acetate	11 - 32	49	N/A	UT
Vinyl Chloride	2.45 - 32	54	N/A	UT
Xylene[b,c]	3.5 - 16	53	91	No

[a] Value is the maximum reported result for nondetected analytes.

[b] Analyte has a detection frequency of less than 5%.

[c] The value for total xylene is used.

N/A = Not available or not applicable.

ESL = Ecological screening level.

UT = Uncertain toxicity.

<u>COMPREHENSIVE RISK ASSESSMENT</u>

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

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ACRONYMS AND ABBREVIATIONS

AA	atomic absorption
AEU	Aquatic Exposure Unit
ASD	Analytical Services Division
COC	chain of custody
CRA	Comprehensive Risk Assessment
CRDL	contract required detection limit
DER	duplicate error ratio
DQA	Data Quality Assessment
DQO	data quality objective
DRC	data review checklist
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
IAG	Interagency Agreement
ICP	inductively couple plasma
IDL	instrument detection limit
LCS	laboratory control sample
MDA	minimum detectable activity
MDL	method detection limit
MK AEU	McKay Ditch Aquatic Exposure Unit
MS	matrix spike
MSA	method of standard additions

MSD	matrix spike duplicate
NIST	National Institute of Standards Technology
NN AEU	No Name Gulch Aquatic Exposure Unit
NW AEU	North Walnut Creek Aquatic Exposure Unit
PARCC	precision, accuracy, representativeness, completeness, and comparability
PPT	pipette
PCB	polychlorinated biphenyl
QC	quality control
RC AEU	Rock Creek Aquatic Exposure Unit
RDL	required detection limit
RFEDS	Rocky Flats Environmental Data System
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SDP	standard data package
SE AEU	Southeast Aquatic Exposure Unit
SOW	Statement of Work
SVOC	semi-volatile organic compound
SW AEU	South Walnut Creek Aquatic Exposure Unit
SWD	Soil Water Database
TCLP	Toxicity Characteristic Leaching Procedure
TIC	tentatively identified compound
V&V	verification and validation

VOC	volatile organic compound
WC AEU	Woman Creek Aquatic Exposure Unit

1.0 INTRODUCTION

This document provides an assessment of the quality of the data for three of the seven Aquatic Exposure Units (AEUs) used in the Comprehensive Risk Assessment (CRA) at the Rocky Flats Environmental Technology Site (RFETS). As such, this Data Quality Assessment (DQA) focuses on all elements of quality control (QC), including both laboratory and sample-specific QC data.

The AEU CRA for RFETS has been prepared in accordance with the CRA Methodology (DOE 2004), which was developed jointly with the regulatory agencies using the consultative process and was approved by the agencies on September 28, 2004. Consistent with the CRA Methodology, data quality was assessed using a standard precision, accuracy, representativeness, completeness, and comparability (PARCC) parameter analysis (EPA 2002), and both laboratory and field quality control (QC) were evaluated.

Although many of the elements of QC that are reviewed in this document affect more than one PARCC parameter, their major impact on data quality is described below.

- Precision, as a measure of agreement among replicate measurements, is determined quantitatively based on the results of replicate laboratory measurements. Precision of the laboratory data was verified through review of:
  - Relative percent differences (RPDs) for laboratory control samples (LCSs) and LCS duplicates compared to the acceptable ranges (analytical precision);
  - RPDs (nonradionuclides) and duplicate error ratios (DERs) (radionuclides) for field samples and field duplicates compared to the acceptable ranges[1] (field precision);
  - RPDs for matrix spikes (MSs) and matrix spike duplicates (MSDs) compared to acceptable control ranges (matrix precision); and
  - RPDs for primary- and second-column analyses (analytical precision).
- Accuracy, as a measure of the distortion of a measurement process that causes error in measuring the true value, is determined quantitatively based on the analysis of samples with a known concentration. Accuracy of the laboratory data was verified through review of:
  - LCS data, calibration verification data, internal standard data, and instrument tune parameters (laboratory accuracy); and

1 The CRA Methodology states that the overall precision of the data is considered adequate if the RPD between the target and the duplicate, at concentrations five times the reporting limit (RL), is less than 35 percent for solids and 20 percent for liquids. The precision adequacy requirement for radiological contaminants is a DER less than 1.96.

- Surrogate recoveries, MSs, and sample preparation (sample-specific accuracy).

- Representativeness of the data was verified through review of:
  - Laboratory blank data;
  - Sample preservation/storage;
  - Adherence to sample holding times;
  - Documentation issues;
  - Contract noncompliance issues; and
  - Laboratory activities affecting the ability to properly identify compounds.

- Completeness is a data adequacy criterion and is addressed in Appendix A, Volume 2 of the Remedial Investigation/Feasibility Study (RI/FS) Report. It refers to the spatial and temporal distribution of the data and their adequacy for estimating exposure point concentrations (EPCs) for the CRA.

- Comparability of the data was verified through evaluation of:
  - Analytical procedures, and whether they were standard U.S. Environmental Protection Agency (EPA) - and RFETS-approved procedures;
  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and
  - MS and surrogate samples, ensuring accuracy within acceptable ranges.

2.0 ANALYTICAL DATA

Depending on the specific AEU, between 63 and 76 percent of the data used in the AEU CRA have undergone verification and validation (V&V) by a validator from the Analytical Services Division (ASD) at RFETS (or from an outside subcontractor) using V&V guidelines for each analytical method developed for RFETS. The specific fraction of the data that was verified and/or validated is discussed in Section 3.0 for each AEU by analyte group/matrix combination. V&V data are identified in the RFETS Soil Water Database (SWD) by a data qualifier flag and reason code(s) that provide an explanation for the qualifier flag. All rejected data have been removed from the AEU data sets used in the CRA because the validator has determined the data are unusable. The other qualifier flags indicate the data are either valid, estimated, or undetected, and are used in the CRA. Approximately 14 percent of the V&V data in each of the AEU data sets was qualified as estimated and/or undetected. Less than 3 percent of the data reported as detected by the laboratory was qualified as undetected due to blank contamination for all AEUs.

Because an extremely large fraction of the data underwent V&V, the results are generally applicable to the data that were not verified and/or validated. All of the data that have been flagged due to V&V findings (except "R"-flagged data) and data that have no flags as a result of V&V findings are used in the AEU CRA. Data that have not undergone V&V are used as provided by the laboratories.

Data V&V involves an in-depth review of the data packages from the laboratory to assess compliance with contract requirements. In general, data validation includes all of the activities of verification as well as additional QC checks and review of some raw laboratory instrument data and calculations. After V&V, a data qualifier flag and/or reason code(s) are assigned to the data record (Tables A2.1 and A2.2). The reason codes provide an explanation for the qualifier flag, thereby making it possible to determine which of the PARCC parameters is affected by the observation (Table A2.3). V&V qualifier flags are used to note issues in the data. V&V flags "V", "V1", and "1" represent data that were reviewed by validators, but no issues were observed. Qualifier flags such as "A", "E", and "P", which indicate valid, usable data with V&V notes not pertaining to estimated or detection status, are summarized in this report only by their associated reason codes. The specific definitions of these other V&V flags are presented in Table A2.1.

V&V qualifier flags are not specifically addressed in this DQA, but rather the reason codes associated with the qualifier flags for each analytical record are summarized and evaluated. This approach was chosen because the validators' specific observations (reason codes), and not the qualifier flags, provide the best descriptors of the data quality.

V&V data records contain a field that may contain V&V reason codes (e.g., 5, 18, 52, 200, 99, 101, 701, etc.) or may be blank. The reason codes represent observations related to assessment of precision, accuracy, and representativeness. For example, the reason code 110 definition (see Table A2.2) is "LCS recovery criteria were not met," which is an observation related to data accuracy.

Multiple reason codes were routinely applied to a specific sample method/matrix/analyte combination. Therefore, it was necessary to parse out the individual codes to create a table that included a unique record identifier and the associated parsed data V&V reason code. With this information and the data V&V reason code definitions, the data validators' observations related to a particular data set can be recreated for each analytical record.

To summarize the reason codes in a logical manner for presentation, it was first necessary to group the reason codes that have slightly different definitions but convey the same meaning. A standardized definition was then applied to the individual reason codes within the group. The grouped reason codes were also assigned a QC category (for example, blanks, calibration, and holding time) and the affected PARCC parameter (Table A2.3). Validation reason codes that have no effect on data quality, such as those indicating transcription errors, are assigned to the category of "Other." The reason codes were then summarized by AEU for each medium and analyte group within each QC category, applying the standardized definition to the summarized codes. The summaries are presented in Section 3.0.

Rejected data (data qualifier flag "R") have been removed from the data used in the AEU because the validator has determined the data to be unusable. The fraction of the data that was rejected during validation and/or verification is discussed for each AEU by analyte group and matrix in Section 3.0.

Finally, evaluating the RPD (DER for radionuclides) between a target sample and the associated field duplicate is not a QC parameter performed during V&V, but is still an important analysis when determining data precision. Because this analysis was not performed during V&V, the target sample/field duplicate RPD and DER calculations are presented and discussed in Section 3.0 for each AEU, also by analyte group/matrix combination.

3.0 AQUATIC EXPOSURE UNITS

The percentages of V&V data; rejected data; data qualified as usable, estimated, or undetected; and laboratory detected data qualified as undetected due to blank contamination are presented below for each of the seven AEUs. V&V observations affecting the CRA data set are also summarized for each AEU by analyte group/matrix/QC category/reason code. The RPDs (DERs for radionuclides) between target sample/field duplicate analyte pairs are presented by analyte group and matrix as the number of pairs exceeding control criteria.

The quality of the laboratory results was evaluated for compliance with CRA Methodology data quality objectives (DQOs) through an overall review of PARCC parameters. Although many of the elements of QC that are reviewed in this document affect more than one PARCC parameter, the general discussions below summarize the data quality per the validation reason codes affecting each specific PARCC parameter. Several V&V reason codes have no real impact on data quality because they represent issues that were noted but corrected, or they represent observations related to missing documentation that was not required for data assessment. These "Other" reason codes do not affect any of the PARCC parameters and are presented in this report only for the purpose of completeness.

3.1 North Walnut Creek Aquatic Exposure Unit (NW AEU)

Depending on the analyte group/matrix combination, anywhere from 23 to 100 percent of the data were validated and/or verified, with an overall 63 percent of the NW AEU data set having undergone V&V (Table A2.3.1.1). Of that 63 percent, approximately 83 percent was qualified as having no issues and 14 percent was qualified as either estimated or undetected due to minor laboratory noncompliance issues (Table A2.3.1.2). The remaining 3 percent of the V&V data are made up of records qualified with additional flags indicating acceptable data such as "A," "E," or "P."

Approximately 2 percent of the data reported as detected by the laboratory were flagged as undetected by the validators due to blank contamination (Table A2.3.1.3).

Approximately 3.7 percent of the entire NW AEU data set was rejected during V&V. The percentage of rejected data is presented by analyte group and matrix in Table A2.3.1.4.

The RPDs (DERs for radionuclides) between a target sample and the field duplicate are presented in Table A2.3.1.5 and discussed in further detail only when exceedances of control criteria are greater than 10 percent for any given analyte group/matrix combination.

V&V observations affecting the NW AEU data set are summarized by analyte in Table A2.3.1.6. The detected and nondetected results are summarized separately to give the reader a better idea of the impact on data usability. Observations noted in large percentages of the data that possibly affect data quality are discussed below in further detail.

3.1.1 Dioxins and Furans – Soil

Calibration issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low and within method expectations.

3.1.2 Dioxins and Furans – Water

Documentation and internal standard issues resulted in data V&V qualifications related to this analyte group/matrix combination. Although the percentage of qualified data is high, it is important to note that all data were qualified as usable.

3.1.3 Herbicides – Soil

Calibration, documentation, internal standard, surrogate, and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. With the exception of those records qualified for transcription errors, the percentage of observations is low and within method expectations. Transcription errors have no impact on data quality because all issues have been previously evaluated and corrected.

3.1.4 Herbicides – Water

Calculation error, calibration, documentation, holding time, internal standard, and other issues resulted in data V&V qualification related to this analyte group/matrix combination. The percentage of qualified data is low with few exceptions. Transcription errors have no impact on data quality because all issues have been previously evaluated and corrected. While the importance of continuing calibration verifications should not be overlooked, it is also important to note that the data were qualified as usable. The majority of the data with validation flags directing the data user to the hard copy validation report for further explanation of the observation were also qualified as estimated. The CRA is performed with this uncertainty in mind, and no further effort was made to identify these observations.

3.1.5 Metals – Soil

Blank, calibration, documentation, holding time, instrument set-up, LCS, matrix, and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of qualified data is low with few exceptions. Although the importance of LCS, pre-digestion MS, and quarterly instrument detection limit (IDL) analyses should not be overlooked, it is also important to note that the data were qualified as usable, although estimated. The percentage of target sample/field duplicate analyte pairs exceeding control limits is high, but the majority of exceedances were seen in one sample, with only eight samples being affected overall. RPD exceedances noted in one sample may indicate matrix interference, but do not indicate an overall precision issue.

3.1.6 Metals – Water

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications associated with this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.1.7 Polychlorinated Biphenyls (PCBs) – Soil

Issues with result confirmation, documentation, matrices, and surrogates resulted in data V&V observations related to this analyte group/matrix combination. The percentage of observations is low with one exception. While the percentage of observations related to missing deliverables is high, it is important to note that the missing information was not required to complete V&V.

3.1.8 Polychlorinated Biphenyls – Water

Issues with documentation, holding times, and surrogates resulted in data V&V observations related to this analyte group/matrix combination. The percentage of observations is low with the exception of those data qualified due to omissions or errors in the data package. It is important to note, however, that the missing information was not required to complete V&V.

3.1.9 Pesticides – Soil

Calibration, documentation, internal standard, matrix, surrogate, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. The data qualified for documentation issues have no impact on data quality because none of the omissions or errors in the data was necessary to perform a complete V&V evaluation. While the importance of MS/MSD precision should not be overlooked, it is important to note that the data were qualified as usable, although estimated.

3.1.10 Pesticides – Water

Calibration, documentation, holding time, internal standard, surrogate, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the exception of those records qualified due to omissions or errors in a portion of the data package not required for V&V. This type of documentation error has no impact on data quality.

3.1.11 Radionuclides – Soil

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Insufficient or incorrect documentation and validator-calculated minimal detectable activity (MDA) levels do not impact data quality because all observations have been previously evaluated and corrected. Issues related to continuing calibration verifications and LCS relative percent error should not be overlooked, but it is important to note that the data were qualified as usable, although estimated.

3.1.12 Radionuclides – Water

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.1.13 Semi-Volatile Organic Compounds (SVOCs) – Soil

Blank, calibration, documentation, internal standard, matrix, surrogate, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.1.14 Semi-Volatile Organic Compounds – Water

Blank, calculation error, calibration, documentation, holding time, internal standard, sample preparation, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the exception of those results qualified because the allowed sample holding time was exceeded. Although the importance of observing allowed sample holding times should not be overlooked, it is important to note that the data were qualified as usable, although estimated.

3.1.15 Volatile Organic Compounds (VOCs) – Soil

Blank, calibration, documentation, holding time, internal standard, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.1.16 Volatile Organic Compounds – Water

Blank, calibration, documentation, holding time, instrument set-up, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. With the exception of those records noted for transcription error, the percentage of observations is low and within method expectations. Transcription errors have no impact on data quality because all issues have been previously evaluated and corrected.

3.1.17 Wet Chemistry Parameters – Soil

Blank, documentation, holding time, matrix, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the exception of those records noted for issues with pre-digestion MS recoveries and expired IDL studies. While the importance of these QC parameters should not be overlooked, it is important to note that this analyte group contains many general chemistry parameters having little impact on site characterization.

3.1.18 Wet Chemistry Parameters – Water

Blanks, calculation error, calibration, documentation, holding time, LCS, matrix, sample preparation, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.1.19 Discussion

Approximately 17 percent of the NW AEU V&V data set was flagged with "Other" validation reason codes that do not affect any of the PARCC parameters. The remaining V&V data are described below.

- Precision—Of the V&V data, approximately 2 percent was noted for observations related to precision. Of that 2 percent, 99 percent was qualified for precision issues related to sample matrices. Confirmation and instrument set-up observations make up the remaining 1 percent. No LCS or sensitivity issues related to precision were noted.

  RPDs and DERs for target sample/field duplicate pairs were found to be acceptable for all analyte group/matrix combinations. Overall, the method precision was found to be generally acceptable.

- Accuracy—Of the V&V data, 26 percent was noted for accuracy-related observations. Of that 26 percent, approximately 68 percent was noted for laboratory practice-related observations. Sample-specific accuracy observations comprise the other 32 percent of the qualified data. Although the percentage of data with noted accuracy issues is slightly elevated, it is important to note that the majority of the data flagged with these accuracy-related observations are also flagged as estimated, and the CRA is performed with this uncertainty in mind. Accuracy was generally acceptable with infrequent performance outside QC limits.

- Representativeness—Of the V&V data, approximately 32 percent was noted for observations related to representativeness. Of that 32 percent, 66 percent was qualified for blank observations, 3 percent for documentation observations affecting representativeness, 20 percent for failure to observe allowed holding times, 2 percent for sensitivity issues related to representativeness, and 8 percent for observations related to sample preparation. Instrument set-up, matrix, LCS, and other issues make up the other 1 percent of the data qualified for observations affecting sample representativeness.

  Reportable levels of target analytes were not routinely detected in the laboratory blanks greater than the laboratory RLs except for relatively isolated incidences. Overall, blank contamination was indicative of normal laboratory operations and was determined to have little impact on the sample data as reported.

  Sample data are representative of the site conditions at the time of sample collection. Some transcription errors and documentation issues were observed that impacted sample results; however, the majority of such issues were corrected in the database. Samples were generally stored and preserved properly. Overall, these elements of QC exceedances are indicative of normal laboratory operations.

- Comparability—Examination of the following parameters showed no systematic issues with comparability:

  - The use of standard EPA- and RFETS-approved analytical procedures;

  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and

  - Evaluation of MS and surrogate samples, ensuring accuracy within acceptable ranges.

- Completeness—As defined in the CRA Methodology, completeness is addressed in Appendix A, Volume 2 of the RI/FS Report. Another indication of completeness that is sometimes used is the number of valid measurements obtained in relation to the total number of measurements planned. Because less than 4 percent of the overall data were rejected, the use of non-V&V data for the NW AEU CRA does not contribute to any completeness issues.

3.2 South Walnut Creek Aquatic Exposure Unit (SW AEU)

Depending on the analyte group/matrix combination, anywhere from 32 to 100 percent of the data were validated and/or verified, with an overall 76 percent of the SW AEU data set having undergone V&V (Table A2.3.2.1). Of that 76 percent, approximately 83 percent was qualified as having no issues and about 14 percent was qualified as either estimated or undetected due to minor laboratory noncompliance issues (Table A2.3.2.2). The remaining 3 percent of the V&V data are made up of records qualified with additional flags indicating acceptable data such as "A," "E," or "P."

Approximately 2 percent of the data reported as detected by the laboratory were flagged as undetected by the validators due to blank contamination (Table A2.3.2.3).

Approximately 2 percent of the entire SW AEU data set was rejected during V&V. The percentage of rejected data is presented by analyte group and matrix in Table A2.3.2.4.

The RPDs (DERs for radionuclides) between a target sample and the field duplicate are presented in Table A2.3.2.5 and discussed in further detail only when exceedances of control criteria are greater than 10 percent for any given analyte group/matrix combination.

V&V observations affecting the SW AEU data set are summarized by analyte in Table A2.3.2.6. The detected and nondetected results are summarized separately to give the reader a better idea of the impact on data usability. Observations noted in large percentages of the data that possibly affect data quality are discussed below in further detail.

3.2.1 Dioxins and Furans – Water

Documentation and internal standard issues resulted in data V&V qualifications related to this analyte group/matrix combination. Although the percentage of observations related to documentation is high, data quality is not impacted because all issues have been previously evaluated and corrected.

3.2.2 Herbicides – Soil

Calibration, documentation, holding time, surrogate and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations. While the percentage of target sample/field duplicate analyte pairs exceeding control criteria is high, it is important to note that this elevated percentage represents only one analyte out of seven. One exceedance does not indicate a greater problem with sample precision.

3.2.3 Herbicides – Water

Calculation error, calibration, documentation, holding time, internal standard, sample preparation, surrogate, and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of qualified data is low with few exceptions. Documentation issues do not impact data quality because all observations have been previously evaluated and corrected. Although issues related to allowed sample holding times and sample preservation should not be overlooked, it is important to note that the data were qualified as usable, although estimated.

3.2.4 Metals – Soil

Blank, calculation error, documentation, holding time, instrument set-up, LCS, matrix, sample preparation, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the exception of those records qualified for due to LCS and predigestion MS recovery criteria exceedances. Although the importance of predigestion MSs and LCS recoveries should not be underestimated, it is also important to note that the data were qualified as usable, although estimated. The percentage of target sample/field duplicate analyte pairs exceeding control limits is high, but the majority of exceedances were seen in only five samples of the 345 total duplicate analyte pairs, with only six samples being affected overall. RPD exceedances noted in only a few samples may indicate matrix interference, but do not indicate an overall precision issue.

3.2.5 Metals – Water

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications associated with this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.2.6 Polychlorinated Biphenyls – Soil

Issues with calculation errors, result confirmation, documentation, surrogates, and others resulted in data V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.2.7 Polychlorinated Biphenyls – Water

Issues with documentation, holding time, and surrogates resulted in data V&V observations related to this analyte group/matrix combination. With the exception of those records qualified because they were added by the validator, the percentage of observations is low and within method expectations. This documentation error has no impact on data quality because all issues have been previously evaluated and corrected.

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3.2.8 Pesticides – Soil

Calibration, documentation, holding time, surrogate, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.2.9 Pesticides – Water

Calibration, documentation, holding time, matrix, sample preparation, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. With the exception of those records qualified because they were added by the validator, the percentage of observations is low and within method expectations. This documentation error has no impact on data quality because all issues have been previously evaluated and corrected.

3.2.10 Radionuclides – Soil

Blank, calculation error, calibration, documentation, instrument set-up, LCS, matrix, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Insufficient or incorrect documentation and validator-calculated MDAs do not impact data quality because all observations have been previously evaluated and corrected. While the importance of blank analyses and continuing calibration verification should not be overlooked, it is important to note that the data were qualified as usable, although estimated.

3.2.11 Radionuclides – Water

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Insufficient or incorrect documentation and validator-calculated MDAs do not impact data quality because all observations have been previously evaluated and corrected. While the importance of continuing calibration verification should not be overlooked, it is also important to note that the data were qualified as usable, although estimated.

3.2.12 Semi-Volatile Organic Compounds – Soil

Blank, calibration, documentation, holding time, internal standard, LCS, matrix, surrogate, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations. Although the percentage of target sample/field duplicate analyte pairs exceeding control limits is high, all exceedances were seen in only one sample of the 411 total duplicate analyte pairs. RPD exceedances noted in only one sample may indicate matrix interference, but does not indicate an overall precision issue.

3.2.13 Semi-Volatile Organic Compounds – Water

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, sample preparation, surrogate, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the few exceptions. Transcription errors have no impact on data quality as all issues have been previously evaluated and corrected. While the importance of observing allowed sample holding times and proper sample preservation should not be underestimated, it is important to note that the data were qualified as usable, although estimated. Most of those records qualified as directing the data user to the hard-copy validation report for further explanation of the qualification were also flagged as estimated and the CRA is performed with this uncertainty in mind. No further effort was made to identify these observations.

3.2.14 Volatile Organic Compounds – Soil

Blank, calibration, documentation, holding time, internal standard, matrix, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of observations is low with the exception of those records qualified because the internal standards did not meet control criteria. While the importance of internal standard analyses should not be overlooked, it is important to note that the data were qualified as usable.

3.2.15 Volatile Organic Compounds – Water

Blank, calibration, result confirmation, documentation, holding time, instrument set-up, internal standard, LCS, matrix, sample preparation, sensitivity, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. With the exception of those records noted for transcription errors and holding time exceedances, the percentage of observations is low and within method expectations. Transcription errors have no impact on data quality because all issues have been previously evaluated and corrected. While the importance of observing allowed sample holding times should not be underestimated, it is important to note that the data were qualified as usable, although estimated.

3.2.16 Wet Chemistry Parameters – Soil

Blank, documentation, holding time, LCS, matrix, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. While the percentage of several observations is high, it is important to note that this analyte group contains many general chemistry parameters having little impact on site characterization.

3.2.17 Wet Chemistry Parameters – Water

Blank, calculation error, calibration, documentation, holding time, LCS, matrix, sample preparation, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.2.18 Discussion

Approximately 15 percent of the SW AEU CRA data set was flagged with "Other" validation reason codes that do not affect any of the PARCC parameters. The remaining V&V data are described below.

- Precision—Of the V&V data, approximately 1.5 percent was noted for observations related to precision. Of that 1.5 percent, 99 percent was qualified for precision issues related to sample matrices. Confirmation and instrument set-up observations make up the remaining 1 percent. No LCS or sensitivity issues related to precision were noted.

  RPDs and DERs for target sample/field duplicate pairs were found to be acceptable for all analyte group/matrix combinations. Overall, the method precision was found to be generally acceptable.

- Accuracy—Of the V&V data, 23 percent was noted for accuracy-related observations. Of that 23 percent, approximately 73 percent was noted for laboratory practice-related observations. Sample-specific accuracy observations comprise the other 27 percent of the qualified data. Accuracy was generally acceptable, with infrequent performance outside QC limits. Although the percentage of data with noted accuracy issues is slightly elevated, it is important to note that the majority of the data flagged with these accuracy-related observations are also flagged as estimated, and the CRA is performed with this uncertainty in mind. Accuracy was generally acceptable with infrequent performance outside QC limits.

- Representativeness—Of the V&V data, approximately 32 percent was noted for observations related to representativeness. Of that 32 percent, 66 percent was qualified for blank observations, 3 percent for documentation observations affecting representativeness, 22 percent for failure to observe allowed holding times, 1 percent for sensitivity issues related to representativeness, and 7 percent for observations related to sample preparation. Instrument set-up, matrix, LCS, and other issues make up the other 1 percent of the data qualified for observations affecting sample representativeness.

  Reportable levels of target analytes were not routinely detected in the laboratory blanks greater than the laboratory RLs except for relatively isolated incidences. Overall, blank contamination was indicative of normal laboratory operations and was determined to have little impact on the sample data as reported.

  Sample data are representative of the site conditions at the time of sample collection. Some transcription errors and documentation issues were observed that impacted sample results; however, the majority of such issues were corrected in the database. Samples were generally stored and preserved properly. Overall, these elements of QC exceedances are indicative of normal laboratory operations.

- Comparability—Examination of the following parameters showed no systematic issues with comparability:
  - The use of standard EPA- and RFETS-approved analytical procedures;
  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and
  - Evaluation of MS and surrogate samples, ensuring accuracy within acceptable ranges.
- Completeness—As defined in the CRA Methodology, completeness is addressed in Appendix A, Volume 2 of the RI/FS Report. Another indication of completeness that is sometimes used is the number of valid measurements obtained in relation to the total number of measurements planned. Because only 2 percent of the overall data were rejected, the use of non-V&V data for the SW AEU CRA does not contribute to any completeness issues.

3.3 Woman Creek Aquatic Exposure Unit (WC AEU)

Depending on the analyte group/matrix combination, anywhere from 48 to 100 percent of the data were validated and/or verified, with an overall 75 percent of the WC AEU data set having undergone V&V (Table A2.3.3.1). Of that 75 percent, approximately 83 percent was qualified as having no issues and approximately 15 percent was qualified as either estimated or undetected due to minor laboratory noncompliance issues (Table A2.3.3.2). The remaining 2 percent of the V&V data are made up of records qualified with additional flags indicating acceptable data such as "A," "E," or "P."

Less than 3 percent of the data reported as detected by the laboratory were flagged as undetected by the validators due to blank contamination (Table A2.3.3.3).

Approximately 5.5 percent of the entire WC AEU data set was rejected during V&V. The percentage of rejected data is presented by analyte group and matrix in Table A2.3.3.4.

The RPDs (DERs for radionuclides) between a target sample and the field duplicate are presented in Table A2.3.3.5 and discussed in further detail only when exceedances of control criteria are greater than 10 percent for any given analyte group/matrix combination.

V&V observations affecting the WC AEU data set are summarized by analyte in Table A2.3.3.6. The detected and nondetected results are summarized separately to give the reader a better idea of the impact on data usability. Observations noted in large percentages of the data that possibly affect data quality are discussed below in further detail.

3.3.1 Dioxins and Furans – Water

Documentation issues resulted in data V&V qualifications related to this analyte group/matrix combination. Documentation issues have no impact on data quality because all issues have been previously evaluated and corrected.

3.3.2 Herbicides – Soil

Calibration, holding time, internal standard and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. With the exception of those records qualified as directing the data user to the hard-copy validation report for further explanation of the observations, the percentage of issues is low and within method expectations. Most of the records qualified in this manner were also flagged as estimated and the CRA is performed with this uncertainty in mind. No further effort was made to identify these observations.

3.3.3 Herbicides – Water

Documentation, holding time, internal standard and other issues resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of qualified data is low with few exceptions. Transcription errors do not impact data quality because all observations have been previously evaluated and corrected. Most of the records qualified as directing the data user to the hard-copy validation report for further explanation of the observations were also flagged as estimated and the CRA is performed with this uncertainty in mind. No further effort was made to identify these observations.

3.3.4 Metals – Soil

Blank, calibration, documentation, holding time, instrument setup, LCS, matrix, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Although the importance of pre-digestion MSs and LCS recoveries should not be underestimated, it is also important to note that the data were qualified as usable, although estimated. The percentage of target sample/field duplicate analyte pairs exceeding control limits is high, but the majority of exceedances were seen in only three samples of the 345 total duplicate pairs, with only five samples being affected overall. RPD exceedances noted in only a few samples may indicate matrix interference, but do not indicate an overall precision issue.

3.3.5 Metals – Water

Blank, calculation error, calibration, documentation, holding time, instrument setup, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications associated with this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.6 Polychlorinated Biphenyls – Soil

Issues with documentation, surrogates, and others resulted in data V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.7 Polychlorinated Biphenyls – Water

Issues with documentation, holding times, and surrogates resulted in data V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.8 Pesticides – Soil

Blank, calibration, documentation, holding time, internal standard, surrogate, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. While the percentage of issues related to surrogate recoveries is high, it is important to note that the data were qualified as usable, although estimated.

3.3.9 Pesticides – Water

Blank, calibration, documentation, holding time, internal standard, surrogate, and other observations resulted in data V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.10 Radionuclides – Soil

Blank, calculation error, calibration, documentation, holding time, instrument set-up, LCS, matrix, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Insufficient or incorrect documentation and validator-calculated MDAs do not impact data quality because all observations have been previously evaluated and corrected. Issues related to the detector efficiency, LCS recoveries, and replicate precision should not be overlooked, but it is important to note that the data were qualified as usable, although estimated.

3.3.11 Radionuclides – Water

Blank, calculation error, calibration, documentation, holding time, LCS, matrix, sample preparation, sensitivity, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of observations is low with the exception of those records flagged due to validator-calculated MDAs. This observation does not impact data quality because all issues have been previously evaluated and corrected.

3.3.12 Semi-Volatile Organic Compounds – Soil

Blank, calibration, documentation, holding time, internal standard, matrix, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. With the exception of those records qualified as directing the data user to the hard-copy validation report for further explanation of the observations, the percentage of issues is low and within method expectations. Most of the records qualified in this manner were also flagged as estimated and the CRA is performed with this uncertainty in mind. No further effort was made to identify these observations.

3.3.13 Semi-Volatile Organic Compounds – Water

Blank, calibration, documentation, holding time, instrument set-up, internal standard, LCS, sample preparation, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.14 Volatile Organic Compounds – Soil

Blank, calculation error, calibration, confirmation, documentation, holding time, internal standard, matrix, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of observations is low with few exceptions. Calculation errors have no impact on data quality because all issues have been previously evaluated and corrected. While the importance of observing allowed sample holding times and analyzing internal standards that meet control criteria should not be overlooked, it is also important to note that the data were qualified as usable, although estimated.

3.3.15 Volatile Organic Compounds – Water

Blank, calibration, documentation, holding time, instrument set-up, internal standard, LCS, matrix, sample preparation, surrogate, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.16 Wet Chemistry Parameters – Soil

Blank, documentation, holding time, matrix, and other observations resulted in V&V qualifications related to this analyte group/matrix combination. The percentage of several observations is high, but it is important to note that this analyte group contains several general chemistry parameters having little impact on site characterization.

3.3.17 Wet Chemistry Parameters – Water

Blank, calibration, documentation, holding time, LCS, matrix, sample preparation, and other issues resulted in V&V observations related to this analyte group/matrix combination. The percentage of all observations is low and within method expectations.

3.3.18 Discussion

Approximately 15 percent of the NN AEU CRA data set was flagged with "Other" validation reason codes that do not affect any of the PARCC parameters. The remaining V&V data are described below.

- Precision—Of the V&V data, approximately 2 percent was noted for observations related to precision. Of that 2 percent, 99 percent was qualified for matrix issues related to result precision. Confirmation and instrument set-up observations make up the other 1 percent. No LCS or sensitivity issues related to precision were noted.

  RPDs and DERs for target sample/field duplicate pairs were found to be acceptable for all analyte group/matrix combinations. Overall, the method precision was found to be generally acceptable.

- Accuracy—Of the V&V data, 25 percent was noted for accuracy-related observations. Of that 25 percent, approximately 73 percent was noted for laboratory practice-related observations. Sample-specific accuracy observations comprise the other 27 percent of the qualified data. Although the percentage of data with noted accuracy issues is slightly elevated, it is important to note that the majority of the data flagged with these accuracy-related observations are also flagged as estimated, and the CRA is performed with this uncertainty in mind. Accuracy was generally acceptable with infrequent performance outside QC limits.

- Representativeness—Of the V&V data, approximately 37 percent was noted for observations related to representativeness. Of that 37 percent, 71 percent was qualified for blank observations, 2 percent for documentation observations affecting representativeness, 21 percent for failure to observe allowed holding times, 1 percent for sensitivity issues related to representativeness, and 4 percent for observations related to sample preparation. Instrument set-up, matrix, LCS,

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and other issues make up the other 1 percent of the data qualified for observations affecting sample representativeness.

Reportable levels of target analytes were not routinely detected in the laboratory blanks greater than the laboratory RLs except for relatively isolated incidences. Overall, blank contamination was indicative of normal laboratory operations and was determined to have little impact on the sample data as reported.

Sample data are representative of the site conditions at the time of sample collection. Some transcription errors and documentation issues were observed that impacted sample results; however, the majority of such issues were corrected in the database. Samples were generally stored and preserved properly. Overall, these elements of QC exceedances are indicative of normal laboratory operations.

- Comparability—Examination of the following parameters showed no systematic issues with comparability:
  - The use of standard EPA- and RFETS-approved analytical procedures;
  - Instrument types and maintenance, sample preparation techniques, and standard units for reporting; and
  - Evaluation of MS and surrogate samples, ensuring accuracy within acceptable ranges.
- Completeness—As defined in the CRA Methodology, completeness is addressed in Appendix A, Volume 2 of the RI/FS Report. Another indication of completeness that is sometimes used is the number of valid measurements obtained in relation to the total number of measurements planned. Because less than 6 percent of the overall data were rejected, the use of non-V&V data for the WC AEU CRA does not contribute to any completeness issues.

3.4 No Name Gulch Aquatic Exposure Unit (NN AEU)

This section is presented in Volume 15B1: Attachment 2 of this CRA.

3.5 Rock Creek Aquatic Exposure Unit (RC AEU)

This section is presented in Volume 15B1: Attachment 2 of this CRA.

3.6 McKay Ditch Aquatic Exposure Unit (MK AEU)

This section is presented in Volume 15B1: Attachment 2 of this CRA.

3.7 Southeast Aquatic Exposure Unit (SE AEU)

This section is presented in Volume 15B1: Attachment 2 of this CRA.

4.0 CONCLUSIONS

The quality of the data used in the AEU CRA was summarized and evaluated according to the PARCC parameters for each AEU. The vast majority of V&V data were qualified as usable, having no QC issues. The data with noted V&V observations were determined to have minimal impact on data precision, accuracy, and representativeness. The completeness of the CRA data set is addressed in Appendix A, Volume 2 of the RI/FS Report. The data for all AEUs are generally acceptable, and it is determined that the CRA DQOs have been met.

Data qualified as estimated or undetected are a result of various minor issues identified by the validators, but are insufficient to render the data unusable. All analyses indicate the data meet the DQOs outlined in the CRA Methodology (DOE 2004) and are therefore adequate for use in the CRA.

5.0 REFERENCES

Department of Energy (DOE), 2004. Final Comprehensive Risk Assessment Work Plan and Methodology, Environmental Restoration, Rocky Flats Environmental Technology Site, Golden, Colorado. September.

U.S. Environmental Protection Agency (EPA), 2002. Guidance for Quality Assurance Project Plans. EPA QA/G-5, EPA/240/R-02/009. Office of Environmental Information, Washington, D.C. December.

TABLES

Table A2.1
V&V Qualifier Flag Definitions

Validation Qualifier Code	Description
1	QC data from a data package – Verification
A	Data acceptable with qualifications
B	Compound was found in BLK and sample
C	Calibration
E	Associated value exceeds calibration range; dilute and reanalyze
J	Estimated quantity – Validation
J1	Estimated quantity – Verification
JB	Organic method blank contamination – Validation
JB1	Organic method blank contamination – Verification
N	Historical – Validators asked not to validate this
NJ	Associated value is presumptively estimated
NJ1	Value presumptively estimated – Verification
P	Systematic error
R	Data unusable – Validation
R1	Data unusable – Verification
S	Matrix spike
U	Analyzed, not detected at/above method detection limit
U1	Analyzed, not detect at/above method detection limit – Verification
UJ	Associated value is considered estimated at an elevated detection
UJ1	Estimated at elevated level – Verification
V	No problems with the data – Validation
V1	No problems with the data – Verification
Y	Analytical results in validation process
Z	Validation was not requested or could not be performed

Table A2.2
V&V Reason Code Definitions

Validation Reason Code	Description
***	Unknown code from RFEDS
1	Holding times were exceeded
2	Holding times were grossly exceeded
3	Initial calibration correlation coefficient <0.995
4	Calibration verification criteria were not met
5	CRDL check sample recovery criteria were not met
6	Incorrect calibration of instrument
7	Analyte values > IDL were found in the blanks
8	Negative bias was indicated in the blanks
9	Interference indicated in the ICP interference check sample
10	Laboratory control sample recovery criteria were not met
11	Duplicate sample precision criteria were not met
12	Predigestion matrix spike criteria were not met (+/- 25 percent)
13	Predigestion matrix spike criteria were not met (<30 percent)
14	Post-digestion matrix spike recovery criteria were not met
15	MSA was required but not performed
16	MSA calibration correlation coefficient <0.995
17	Serial dilution criteria not met
18	Documentation was not provided
19	Calibration verification criteria not met
20	AA duplicate injection precision criteria were not met
21	Reagent blanks exceeded MDA
22	Tracer contamination
23	Improper aliquot size
24	Sample aliquot not taken quantitatively
25	Primary standard had exceeded expiration date
26	No raw data submitted by the laboratory
27	Recovery criteria were not met
28	Duplicate analysis was not performed
29	Verification criteria were not met
30	Replicate precision criteria were not met
31	Replicate analysis was not performed
32	Laboratory control samples >+/- 3 sigma
33	Laboratory control samples >+/- 2 sigma and <+/- 3 sigma
35	Transformed spectral index external ST criteria were not met
36	MDA exceeded the RDL
37	Sample exceeded efficiency curve weight limit
38	Excessive solids on planchet
39	Tune criteria not met
40	Organics initial calibration criteria were not met
41	Organics continuing calibration criteria were not met
42	Surrogates were outside criteria
43	Internal standards outside criteria
44	No mass spectra were provided
45	Results were not confirmed
47	Percent breakdown exceeded 20 percent
48	Linear range of instrument was exceeded
49	Method blank contamination
51	Nonverifiable laboratory results and/or unsubmitted data

Table A2.2
V&V Reason Code Definitions

Validation Reason Code	Description
52	Transcription error
53	Calculation error
54	Incorrect reported activity or MDA
55	Result exceeds linear range; serial dilution value reported
56	IDL changed due to significant figure discrepancy
57	Percent solids < 30 percent
58	Percent solids < 10 percent
59	Blank activity exceeded RDL
60	Blank recovery criteria were not met
61	Replicate recovery criteria were not met
62	LCS relative percent error criteria not met
63	LCS expected value not submitted/verifiable
64	Nontraceable/noncertified standard was used
67	Sample results not submitted/verifiable
68	Frequency of quality control samples not met
69	Samples not distilled
70	Resolution criteria not met
71	Unit conversion of results
72	Calibration counting statistics not met
73	Daily instrument performance assessment not performed
74	LCS data not submitted
75	Blank data not submitted
76	Instrument gain and/or efficiency not submitted
77	Detector efficiency criteria not met
78	MDAs were calculated by reviewer
79	Result obtained through dilution
80	Spurious counts of unknown origin
81	Repeat count outside of 3 sigma counting error
82	Sample results were not corrected for decay
83	Sample results were not included on Data Summary Table
84	Key fields wrong
85	Record added by QLI
86	Results considered qualitative not quantitative
87	Laboratory did no analysis for this record
88	Blank corrected results
89	Sample analysis was not requested
90	Sample result was not validated due to reanalysis
91	Unit conversion; QC sample activity/uncertainty/MDA
99	See hard copy for further explanation
101	Holding times were exceeded (attributed to laboratory problem)
102	Holding times were grossly exceeded (attribute to laboratory problem)
103	Calibration correlation coefficient does not meet requirement
104	Calibration verification recovery criteria were not met
105	Low-level check sample recovery criteria were not met
106	Calibration did not contain minimum number of standards
107	Analyte detected but < RDL in calibration blank verification
109	Interference indicated in the ICP interference check sample
110	Laboratory control sample recovery criteria were not met
111	Laboratory duplicate sample precision criteria were not met

Table A2.2
V&V Reason Code Definitions

Validation Reason Code	Description
112	Predigestion matrix spike criteria were not met (+/- 25 percent)
113	Predigestion matrix spike recovery is <30 percent
114	Post-digestion matrix spike criteria were not met
115	MSA was required but not performed
116	MSA calibration correlation coefficient <0.995
117	Serial dilution percent D criteria not met
123	Improper aliquot size
128	Laboratory duplicate was not analyzed
129	Verification criteria for frequency or sequence were not met
130	Replicate precision criteria were not met
131	Confirmation percent difference criteria not met
132	Laboratory control samples >+/- 3 sigma
136	MDA exceeded the RDL
139	Tune criteria not met
140	Requirements for independent calibration verification were not met
141	Continuing calibration verification criteria were not met
142	Surrogates were outside criteria
143	Internal standards outside criteria
145	Results were not confirmed
147	Percent breakdown exceeded 20 percent
148	Linear range of measurement system was exceeded
149	Method, preparation, or reagent blank contamination > RDL
150	Unknown carrier volume
152	Reported data do not agree with raw data
153	Calculation error
155	Original result exceeds linear range; serial dilution value reported
159	Magnitude of calibration verification blank result exceeded the RDL
164	Standard traceability or certification requirements not met
166	Carrier aliquot nonverifiable
168	QC sample frequency does not meet requirements
170	Resolution criteria not met
172	Calibration counting statistics not met
174	LCS data not submitted
175	Blank data not submitted
177	Detector efficiency criteria not met
188	Blank corrected results
199	See hard copy for further explanation
201	Preservation requirements not met by the laboratory
205	Unobtainable omissions or errors on SDP (required for databases)
206	Analyses were not requested according to the SOW
207	Sample pretreatment or sample preparation method is incorrect
211	Poor cleanup recovery
212	Instrument detection limit was not provided
213	Instrument detection limit is > the associated RDL
214	IDL is older than 3 months from date of analysis
215	Blank results were not reported to the IDL/MDL
216	Post-digestion spike recoveries outside of 85-115 percent criteria
217	Post-digestion spike recoveries were < 10 percent
218	Sample COC was not verifiable (attributed to laboratory)

Table A2.2
V&V Reason Code Definitions

Validation Reason Code	Description
219	Standards have expired or are not valid
220	TCLP sample percent solids < 0.5 percent
222	TCLP particle size was not performed
224	Incomplete TCLP extraction data
225	Insufficient TCLP extraction time
226	TIC misidentification
227	No documentation regarding deviations from methods or SOW
228	Calibration recoveries affecting data quality have not been met
229	Element not analyzed in ICP interference check sample
230	QC sample/analyte (e.g., spike, duplicate, LCS) not analyzed
231	MS/MSD criteria not met
232	Control limits not assigned correctly
233	Sample matrix QC does not represent samples analyzed
234	QC sample does not meet method requirement
235	Duplicate sample control limits do not pass
236	LCS control limits do not pass
237	Preparation blank control limits do not pass
238	Blank correction was not performed
239	Winsorized mean plus standard deviation of the same not calculated or calculated wrong
240	Sample preparations for soil/sludge/sediment were not homog/aliq properly
241	No micro PPT or electroplating data available
242	Tracer requirements were not met
243	Standard values were not calculated correctly (LCS, tracer, standards)
244	Standard or tracer is not NIST traceable
245	Energy calibration criteria not met
246	Background calibration criteria were not met
247	Sample or control analysis not chemically separated from each other
248	Single combined TCLP result was not repeated for sample with both mis+nonm
249	Result qualified due to blank contamination
250	Incorrect analysis sequence
251	Misidentified target compounds
252	Result is suspect DU
701	Holding times were exceeded (not attributed to laboratory)
702	Holding times were grossly exceeded (not attributed to laboratory)
703	Samples were not preserved properly in the field (not attributed to laboratory)
801	Missing deliverables (required for data assessment)
802	Missing deliverables (not required for data assessment)
803	Omissions or errors on SDP deliverables (required for data assessment)
804	Omissions or errors on SDP deliverables (not required for data assessment
805	Information missing from case narrative
806	Site samples not used for sample matrix QC
807	Original documentation not provided
808	Incorrect or incomplete DRC
809	Non-site samples reported with site samples
810	EDD does not match hard copy; EDD may be resubmitted

Table A2.3
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
188, 88	Blank corrected results	Blanks	Representativeness
238	Blank correction was not performed	Blanks	Representativeness
175, 75	Blank data not submitted	Blanks	Representativeness
60	Blank recovery criteria were not met	Blanks	Representativeness
215	Blank results were not reported to the	Blanks	Representativeness
107, 159	Calibration verification blank contamination	Blanks	Representativeness
149, 21, 237, 249, 49, 59, 7	Method, preparation, or reagent blank contamination	Blanks	Representativeness
8	Negative bias indicated in the blanks	Blanks	Representativeness
153, 53	Calculation error	Transcription Errors	Other
232	Control limits not assigned correctly	Transcription Errors	Other
246	Background calibration criteria were not met	Calibration	Accuracy
103, 3	Calibration correlation coefficient did not meet requirements	Calibration	Accuracy
172, 72	Calibration counting statistics did not meet criteria	Calibration	Accuracy
106	Calibration did not contain minimum number of standards	Calibration	Accuracy
228	Calibration requirements affecting data quality have not been met	Calibration	Accuracy
104, 141, 19, 29, 4, 40, 41	Continuing calibration verification criteria were not met	Calibration	Accuracy
245	Energy calibration criteria not met	Calibration	Accuracy
6	Incorrect calibration of instrument	Calibration	Accuracy
148, 48	Result exceeded linear range of measurement system	Calibration	Accuracy
155, 55	Original result exceeded linear range, serial dilution value reported	Calibration	Accuracy
140	Requirements for independent calibration verification were not met	Calibration	Accuracy
129	Frequency or sequencing verification criteria not met	Calibration	Accuracy
131	Confirmation percent difference criteria not met	Confirmation	Precision
145, 45	Results were not confirmed	Confirmation	Precision
18	Sufficient documentation not provided by the laboratory	Documentation issues	Representativeness
705	Electronic qualifiers were applied from validation report by hand	Documentation issues	Other
805	Information missing from case narrative	Documentation issues	Other
84	Key data field incorrect	Documentation issues	Other
802	Missing deliverables (not required for	Documentation issues	Other
801	Missing deliverables (required for validation)	Documentation issues	Representativeness
227	No documentation regarding deviations from methods or SOW	Documentation issues	Other
44	No mass spectra were provided	Documentation issues	Representativeness
241	No micro pipette or electroplating data	Documentation issues	Other
26	No raw data submitted by the laboratory	Documentation issues	Representativeness

Table A2.3
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
804	Omissions or errors in SDP (not required for	Documentation issues	Other
803	Omissions or errors in SDP (required for data	Documentation issues	Representativeness
807	Original documentation not provided	Documentation issues	Other
85	Record added by the validator	Documentation issues	Other
152	Reported data do not agree with raw data	Documentation issues	Other
89	Sample analysis was not requested	Documentation issues	Other
218	Sample COC was not verifiable (attributed to laboratory)	Documentation issues	Representativeness
704	Sample COC was not verifiable (not attributed to laboratory)	Documentation issues	Representativeness
83	Sample results were not included on Data Summary Table	Documentation issues	Other
52	Transcription error	Documentation issues	Other
205	Unobtainable omissions or errors on SDP (required for data assessment)	Documentation issues	Representativeness
1, 101, 701	Holding times were exceeded	Holding times	Representativeness
2, 102, 702	Holding times were grossly exceeded	Holding times	Representativeness
251	Misidentified target compounds	Identification errors	Representativeness
70	Resolution criteria not met	Identification errors	Representativeness
226	TIC misidentification	Identification errors	Representativeness
143, 43	Internal standards did not meet criteria	Internal standards	Accuracy
5	CRDL check sample recovery criteria were not met	LCS	Accuracy
33	LCS > ± 2 sigma and < ± 3 sigma	LCS	Accuracy
10, 110, 236	LCS recovery criteria were not met	LCS	Accuracy
132, 32	Laboratory control samples > ± 3 sigma	LCS	Accuracy
174, 74	LCS data not submitted	LCS	Representativeness
63	Expected LCS value not submitted/verifiable	LCS	Representativeness
62	LCS relative percent error criteria not met	LCS	Accuracy
105	Low-level check sample recovery criteria were not met	LCS	Accuracy
230	QC sample/analyte (e.g., spike, duplicate, LCS) not analyzed	LCS	Representativeness
28	Duplicate analysis was not performed	Matrices	Precision
11, 235	Duplicate sample precision criteria were not met	Matrices	Precision
111	LCS/LCSD precision criteria were not met	Matrices	Precision
128	Laboratory duplicate was not analyzed	Matrices	Precision
231	MS/MSD criteria not met	Matrices	Precision
116, 16	MSA calibration correlation coefficient <0.995	Matrices	Accuracy
115, 15	MSA was required but not performed	Matrices	Representativeness
58	Sample contained < 10 percent solid material	Matrices	Representativeness
57	Sample contained < 30 percent solid material	Matrices	Representativeness
217	Post-digestion spike recoveries were < 10%	Matrices	Accuracy

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Table A2.3
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
14, 114, 216	Post-digestion matrix spike criteria were not met	Matrices	Accuracy
113, 13	Predigestion matrix spike recovery is <30%	Matrices	Accuracy
112, 12	Predigestion matrix spike recovery criteria were not met	Matrices	Accuracy
27	Recovery criteria were not met	Matrices	Accuracy
31	Replicate analysis was not performed	Matrices	Precision
130, 30	Replicate precision criteria were not met	Matrices	Precision
61	Replicate recovery criteria were not met	Matrices	Accuracy
233	Sample matrix QC does not represent samples analyzed	Matrices	Representativeness
117, 17	Serial dilution criteria not met	Matrices	Accuracy
806	Site samples not used for sample matrix QC	Matrices	Representativeness
810	EDD does not match hard copy; EDD may be resubmitted	Other	Other
214	IDL is older than 3 months from date of	Other	Accuracy
250	Incorrect analysis sequence	Other	Representativeness
808	Incorrect or incomplete DRC	Other	Representativeness
212	Instrument detection limit was not provided	Other	Other
87	Laboratory did no analysis for this record	Other	Other
809	Nonsite samples reported with Site samples	Other	Other
64	Nontraceable/noncertified standard was used	Other	Accuracy
51	Nonverifiable laboratory results and/or unsubmitted data	Other	Representativeness
211	Poor cleanup recovery	Other	Accuracy
25	Primary standard had exceeded expiration date	Other	Accuracy
234	QC sample does not meet method requirement	Other	Representativeness
168, 68	QC sample frequency does not meet requirements	Other	Representativeness
252	Result is suspect due to dilution	Other	Other
79	Result obtained through dilution	Other	Other
37	Sample exceeded efficiency curve weight limit	Other	Accuracy
247	Sample or control analyses not chemically separated from each other	Other	Representativeness
90	Sample result was not validated due to re-analysis	Other	Other
67	Sample results not submitted/verifiable	Other	Representativeness
199, 99	See hard copy for further explanation	Other	Other
248	Single combined TCLP results was not reported for sample with both mis+nonm	Other	Accuracy
80	Spurious counts of unknown origin	Other	Representativeness
244	Standard or tracer is not NIST traceable	Other	Accuracy
164	Standard traceability or certification requirements not met	Other	Accuracy
219	Standards have expired or are not valid	Other	Accuracy

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Table A2.3
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
243	Standard values were not calculated correctly (LCS, tracer, standards)	Other	Other
22	Tracer contamination	Other	Accuracy
242	Tracer requirements were not met	Other	Accuracy
71	Unit conversion of results	Other	Other
239	Winsorized mean+standard deviation of the same not calculated or calculated wrong	Other	Other
38	Excessive solids on planchet	Sample preparation	Accuracy
123, 23	Improper aliquot size	Sample preparation	Accuracy
224	Incomplete TCLP extraction data	Sample preparation	Representativeness
225	Insufficient TCLP extraction time	Sample preparation	Representativeness
201	Preservation requirements not met by the laboratory	Sample preparation	Representativeness
24	Sample aliquot not taken quantitatively	Sample preparation	Accuracy
240	Sample preparation for soil/sludge/ sediment were not homog/aliq properly	Sample preparation	Representativeness
207	Sample pretreatment or preparation method is incorrect	Sample preparation	Representativeness
69	Samples not distilled	Sample preparation	Representativeness
703	Samples were not preserved properly in the	Sample preparation	Representativeness
222	TCLP particle size was not performed	Sample preparation	Representativeness
220	TCLP sample percent solids < 0.5 percent	Sample preparation	Representativeness
56	IDL changed due to significant figure discrepancy	Sensitivity	Representativeness
54	Incorrect reported activity or MDA	Sensitivity	Other
213	Instrument detection limit > the associated RDL	Sensitivity	Representativeness
136, 36	MDA exceeded the RDL	Sensitivity	Representativeness
78	MDA was calculated by reviewer	Sensitivity	Other
81	Repeat count outside of 3 sigma counting error	Sensitivity	Precision
86	Results considered qualitative not quantitative	Sensitivity	Accuracy
82	Sample results were not corrected for decay	Sensitivity	Other
91	Unit conversion, QC sample activity	Sensitivity	Representativeness
142, 42	Surrogates were outside criteria	Surrogate	Accuracy
20	AA duplicate injection precision criteria were not met	Instrument Set-up	Precision
73	Daily instrument performance assessment not performed	Instrument Set-up	Accuracy
177, 77	Detector efficiency criteria not met	Instrument Set-up	Accuracy
229	Element not analyzed in ICP interference check sample	Instrument Set-up	Representativeness
76	Instrument gain and/or efficiency not submitted	Instrument Set-up	Representativeness
109, 9	Interference indicated in the ICP interference check sample	Instrument Set-up	Accuracy
147, 47	Percent breakdown exceeded 20 percent	Instrument Set-up	Representativeness
170	Resolution criteria not met	Instrument Set-up	Representativeness
35	Transformed spectral index external site criteria were not met	Instrument Set-up	Representativeness

Table A2.3
Standardized V&V Reason Code Definitions, QC Categories, and Affected PARCC Parameters

Validation Reason Codes	Standardized Description	QC Category	Affected PARCC Parameter
139, 39	Tune criteria not met	Instrument Set-up	Accuracy
206	Analysis was not requested according to SOW	Unknown	Other
166	Carrier aliquot nonverifiable	Unknown	Representativeness
150	Unknown carrier volume	Unknown	Representativeness

Table A2.3.1.1
NW AEU - CRA Data V&V Summary

Analyte Group	Matrix	Total No. of V&V Records	Total No. of CRA Records	Percent V&V (%)
Dioxins and Furans	SOIL	68	68	100.00
Dioxins and Furans	WATER	24	31	77.42
Herbicide	SOIL	101	115	87.83
Herbicide	WATER	139	615	22.60
Metal	SOIL	3,147	3,191	98.62
Metal	WATER	21,098	26,812	78.69
PCB	SOIL	703	850	82.71
PCB	WATER	322	833	38.66
Pesticide	SOIL	1,267	1,710	74.09
Pesticide	WATER	907	3,391	26.75
Radionuclide	SOIL	790	1,025	77.07
Radionuclide	WATER	7,089	12,097	58.60
SVOC	SOIL	5,330	6,090	87.52
SVOC	WATER	5,066	12,405	40.84
VOC	SOIL	2,873	3,356	85.61
VOC	WATER	7,630	15,768	48.39
Wet Chemistry	SOIL	71	158	44.94
Wet Chemistry	WATER	1,639	3,300	49.67
	Total	**58,264**	**91,815**	**63.46%**

Table A2.3.1.2
NW AEU - Summary of Data Estimated or Undetected Due to V&V Determinations

Analyte Group	Matrix	No. of CRA Data Records Qualified	Total No. of V&V CRA Records	Detect?	Percent Qualified (%)
Dioxins and Furans	SOIL	1	68	Yes	1.47
Dioxins and Furans	WATER	3	24	No	12.50
Herbicide	SOIL	8	101	No	7.92
Herbicide	WATER	44	139	No	31.65
Metal	SOIL	581	3,147	Yes	18.46
Metal	SOIL	415	3,147	No	13.19
Metal	WATER	2,224	21,098	No	10.54
Metal	WATER	2,468	21,098	Yes	11.70
PCB	SOIL	1	703	Yes	0.14
PCB	SOIL	14	703	No	1.99
PCB	WATER	21	322	No	6.52
Pesticide	SOIL	58	1,267	No	4.58
Pesticide	SOIL	1	1,267	Yes	0.08
Pesticide	WATER	100	907	No	11.03
Radionuclide	SOIL	16	790	No	2.03
Radionuclide	SOIL	4	790	Yes	0.51
Radionuclide	WATER	53	7,089	No	0.75
Radionuclide	WATER	81	7,089	Yes	1.14
SVOC	SOIL	17	5,330	Yes	0.32
SVOC	SOIL	255	5,330	No	4.78
SVOC	WATER	5	5,066	Yes	0.10
SVOC	WATER	661	5,066	No	13.05
VOC	SOIL	21	2,873	Yes	0.73
VOC	SOIL	263	2,873	No	9.15
VOC	WATER	33	7,630	Yes	0.43
VOC	WATER	631	7,630	No	8.27
Wet Chemistry	SOIL	38	71	Yes	53.52
Wet Chemistry	SOIL	10	71	No	14.08
Wet Chemistry	WATER	107	1,639	Yes	6.53
Wet Chemistry	WATER	38	1,639	No	2.32
	Total	**8,172**	**58,264**		**14.03%**

Table A2.3.1.3
NW AEU - Summary of Data Qualified as Undetected Due to Blank Contamination

Analyte Group	Matrix	No. of CRA Records Qualified as Undetected	Total No. of CRA Records with Detected Results[a]	Percent Qualified as Undetected
Metal	SOIL	39	2,314	1.69
Metal	WATER	398	13,328	2.99
Pesticide	WATER	1	14	7.14
Radionuclide	WATER	1	5,084	0.02
VOC	SOIL	6	66	9.09
VOC	WATER	1	164	0.61
	Total	**446**	**20,970**	**2.13%**

[a] As determined by the laboratory prior to V&V.

Table A2.3.1.4
NW AEU - Summary of Data Rejected During V&V

Analyte Group	Matrix	Total No. of Rejected Records	Total No. of Records	Percent Rejected (%)
Dioxins and Furans	SOIL	0	103	0.00
Dioxins and Furans	WATER	0	40	0.00
Herbicide	SOIL	2	152	1.32
Herbicide	WATER	11	208	5.29
Metal	SOIL	73	5,207	1.40
Metal	WATER	694	32,967	2.11
PCB	SOIL	33	1,181	2.79
PCB	WATER	7	756	0.93
Pesticide	SOIL	32	2,312	1.38
Pesticide	WATER	30	2,235	1.34
Radionuclide	SOIL	202	2,565	7.88
Radionuclide	WATER	1,231	10,896	11.30
SVOC	SOIL	114	8,282	1.38
SVOC	WATER	380	8,435	4.51
VOC	SOIL	54	4,888	1.10
VOC	WATER	639	13,620	4.69
Wet Chemistry	SOIL	33	130	25.38
Wet Chemistry	WATER	50	2,888	1.73
	Total	**3,585**	**96,865**	**3.70%**

Table A2.3.1.5
NW AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs

Analyte Group	Matrix	No. of Duplicates Failing RPD/DER Criteria	Total No. of Duplicate Pairs	Percent Failure (%)	Field Duplicate Frequency (%)
Herbicide	SOIL	0	14	0.00	12.17
Metal	SOIL	42	373	11.26	11.69
Metal	WATER	55	879	6.26	3.28
PCB	SOIL	0	105	0.00	12.35
Pesticide	SOIL	0	238	0.00	13.92
Radionuclide	SOIL	4	132	3.03	12.88
Radionuclide	WATER	4	386	1.04	3.19
SVOC	SOIL	3	815	0.37	13.38
VOC	SOIL	0	313	0.00	9.33
Wet Chemistry	SOIL	0	22	0.00	13.92
Wet Chemistry	WATER	3	74	4.05	2.24

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Dioxins and Furans	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1	68	1.47
Dioxins and Furans	WATER	Documentation Issues	Record added by the validator	No	2	24	8.33
Dioxins and Furans	WATER	Documentation Issues	Transcription error	No	7	24	29.17
Dioxins and Furans	WATER	Internal Standards	Internal standards did not meet criteria	No	3	24	12.50
Herbicide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	4	101	3.96
Herbicide	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	5	101	4.95
Herbicide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	4	101	3.96
Herbicide	SOIL	Documentation Issues	Transcription error	No	10	101	9.90
Herbicide	SOIL	Internal Standards	Internal standards did not meet criteria	No	1	101	0.99
Herbicide	SOIL	Other	See hard copy for further explanation	No	3	101	2.97
Herbicide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	1	101	0.99
Herbicide	WATER	Calculation Errors	Calculation error	No	1	139	0.72
Herbicide	WATER	Calibration	Continuing calibration verification criteria were not met	No	22	139	15.83
Herbicide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	139	1.44
Herbicide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	5	139	3.60
Herbicide	WATER	Documentation Issues	Record added by the validator	No	1	139	0.72
Herbicide	WATER	Documentation Issues	Transcription error	No	36	139	25.90
Herbicide	WATER	Holding Times	Holding times were exceeded	No	7	139	5.04
Herbicide	WATER	Internal Standards	Internal standards did not meet criteria	No	2	139	1.44
Herbicide	WATER	Other	Sample results were not validated due to re-analysis	No	10	139	7.19
Herbicide	WATER	Other	See hard copy for further explanation	No	13	139	9.35
Metal	SOIL	Blanks	Calibration verification blank contamination	No	48	3,147	1.53
Metal	SOIL	Blanks	Calibration verification blank contamination	Yes	6	3,147	0.19
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	129	3,147	4.10
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	17	3,147	0.54
Metal	SOIL	Blanks	Negative bias indicated in the blanks	No	23	3,147	0.73

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Blanks	Negative bias indicated in the blanks	Yes	33	3,147	1.05
Metal	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1	3,147	0.03
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	38	3,147	1.21
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	181	3,147	5.75
Metal	SOIL	Documentation Issues	Record added by the validator	Yes	1	3,147	0.03
Metal	SOIL	Documentation Issues	Transcription error	No	16	3,147	0.51
Metal	SOIL	Documentation Issues	Transcription error	Yes	102	3,147	3.24
Metal	SOIL	Holding Times	Holding times were exceeded	No	2	3,147	0.06
Metal	SOIL	Holding Times	Holding times were exceeded	Yes	2	3,147	0.06
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	No	3	3,147	0.10
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	Yes	2	3,147	0.06
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	No	31	3,147	0.99
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	Yes	26	3,147	0.83
Metal	SOIL	LCS	LCS recovery criteria were not met	No	94	3,147	2.99
Metal	SOIL	LCS	LCS recovery criteria were not met	Yes	204	3,147	6.48
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	No	27	3,147	0.86
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	Yes	26	3,147	0.83
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	74	3,147	2.35
Metal	SOIL	Matrices	LCS/LCSD precision criteria were not met	Yes	3	3,147	0.10
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	No	7	3,147	0.22
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	Yes	9	3,147	0.29
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	82	3,147	2.61

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	225	3,147	7.15
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	No	2	3,147	0.06
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	2	3,147	0.06
Metal	SOIL	Matrices	Serial dilution criteria were not met	No	1	3,147	0.03
Metal	SOIL	Matrices	Serial dilution criteria were not met	Yes	45	3,147	1.43
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	No	59	3,147	1.87
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	245	3,147	7.79
Metal	SOIL	Other	Result obtained through dilution	Yes	4	3,147	0.13
Metal	WATER	Blanks	Calibration verification blank contamination	No	723	21,098	3.43
Metal	WATER	Blanks	Calibration verification blank contamination	Yes	161	21,098	0.76
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	No	442	21,098	2.09
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	412	21,098	1.95
Metal	WATER	Blanks	Negative bias indicated in the blanks	No	195	21,098	0.92
Metal	WATER	Blanks	Negative bias indicated in the blanks	Yes	117	21,098	0.55
Metal	WATER	Calculation Errors	Control limits not assigned correctly	No	1	21,098	0.00
Metal	WATER	Calculation Errors	Control limits not assigned correctly	Yes	7	21,098	0.03
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	No	46	21,098	0.22
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	5	21,098	0.02
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	No	20	21,098	0.09
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	17	21,098	0.08
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	No	15	21,098	0.07
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	Yes	27	21,098	0.13
Metal	WATER	Documentation Issues	Key data fields incorrect	No	82	21,098	0.39
Metal	WATER	Documentation Issues	Key data fields incorrect	Yes	403	21,098	1.91

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	86	21,098	0.41
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	79	21,098	0.37
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	No	44	21,098	0.21
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	44	21,098	0.21
Metal	WATER	Documentation Issues	No raw data submitted by the laboratory	No	2	21,098	0.01
Metal	WATER	Documentation Issues	No raw data submitted by the laboratory	Yes	1	21,098	0.00
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	257	21,098	1.22
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	719	21,098	3.41
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	22	21,098	0.10
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	31	21,098	0.15
Metal	WATER	Documentation Issues	Original documentation not provided	No	4	21,098	0.02
Metal	WATER	Documentation Issues	Original documentation not provided	Yes	4	21,098	0.02
Metal	WATER	Documentation Issues	Record added by the validator	No	108	21,098	0.51
Metal	WATER	Documentation Issues	Record added by the validator	Yes	122	21,098	0.58
Metal	WATER	Documentation Issues	Transcription error	No	320	21,098	1.52
Metal	WATER	Documentation Issues	Transcription error	Yes	283	21,098	1.34
Metal	WATER	Holding Times	Holding times were exceeded	No	107	21,098	0.51
Metal	WATER	Holding Times	Holding times were exceeded	Yes	65	21,098	0.31
Metal	WATER	Holding Times	Holding times were grossly exceeded	No	1	21,098	0.00
Metal	WATER	Holding Times	Holding times were grossly exceeded	Yes	2	21,098	0.01
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	1	21,098	0.00
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	No	111	21,098	0.53
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	Yes	112	21,098	0.53
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	No	84	21,098	0.40
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	Yes	119	21,098	0.56

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	LCS	LCS recovery criteria were not met	No	61	21,098	0.29
Metal	WATER	LCS	LCS recovery criteria were not met	Yes	167	21,098	0.79
Metal	WATER	LCS	Low level check sample recovery criteria were not met	No	118	21,098	0.56
Metal	WATER	LCS	Low level check sample recovery criteria were not met	Yes	279	21,098	1.32
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	7	21,098	0.03
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	12	21,098	0.06
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	No	17	21,098	0.08
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	91	21,098	0.43
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	No	15	21,098	0.07
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	48	21,098	0.23
Metal	WATER	Matrices	MS/MSD precision criteria were not met	No	7	21,098	0.03
Metal	WATER	Matrices	MS/MSD precision criteria were not met	Yes	1	21,098	0.00
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	Yes	10	21,098	0.05
Metal	WATER	Matrices	MSA was required, but not performed	Yes	3	21,098	0.01
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	No	196	21,098	0.93
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	Yes	54	21,098	0.26
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	No	238	21,098	1.13
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	394	21,098	1.87
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	No	2	21,098	0.01
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	31	21,098	0.15
Metal	WATER	Matrices	Serial dilution criteria were not met	No	10	21,098	0.05
Metal	WATER	Matrices	Serial dilution criteria were not met	Yes	525	21,098	2.49
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	No	5	21,098	0.02
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	21	21,098	0.10

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Table A2.3.1.6

NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Other	Analysis was not requested according to the statement of work	No	1	21,098	0.00
Metal	WATER	Other	Analysis was not requested according to the statement of work	Yes	1	21,098	0.00
Metal	WATER	Other	IDL is older than 3 months from date of analysis	No	250	21,098	1.18
Metal	WATER	Other	IDL is older than 3 months from date of analysis	Yes	766	21,098	3.63
Metal	WATER	Other	Incorrect analysis sequence	No	1	21,098	0.00
Metal	WATER	Other	Incorrect analysis sequence	Yes	2	21,098	0.01
Metal	WATER	Other	QC sample frequency does not meet method requirements	No	6	21,098	0.03
Metal	WATER	Other	QC sample frequency does not meet method requirements	Yes	5	21,098	0.02
Metal	WATER	Other	See hard copy for further explanation	No	135	21,098	0.64
Metal	WATER	Other	See hard copy for further explanation	Yes	201	21,098	0.95
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	No	266	21,098	1.26
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	845	21,098	4.01
Metal	WATER	Sensitivity	IDL changed due to a significant figure discrepancy	No	25	21,098	0.12
Metal	WATER	Sensitivity	Instrument detection limit > the associated RDL	Yes	1	21,098	0.00
PCB	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	11	703	1.56
PCB	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	62	703	8.82
PCB	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	1	703	0.14
PCB	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	35	703	4.98
PCB	SOIL	Matrices	MS/MSD precision criteria were not met	No	27	703	3.84
PCB	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	1	703	0.14
PCB	SOIL	Matrices	Percent solids < 30 percent	Yes	3	703	0.43
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	No	21	703	2.99

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
PCB	WATER	Documentation Issues	Missing deliverables (required for validation)	No	14	322	4.35
PCB	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	35	322	10.87
PCB	WATER	Documentation Issues	Record added by the validator	No	7	322	2.17
PCB	WATER	Documentation Issues	Transcription error	No	14	322	4.35
PCB	WATER	Holding Times	Holding times were exceeded	No	7	322	2.17
PCB	WATER	Surrogates	Surrogate recovery criteria were not met	No	14	322	4.35
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	18	1,267	1.42
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,267	0.08
Pesticide	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	185	1,267	14.60
Pesticide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	104	1,267	8.21
Pesticide	SOIL	Internal Standards	Internal standards did not meet criteria	No	1	1,267	0.08
Pesticide	SOIL	Matrices	MS/MSD precision criteria were not met	No	80	1,267	6.31
Pesticide	SOIL	Other	See hard copy for further explanation	No	1	1,267	0.08
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	61	1,267	4.81
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	No	27	907	2.98
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	1	907	0.11
Pesticide	WATER	Calibration	Independent calibration verification criteria not met	No	1	907	0.11
Pesticide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	907	0.22
Pesticide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	38	907	4.19
Pesticide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	2	907	0.22
Pesticide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	103	907	11.36
Pesticide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2	907	0.22
Pesticide	WATER	Documentation Issues	Record added by the validator	No	21	907	2.32
Pesticide	WATER	Documentation Issues	Transcription error	No	6	907	0.66
Pesticide	WATER	Documentation Issues	Transcription error	Yes	3	907	0.33

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Pesticide	WATER	Holding Times	Holding times were exceeded	No	43	907	4.74
Pesticide	WATER	Internal Standards	Internal standards did not meet criteria	No	2	907	0.22
Pesticide	WATER	Other	See hard copy for further explanation	Yes	5	907	0.55
Pesticide	WATER	Surrogates	Surrogate recovery criteria were not met	No	42	907	4.63
Radionuclide	SOIL	Blanks	Blank recovery criteria were not met	Yes	4	790	0.51
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	1	790	0.13
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	42	790	5.32
Radionuclide	SOIL	Calculation Errors	Calculation error	Yes	12	790	1.52
Radionuclide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	118	790	14.94
Radionuclide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	12	790	1.52
Radionuclide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	33	790	4.18
Radionuclide	SOIL	Documentation Issues	Record added by the validator	Yes	2	790	0.25
Radionuclide	SOIL	Documentation Issues	Results were not included on Data Summary Table	No	3	790	0.38
Radionuclide	SOIL	Documentation Issues	Sufficient documentation not provided by the laboratory	No	1	790	0.13
Radionuclide	SOIL	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	159	790	20.13
Radionuclide	SOIL	Documentation Issues	Transcription error	No	4	790	0.51
Radionuclide	SOIL	Documentation Issues	Transcription error	Yes	206	790	26.08
Radionuclide	SOIL	Holding Times	Holding times were grossly exceeded	Yes	15	790	1.90
Radionuclide	SOIL	Instrument Set-up	Detector efficiency did not meet requirements	Yes	24	790	3.04
Radionuclide	SOIL	Instrument Set-up	Resolution criteria were not met	Yes	24	790	3.04
Radionuclide	SOIL	LCS	LCS recovery > +/- 3 sigma	Yes	24	790	3.04
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	Yes	3	790	0.38
Radionuclide	SOIL	LCS	LCS relative percent error criteria not met	Yes	46	790	5.82
Radionuclide	SOIL	Matrices	Recovery criteria were not met	Yes	4	790	0.51
Radionuclide	SOIL	Matrices	Replicate analysis was not performed	Yes	2	790	0.25
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	Yes	21	790	2.66
Radionuclide	SOIL	Matrices	Replicate recovery criteria were not met	Yes	15	790	1.90

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	No	8	790	1.01
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	8	790	1.01
Radionuclide	SOIL	Other	Sample exceeded efficiency curve weight limit	Yes	1	790	0.13
Radionuclide	SOIL	Other	See hard copy for further explanation	No	1	790	0.13
Radionuclide	SOIL	Other	See hard copy for further explanation	Yes	26	790	3.29
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	No	8	790	1.01
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	Yes	10	790	1.27
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	Yes	269	790	34.05
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	No	4	790	0.51
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	Yes	4	790	0.51
Radionuclide	WATER	Blanks	Blank correction was not performed	No	4	7,089	0.06
Radionuclide	WATER	Blanks	Blank correction was not performed	Yes	6	7,089	0.08
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	No	6	7,089	0.08
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	Yes	19	7,089	0.27
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	No	28	7,089	0.39
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	146	7,089	2.06
Radionuclide	WATER	Calculation Errors	Calculation error	No	32	7,089	0.45
Radionuclide	WATER	Calculation Errors	Calculation error	Yes	47	7,089	0.66
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	Yes	3	7,089	0.04
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	No	12	7,089	0.17
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	134	7,089	1.89
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	No	14	7,089	0.20
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	Yes	23	7,089	0.32
Radionuclide	WATER	Documentation Issues	Key data fields incorrect	Yes	1	7,089	0.01
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	10	7,089	0.14

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	22	7,089	0.31
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	11	7,089	0.16
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	16	7,089	0.23
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	97	7,089	1.37
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	269	7,089	3.79
Radionuclide	WATER	Documentation Issues	Record added by the validator	Yes	4	7,089	0.06
Radionuclide	WATER	Documentation Issues	Sample analysis was not requested	No	1	7,089	0.01
Radionuclide	WATER	Documentation Issues	Sample analysis was not requested	Yes	9	7,089	0.13
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	No	2	7,089	0.03
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	76	7,089	1.07
Radionuclide	WATER	Documentation Issues	Transcription error	No	105	7,089	1.48
Radionuclide	WATER	Documentation Issues	Transcription error	Yes	96	7,089	1.35
Radionuclide	WATER	Holding Times	Holding times were exceeded	No	21	7,089	0.30
Radionuclide	WATER	Holding Times	Holding times were exceeded	Yes	94	7,089	1.33
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	No	8	7,089	0.11
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	Yes	26	7,089	0.37
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	No	1	7,089	0.01
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	Yes	6	7,089	0.08
Radionuclide	WATER	Instrument Set-up	Transformed spectral index external site criteria were not met	No	1	7,089	0.01
Radionuclide	WATER	Instrument Set-up	Transformed spectral index external site criteria were not met	Yes	1	7,089	0.01
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	Yes	3	7,089	0.04
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	No	51	7,089	0.72
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	Yes	67	7,089	0.95
Radionuclide	WATER	LCS	LCS recovery criteria were not met	No	4	7,089	0.06
Radionuclide	WATER	LCS	LCS recovery criteria were not met	Yes	11	7,089	0.16
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	No	39	7,089	0.55
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	Yes	94	7,089	1.33
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	No	2	7,089	0.03
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	Yes	10	7,089	0.14

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	No	11	7,089	0.16
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	20	7,089	0.28
Radionuclide	WATER	Matrices	Recovery criteria were not met	No	7	7,089	0.10
Radionuclide	WATER	Matrices	Recovery criteria were not met	Yes	15	7,089	0.21
Radionuclide	WATER	Matrices	Replicate analysis was not performed	No	1	7,089	0.01
Radionuclide	WATER	Matrices	Replicate analysis was not performed	Yes	29	7,089	0.41
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	No	48	7,089	0.68
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	Yes	170	7,089	2.40
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	No	2	7,089	0.03
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	Yes	1	7,089	0.01
Radionuclide	WATER	Other	Lab results not verified due to unsubmitted data	Yes	7	7,089	0.10
Radionuclide	WATER	Other	QC sample does not meet method requirements	No	27	7,089	0.38
Radionuclide	WATER	Other	QC sample does not meet method requirements	Yes	69	7,089	0.97
Radionuclide	WATER	Other	QC sample frequency does not meet method requirements	Yes	2	7,089	0.03
Radionuclide	WATER	Other	Sample or control analyses not chemically separated	Yes	6	7,089	0.08
Radionuclide	WATER	Other	See hard copy for further explanation	No	98	7,089	1.38
Radionuclide	WATER	Other	See hard copy for further explanation	Yes	145	7,089	2.05
Radionuclide	WATER	Other	Tracer requirements were not met	No	16	7,089	0.23
Radionuclide	WATER	Other	Tracer requirements were not met	Yes	70	7,089	0.99
Radionuclide	WATER	Sample Preparation	Excessive solids on planchet	Yes	2	7,089	0.03
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	13	7,089	0.18
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	18	7,089	0.25
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	No	1	7,089	0.01
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	7	7,089	0.10
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	No	46	7,089	0.65
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	Yes	91	7,089	1.28
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	No	7	7,089	0.10

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	Yes	311	7,089	4.39
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	27	5,330	0.51
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	1	5,330	0.02
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	22	5,330	0.41
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	18	5,330	0.34
SVOC	SOIL	Calibration	Independent calibration verification criteria not met	No	13	5,330	0.24
SVOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	232	5,330	4.35
SVOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	58	5,330	1.09
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	191	5,330	3.58
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	41	5,330	0.77
SVOC	SOIL	Documentation Issues	Transcription error	Yes	1	5,330	0.02
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	71	5,330	1.33
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	11	5,330	0.21
SVOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	4	5,330	0.08
SVOC	SOIL	Other	See hard copy for further explanation	No	143	5,330	2.68
SVOC	SOIL	Other	See hard copy for further explanation	Yes	33	5,330	0.62
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	57	5,330	1.07
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	5	5,330	0.09
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	16	5,066	0.32
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	2	5,066	0.04
SVOC	WATER	Calculation Errors	Calculation error	No	8	5,066	0.16
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	51	5,066	1.01
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	2	5,066	0.04

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	WATER	Calibration	Independent calibration verification criteria not met	No	5	5,066	0.10
SVOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	119	5,066	2.35
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	296	5,066	5.84
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	3	5,066	0.06
SVOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	3	5,066	0.06
SVOC	WATER	Documentation Issues	Record added by the validator	No	41	5,066	0.81
SVOC	WATER	Documentation Issues	Transcription error	No	107	5,066	2.11
SVOC	WATER	Holding Times	Holding times were exceeded	No	314	5,066	6.20
SVOC	WATER	Holding Times	Holding times were exceeded	Yes	3	5,066	0.06
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	No	149	5,066	2.94
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	1	5,066	0.02
SVOC	WATER	Other	Sample results were not validated due to re-analysis	No	3	5,066	0.06
SVOC	WATER	Other	See hard copy for further explanation	No	162	5,066	3.20
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	9	5,066	0.18
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	80	2,873	2.78
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	8	2,873	0.28
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	25	2,873	0.87
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	11	2,873	0.38
VOC	SOIL	Calibration	Independent calibration verification criteria not met	No	3	2,873	0.10
VOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	172	2,873	5.99
VOC	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	9	2,873	0.31

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	168	2,873	5.85
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	9	2,873	0.31
VOC	SOIL	Documentation Issues	Transcription error	No	34	2,873	1.18
VOC	SOIL	Documentation Issues	Transcription error	Yes	3	2,873	0.10
VOC	SOIL	Holding Times	Holding times were exceeded	No	60	2,873	2.09
VOC	SOIL	Holding Times	Holding times were exceeded	Yes	5	2,873	0.17
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	62	2,873	2.16
VOC	SOIL	Other	See hard copy for further explanation	No	12	2,873	0.42
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	62	2,873	2.16
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	32	7,630	0.42
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	19	7,630	0.25
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	132	7,630	1.73
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	9	7,630	0.12
VOC	WATER	Calibration	Independent calibration verification criteria not met	No	3	7,630	0.04
VOC	WATER	Calibration	Independent calibration verification criteria not met	Yes	6	7,630	0.08
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	94	7,630	1.23
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	6	7,630	0.08
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	183	7,630	2.40
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	12	7,630	0.16
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	56	7,630	0.73
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	5	7,630	0.07
VOC	WATER	Documentation Issues	Record added by the validator	No	108	7,630	1.42

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	WATER	Documentation Issues	Record added by the validator	Yes	2	7,630	0.03
VOC	WATER	Documentation Issues	Transcription error	No	651	7,630	8.53
VOC	WATER	Documentation Issues	Transcription error	Yes	16	7,630	0.21
VOC	WATER	Holding Times	Holding times were exceeded	No	359	7,630	4.71
VOC	WATER	Holding Times	Holding times were exceeded	Yes	3	7,630	0.04
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	32	7,630	0.42
VOC	WATER	Internal Standards	Internal standards did not meet criteria	No	53	7,630	0.69
VOC	WATER	LCS	LCS recovery criteria were not met	Yes	1	7,630	0.01
VOC	WATER	Matrices	MS/MSD precision criteria were not met	No	1	7,630	0.01
VOC	WATER	Other	Sample results were not validated due to re-analysis	No	45	7,630	0.59
VOC	WATER	Other	Sample results were not validated due to re-analysis	Yes	1	7,630	0.01
VOC	WATER	Other	See hard copy for further explanation	No	5	7,630	0.07
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	213	7,630	2.79
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	2	7,630	0.03
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	No	57	7,630	0.75
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	3	7,630	0.04
Wet Chemistry	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	3	71	4.23
Wet Chemistry	SOIL	Documentation Issues	Transcription error	No	1	71	1.41
Wet Chemistry	SOIL	Holding Times	Holding times were exceeded	No	1	71	1.41
Wet Chemistry	SOIL	Holding Times	Holding times were exceeded	Yes	2	71	2.82
Wet Chemistry	SOIL	Holding Times	Holding times were grossly exceeded	Yes	3	71	4.23
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	6	71	8.45
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	13	71	18.31
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	20	71	28.17
Wet Chemistry	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	4	71	5.63
Wet Chemistry	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	1	71	1.41
Wet Chemistry	SOIL	Other	Result obtained through dilution	Yes	1	71	1.41

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chemistry	WATER	Blanks	Negative bias indicated in the blanks	No	3	1,639	0.18
Wet Chemistry	WATER	Blanks	Negative bias indicated in the blanks	Yes	3	1,639	0.18
Wet Chemistry	WATER	Calculation Errors	Control limits not assigned correctly	Yes	8	1,639	0.49
Wet Chemistry	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	1	1,639	0.06
Wet Chemistry	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,639	0.06
Wet Chemistry	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	1	1,639	0.06
Wet Chemistry	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	4	1,639	0.24
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1	1,639	0.06
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	30	1,639	1.83
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	2	1,639	0.12
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	No	17	1,639	1.04
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	Yes	16	1,639	0.98
Wet Chemistry	WATER	Documentation Issues	Transcription error	No	3	1,639	0.18
Wet Chemistry	WATER	Documentation Issues	Transcription error	Yes	29	1,639	1.77
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	No	20	1,639	1.22
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	Yes	23	1,639	1.40
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	No	5	1,639	0.31
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	Yes	19	1,639	1.16
Wet Chemistry	WATER	LCS	LCS recovery criteria were not met	No	1	1,639	0.06
Wet Chemistry	WATER	LCS	LCS recovery criteria were not met	Yes	1	1,639	0.06
Wet Chemistry	WATER	Matrices	Duplicate sample precision criteria were not met	No	2	1,639	0.12
Wet Chemistry	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	2	1,639	0.12
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	No	10	1,639	0.61
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	31	1,639	1.89
Wet Chemistry	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	1	1,639	0.06

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Table A2.3.1.6
NW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chemistry	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	11	1,639	0.67
Wet Chemistry	WATER	Other	IDL is older than 3 months from date of analysis	Yes	1	1,639	0.06
Wet Chemistry	WATER	Other	Lab results not verified due to unsubmitted data	Yes	6	1,639	0.37
Wet Chemistry	WATER	Other	Result obtained through dilution	Yes	1	1,639	0.06
Wet Chemistry	WATER	Other	See hard copy for further explanation	No	1	1,639	0.06
Wet Chemistry	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	26	1,639	1.59
Wet Chemistry	WATER	Sample Preparation	Samples were not properly preserved in the field	No	3	1,639	0.18
Wet Chemistry	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	45	1,639	2.75

Table A2.3.2.1
SW AEU - CRA Data V&V Summary

Analyte Group	Matrix	Total No. of V&V Records	Total No. of CRA Records	Percent V&V (%)
Dioxins and Furans	WATER	34	34	100.00
Herbicide	SOIL	79	84	94.05
Herbicide	WATER	111	349	31.81
Metal	SOIL	3,597	3,601	99.89
Metal	WATER	58,190	67,871	85.74
PCB	SOIL	602	679	88.66
PCB	WATER	189	490	38.57
Pesticide	SOIL	1,182	1,425	82.95
Pesticide	WATER	666	2,031	32.79
Radionuclide	SOIL	917	1,137	80.65
Radionuclide	WATER	14,154	25,635	55.21
SVOC	SOIL	4,690	4,930	95.13
SVOC	WATER	6,703	11,221	59.74
VOC	SOIL	3,511	3,699	94.92
VOC	WATER	48,379	63,050	76.73
Wet Chemistry	SOIL	75	141	53.19
Wet Chemistry	WATER	6,589	11,230	58.67
	Total	**149,668**	**197,607**	**75.74%**

Table A2.3.2.2
SW AEU - Summary of Data Estimated or Undetected Due to V&V Determinations

Analyte Group	Matrix	No. of CRA Data Records Qualified	Total No. of V&V CRA Records	Detect?	Percent Qualified (%)
Dioxins and Furans	WATER	1	34	No	2.94
Herbicide	SOIL	5	79	No	6.33
Herbicide	WATER	21	111	No	18.92
Metal	SOIL	764	3,597	Yes	21.24
Metal	SOIL	492	3,597	No	13.68
Metal	WATER	6,605	58,190	No	11.35
Metal	WATER	5,182	58,190	Yes	8.91
PCB	SOIL	2	602	Yes	0.33
PCB	SOIL	13	602	No	2.16
PCB	WATER	14	189	No	7.41
Pesticide	SOIL	68	1,182	No	5.75
Pesticide	SOIL	2	1,182	Yes	0.17
Pesticide	WATER	63	666	No	9.46
Radionuclide	SOIL	3	917	No	0.33
Radionuclide	SOIL	5	917	Yes	0.55
Radionuclide	WATER	78	14,154	No	0.55
Radionuclide	WATER	110	14,154	Yes	0.78
SVOC	SOIL	5	4,690	Yes	0.11
SVOC	SOIL	142	4,690	No	3.03
SVOC	WATER	1,088	6,703	No	16.23
SVOC	WATER	2	6,703	Yes	0.03
VOC	SOIL	26	3,511	Yes	0.74
VOC	SOIL	529	3,511	No	15.07
VOC	WATER	297	48,379	Yes	0.61
VOC	WATER	4,409	48,379	No	9.11
Wet Chemistry	SOIL	40	75	Yes	53.33
Wet Chemistry	SOIL	8	75	No	10.67
Wet Chemistry	WATER	376	6,589	Yes	5.71
Wet Chemistry	WATER	33	6,589	No	0.50
	Total	**20,383**	**149,668**		**13.62%**

Table A2.3.2.3
SW AEU - Summary of Data Qualified as Undetected Due to Blank Contamination

Analyte Group	Matrix	No. of CRA Records Qualified as Undetected	Total No. of CRA Records with Detected Results[a]	Percent Qualified as Undetected
Metal	SOIL	77	2,624	2.93
Metal	WATER	669	29,972	2.23
SVOC	SOIL	2	594	0.34
VOC	SOIL	4	92	4.35
VOC	WATER	13	3,458	0.38
Wet Chemistry	SOIL	4	53	7.55
	Total	**769**	**36,793**	**2.09%**

[a] As determined by the laboratory prior to V&V.

Table A2.3.2.4
SW AEU - Summary of Data Rejected During V&V

Analyte Group	Matrix	Total No. of Rejected Records	Total No. of Records	Percent Rejected (%)
Dioxins and Furans	WATER	2	63	3.17
Herbicide	SOIL	1	134	0.75
Herbicide	WATER	9	160	5.63
Metal	SOIL	56	6,005	0.93
Metal	WATER	807	68,188	1.18
PCB	SOIL	24	1,072	2.24
PCB	WATER	14	469	2.99
Pesticide	SOIL	18	2,294	0.78
Pesticide	WATER	45	1,560	2.88
Radionuclide	SOIL	146	2,487	5.87
Radionuclide	WATER	1,158	17,247	6.71
SVOC	SOIL	20	7,955	0.25
SVOC	WATER	300	9,746	3.08
VOC	SOIL	43	6,608	0.65
VOC	WATER	1,302	54,094	2.41
Wet Chemistry	SOIL	35	178	19.66
Wet Chemistry	WATER	59	7,306	0.81
	Total	**4,039**	**185,566**	**2.18%**

Table A2.3.2.5
SW AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs

Analyte Group	Matrix	No. of Duplicates Failing RPD/DER Criteria	Total No. of Duplicate Pairs	Percent Failure (%)	Field Duplicate Frequency (%)
Herbicide	SOIL	1	7	14.29	8.33
Herbicide	WATER	0	9	0.00	2.58
Metal	SOIL	59	345	17.10	9.58
Metal	WATER	58	1,695	3.42	2.50
PCB	SOIL	0	63	0.00	9.28
Pesticide	SOIL	1	168	0.60	11.79
Pesticide	WATER	0	125	0.00	6.15
Radionuclide	SOIL	1	104	0.96	9.15
Radionuclide	WATER	9	765	1.18	2.98
SVOC	SOIL	56	411	13.63	8.34
SVOC	WATER	0	324	0.00	2.89
VOC	SOIL	4	264	1.52	7.14
VOC	WATER	5	1,459	0.34	2.31
Wet Chemistry	SOIL	1	12	8.33	8.51
Wet Chemistry	WATER	10	251	3.98	2.24

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Dioxins and Furans	WATER	Documentation Issues	Record added by the validator	No	4	34	11.76
Dioxins and Furans	WATER	Documentation Issues	Transcription error	No	6	34	17.65
Dioxins and Furans	WATER	Internal Standards	Internal standards did not meet criteria	No	1	34	2.94
Herbicide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	4	79	5.06
Herbicide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1	79	1.27
Herbicide	SOIL	Holding Times	Holding times were exceeded	No	1	79	1.27
Herbicide	SOIL	Other	Sample results were not validated due to re-analysis	No	1	79	1.27
Herbicide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	2	79	2.53
Herbicide	WATER	Calculation Errors	Calculation error	No	2	111	1.80
Herbicide	WATER	Calibration	Continuing calibration verification criteria were not met	No	1	111	0.90
Herbicide	WATER	Documentation Issues	Record added by the validator	No	8	111	7.21
Herbicide	WATER	Documentation Issues	Transcription error	No	19	111	17.12
Herbicide	WATER	Holding Times	Holding times were exceeded	No	10	111	9.01
Herbicide	WATER	Internal Standards	Internal standards did not meet criteria	No	2	111	1.80
Herbicide	WATER	Other	Lab results not verified due to unsubmitted data	No	1	111	0.90
Herbicide	WATER	Other	See hard copy for further explanation	No	5	111	4.50
Herbicide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	10	111	9.01
Herbicide	WATER	Surrogates	Surrogate recovery criteria were not met	No	2	111	1.80
Metal	SOIL	Blanks	Calibration verification blank contamination	No	96	3,597	2.67
Metal	SOIL	Blanks	Calibration verification blank contamination	Yes	16	3,597	0.44
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	153	3,597	4.25
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	19	3,597	0.53
Metal	SOIL	Blanks	Negative bias indicated in the blanks	No	11	3,597	0.31
Metal	SOIL	Blanks	Negative bias indicated in the blanks	Yes	19	3,597	0.53
Metal	SOIL	Calculation Errors	Control limits not assigned correctly	Yes	1	3,597	0.03
Metal	SOIL	Documentation Issues	Information missing from case narrative	No	6	3,597	0.17
Metal	SOIL	Documentation Issues	Information missing from case narrative	Yes	21	3,597	0.58
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	6	3,597	0.17
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	45	3,597	1.25
Metal	SOIL	Documentation Issues	Missing deliverables (required for validation)	No	1	3,597	0.03
Metal	SOIL	Documentation Issues	Missing deliverables (required for validation)	Yes	1	3,597	0.03

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	38	3,597	1.06
Metal	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	153	3,597	4.25
Metal	SOIL	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	3,597	0.03
Metal	SOIL	Documentation Issues	Transcription error	No	35	3,597	0.97
Metal	SOIL	Documentation Issues	Transcription error	Yes	185	3,597	5.14
Metal	SOIL	Holding Times	Holding times were exceeded	No	10	3,597	0.28
Metal	SOIL	Holding Times	Holding times were exceeded	Yes	22	3,597	0.61
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	Yes	3	3,597	0.08
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	No	29	3,597	0.81
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	Yes	33	3,597	0.92
Metal	SOIL	LCS	LCS recovery criteria were not met	No	92	3,597	2.56
Metal	SOIL	LCS	LCS recovery criteria were not met	Yes	203	3,597	5.64
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	No	52	3,597	1.45
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	Yes	53	3,597	1.47
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	No	2	3,597	0.06
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	53	3,597	1.47
Metal	SOIL	Matrices	LCS/LCSD precision criteria were not met	Yes	63	3,597	1.75
Metal	SOIL	Matrices	MSA calibration correlation coefficient < 0.995	Yes	1	3,597	0.03
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	No	10	3,597	0.28
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	Yes	14	3,597	0.39
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	89	3,597	2.47
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	237	3,597	6.59
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	No	1	3,597	0.03
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	7	3,597	0.19
Metal	SOIL	Matrices	Serial dilution criteria were not met	No	1	3,597	0.03
Metal	SOIL	Matrices	Serial dilution criteria were not met	Yes	74	3,597	2.06
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	No	13	3,597	0.36
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	20	3,597	0.56
Metal	SOIL	Other	Primary standard exceeded the expiration date	Yes	1	3,597	0.03

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Other	Result obtained through dilution	No	1	3,597	0.03
Metal	SOIL	Other	Result obtained through dilution	Yes	4	3,597	0.11
Metal	SOIL	Sample Preparation	Sample pretreatment or preparation method was incorrect	No	5	3,597	0.14
Metal	SOIL	Sample Preparation	Sample pretreatment or preparation method was incorrect	Yes	44	3,597	1.22
Metal	WATER	Blanks	Calibration verification blank contamination	No	1,210	58,190	2.08
Metal	WATER	Blanks	Calibration verification blank contamination	Yes	285	58,190	0.49
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	No	2,409	58,190	4.14
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	1,076	58,190	1.85
Metal	WATER	Blanks	Negative bias indicated in the blanks	No	788	58,190	1.35
Metal	WATER	Blanks	Negative bias indicated in the blanks	Yes	482	58,190	0.83
Metal	WATER	Calculation Errors	Control limits not assigned correctly	No	18	58,190	0.03
Metal	WATER	Calculation Errors	Control limits not assigned correctly	Yes	5	58,190	0.01
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	No	314	58,190	0.54
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	19	58,190	0.03
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	No	17	58,190	0.03
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	19	58,190	0.03
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	No	20	58,190	0.03
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	Yes	50	58,190	0.09
Metal	WATER	Documentation Issues	Information missing from case narrative	No	1	58,190	0.00
Metal	WATER	Documentation Issues	Information missing from case narrative	Yes	1	58,190	0.00
Metal	WATER	Documentation Issues	Key data fields incorrect	No	96	58,190	0.16
Metal	WATER	Documentation Issues	Key data fields incorrect	Yes	538	58,190	0.92
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	144	58,190	0.25
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	182	58,190	0.31
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	No	73	58,190	0.13
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	85	58,190	0.15
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	768	58,190	1.32

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1,706	58,190	2.93
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	15	58,190	0.03
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	8	58,190	0.01
Metal	WATER	Documentation Issues	Original documentation not provided	No	2	58,190	0.00
Metal	WATER	Documentation Issues	Original documentation not provided	Yes	2	58,190	0.00
Metal	WATER	Documentation Issues	Record added by the validator	No	109	58,190	0.19
Metal	WATER	Documentation Issues	Record added by the validator	Yes	131	58,190	0.23
Metal	WATER	Documentation Issues	Transcription error	No	289	58,190	0.50
Metal	WATER	Documentation Issues	Transcription error	Yes	230	58,190	0.40
Metal	WATER	Holding Times	Holding times were exceeded	No	133	58,190	0.23
Metal	WATER	Holding Times	Holding times were exceeded	Yes	105	58,190	0.18
Metal	WATER	Holding Times	Holding times were grossly exceeded	No	1	58,190	0.00
Metal	WATER	Holding Times	Holding times were grossly exceeded	Yes	3	58,190	0.01
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	No	4	58,190	0.01
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	1	58,190	0.00
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	No	61	58,190	0.10
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	Yes	201	58,190	0.35
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	No	183	58,190	0.31
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	Yes	193	58,190	0.33
Metal	WATER	LCS	LCS recovery criteria were not met	No	89	58,190	0.15
Metal	WATER	LCS	LCS recovery criteria were not met	Yes	360	58,190	0.62
Metal	WATER	LCS	Low level check sample recovery criteria were not met	No	194	58,190	0.33
Metal	WATER	LCS	Low level check sample recovery criteria were not met	Yes	295	58,190	0.51
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	26	58,190	0.04
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	32	58,190	0.05
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	No	106	58,190	0.18

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Table A2.3.2.6

SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	174	58,190	0.30
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	No	26	58,190	0.04
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	71	58,190	0.12
Metal	WATER	Matrices	MS/MSD precision criteria were not met	No	6	58,190	0.01
Metal	WATER	Matrices	MS/MSD precision criteria were not met	Yes	2	58,190	0.00
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	No	3	58,190	0.01
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	Yes	6	58,190	0.01
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	No	579	58,190	1.00
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	Yes	239	58,190	0.41
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	No	630	58,190	1.08
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	599	58,190	1.03
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	No	7	58,190	0.01
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	23	58,190	0.04
Metal	WATER	Matrices	Serial dilution criteria were not met	No	17	58,190	0.03
Metal	WATER	Matrices	Serial dilution criteria were not met	Yes	922	58,190	1.58
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	No	2	58,190	0.00
Metal	WATER	Other	Analysis was not requested according to the statement of work	No	2	58,190	0.00
Metal	WATER	Other	Analysis was not requested according to the statement of work	Yes	1	58,190	0.00
Metal	WATER	Other	IDL is older than 3 months from date of analysis	No	311	58,190	0.53
Metal	WATER	Other	IDL is older than 3 months from date of analysis	Yes	824	58,190	1.42
Metal	WATER	Other	Incorrect analysis sequence	No	12	58,190	0.02
Metal	WATER	Other	Incorrect analysis sequence	Yes	21	58,190	0.04
Metal	WATER	Other	QC sample frequency does not meet method requirements	No	7	58,190	0.01
Metal	WATER	Other	QC sample frequency does not meet method requirements	Yes	10	58,190	0.02
Metal	WATER	Other	Result obtained through dilution	No	4	58,190	0.01
Metal	WATER	Other	Result obtained through dilution	Yes	2	58,190	0.00
Metal	WATER	Other	See hard copy for further explanation	No	510	58,190	0.88
Metal	WATER	Other	See hard copy for further explanation	Yes	666	58,190	1.14
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	No	389	58,190	0.67
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	1,197	58,190	2.06
Metal	WATER	Sensitivity	IDL changed due to a significant figure discrepancy	No	2	58,190	0.00

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
PCB	SOIL	Calculation Errors	Calculation error	Yes	1	602	0.17
PCB	SOIL	Confirmation	Confirmation percent difference criteria not met	Yes	1	602	0.17
PCB	SOIL	Documentation Issues	Transcription error	Yes	1	602	0.17
PCB	SOIL	Other	See hard copy for further explanation	Yes	1	602	0.17
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	No	19	602	3.16
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	2	602	0.33
PCB	WATER	Documentation Issues	Record added by the validator	No	28	189	14.81
PCB	WATER	Holding Times	Holding times were exceeded	No	7	189	3.70
PCB	WATER	Surrogates	Surrogate recovery criteria were not met	No	7	189	3.70
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	28	1,182	2.37
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,182	0.08
Pesticide	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1	1,182	0.08
Pesticide	SOIL	Documentation Issues	Transcription error	No	47	1,182	3.98
Pesticide	SOIL	Holding Times	Holding times were exceeded	No	1	1,182	0.08
Pesticide	SOIL	Other	Sample results were not validated due to re-analysis	No	1	1,182	0.08
Pesticide	SOIL	Other	See hard copy for further explanation	No	1	1,182	0.08
Pesticide	SOIL	Other	See hard copy for further explanation	Yes	1	1,182	0.08
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	79	1,182	6.68
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	3	1,182	0.25
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	No	13	666	1.95
Pesticide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	1	666	0.15
Pesticide	WATER	Documentation Issues	Record added by the validator	No	88	666	13.21
Pesticide	WATER	Documentation Issues	Transcription error	No	5	666	0.75
Pesticide	WATER	Holding Times	Holding times were exceeded	No	24	666	3.60
Pesticide	WATER	Internal Standards	Internal standards did not meet criteria	No	3	666	0.45
Pesticide	WATER	Other	Lab results not verified due to unsubmitted data	No	1	666	0.15
Pesticide	WATER	Other	See hard copy for further explanation	No	7	666	1.05
Pesticide	WATER	Other	See hard copy for further explanation	Yes	2	666	0.30
Pesticide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	12	666	1.80
Pesticide	WATER	Surrogates	Surrogate recovery criteria were not met	No	21	666	3.15

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	2	917	0.22
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	57	917	6.22
Radionuclide	SOIL	Calculation Errors	Calculation error	No	8	917	0.87
Radionuclide	SOIL	Calculation Errors	Calculation error	Yes	15	917	1.64
Radionuclide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	103	917	11.23
Radionuclide	SOIL	Documentation Issues	Record added by the validator	Yes	3	917	0.33
Radionuclide	SOIL	Documentation Issues	Results were not included on Data Summary Table	No	7	917	0.76
Radionuclide	SOIL	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	150	917	16.36
Radionuclide	SOIL	Documentation Issues	Transcription error	No	7	917	0.76
Radionuclide	SOIL	Documentation Issues	Transcription error	Yes	154	917	16.79
Radionuclide	SOIL	Instrument Set-up	Detector efficiency did not meet requirements	Yes	4	917	0.44
Radionuclide	SOIL	Instrument Set-up	Resolution criteria were not met	Yes	5	917	0.55
Radionuclide	SOIL	LCS	LCS recovery > +/- 3 sigma	Yes	20	917	2.18
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	No	1	917	0.11
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	Yes	20	917	2.18
Radionuclide	SOIL	LCS	LCS relative percent error criteria not met	Yes	23	917	2.51
Radionuclide	SOIL	Matrices	Recovery criteria were not met	Yes	4	917	0.44
Radionuclide	SOIL	Matrices	Replicate analysis was not performed	Yes	1	917	0.11
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	Yes	17	917	1.85
Radionuclide	SOIL	Matrices	Replicate recovery criteria were not met	Yes	8	917	0.87
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	No	3	917	0.33
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	1	917	0.11
Radionuclide	SOIL	Other	QC sample does not meet method requirements	Yes	1	917	0.11
Radionuclide	SOIL	Other	Sample exceeded efficiency curve weight limit	Yes	2	917	0.22
Radionuclide	SOIL	Other	See hard copy for further explanation	No	1	917	0.11
Radionuclide	SOIL	Other	See hard copy for further explanation	Yes	14	917	1.53
Radionuclide	SOIL	Sensitivity	Incorrect reported activity or MDA	No	3	917	0.33
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	No	1	917	0.11
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	Yes	8	917	0.87
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	No	3	917	0.33
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	Yes	219	917	23.88
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	No	1	917	0.11
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	Yes	1	917	0.11

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Blanks	Blank correction was not performed	No	5	14,154	0.04
Radionuclide	WATER	Blanks	Blank correction was not performed	Yes	3	14,154	0.02
Radionuclide	WATER	Blanks	Blank data not submitted	Yes	4	14,154	0.03
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	No	11	14,154	0.08
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	Yes	102	14,154	0.72
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	No	154	14,154	1.09
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	328	14,154	2.32
Radionuclide	WATER	Calculation Errors	Calculation error	No	132	14,154	0.93
Radionuclide	WATER	Calculation Errors	Calculation error	Yes	69	14,154	0.49
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	No	47	14,154	0.33
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	Yes	9	14,154	0.06
Radionuclide	WATER	Calibration	Calibration requirements affecting data quality have not been met	No	1	14,154	0.01
Radionuclide	WATER	Calibration	Calibration requirements affecting data quality have not been met	Yes	1	14,154	0.01
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	No	202	14,154	1.43
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	898	14,154	6.34
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	No	32	14,154	0.23
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	Yes	50	14,154	0.35
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	12	14,154	0.08
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	35	14,154	0.25
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	27	14,154	0.19
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	15	14,154	0.11
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	167	14,154	1.18
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	388	14,154	2.74
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	4	14,154	0.03
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	5	14,154	0.04
Radionuclide	WATER	Documentation Issues	Record added by the validator	Yes	46	14,154	0.32
Radionuclide	WATER	Documentation Issues	Sample analysis was not requested	No	9	14,154	0.06

Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	No	25	14,154	0.18
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	914	14,154	6.46
Radionuclide	WATER	Documentation Issues	Transcription error	No	413	14,154	2.92
Radionuclide	WATER	Documentation Issues	Transcription error	Yes	386	14,154	2.73
Radionuclide	WATER	Holding Times	Holding times were exceeded	No	50	14,154	0.35
Radionuclide	WATER	Holding Times	Holding times were exceeded	Yes	95	14,154	0.67
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	No	16	14,154	0.11
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	Yes	25	14,154	0.18
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	No	3	14,154	0.02
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	Yes	14	14,154	0.10
Radionuclide	WATER	Instrument Set-up	Transformed spectral index external site criteria were not met	No	2	14,154	0.01
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	No	16	14,154	0.11
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	Yes	28	14,154	0.20
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	No	330	14,154	2.33
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	Yes	254	14,154	1.79
Radionuclide	WATER	LCS	LCS recovery criteria were not met	No	24	14,154	0.17
Radionuclide	WATER	LCS	LCS recovery criteria were not met	Yes	45	14,154	0.32
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	No	108	14,154	0.76
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	Yes	270	14,154	1.91
Radionuclide	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	1	14,154	0.01
Radionuclide	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	1	14,154	0.01
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	No	4	14,154	0.03
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	Yes	8	14,154	0.06
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	No	3	14,154	0.02
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	20	14,154	0.14
Radionuclide	WATER	Matrices	Laboratory duplicate was not analyzed	No	4	14,154	0.03
Radionuclide	WATER	Matrices	Laboratory duplicate was not analyzed	Yes	2	14,154	0.01
Radionuclide	WATER	Matrices	Recovery criteria were not met	No	34	14,154	0.24
Radionuclide	WATER	Matrices	Recovery criteria were not met	Yes	35	14,154	0.25
Radionuclide	WATER	Matrices	Replicate analysis was not performed	No	10	14,154	0.07

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Matrices	Replicate analysis was not performed	Yes	154	14,154	1.09
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	No	175	14,154	1.24
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	Yes	335	14,154	2.37
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	No	1	14,154	0.01
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	Yes	32	14,154	0.23
Radionuclide	WATER	Other	Lab results not verified due to unsubmitted data	No	1	14,154	0.01
Radionuclide	WATER	Other	QC sample does not meet method requirements	No	34	14,154	0.24
Radionuclide	WATER	Other	QC sample does not meet method requirements	Yes	56	14,154	0.40
Radionuclide	WATER	Other	Sample exceeded efficiency curve weight limit	No	3	14,154	0.02
Radionuclide	WATER	Other	Sample exceeded efficiency curve weight limit	Yes	6	14,154	0.04
Radionuclide	WATER	Other	Sample or control analyses not chemically separated	No	1	14,154	0.01
Radionuclide	WATER	Other	Sample or control analyses not chemically separated	Yes	5	14,154	0.04
Radionuclide	WATER	Other	Sample results were not validated due to re-analysis	No	1	14,154	0.01
Radionuclide	WATER	Other	Sample results were not validated due to re-analysis	Yes	4	14,154	0.03
Radionuclide	WATER	Other	See hard copy for further explanation	No	150	14,154	1.06
Radionuclide	WATER	Other	See hard copy for further explanation	Yes	204	14,154	1.44
Radionuclide	WATER	Other	Tracer requirements were not met	No	36	14,154	0.25
Radionuclide	WATER	Other	Tracer requirements were not met	Yes	62	14,154	0.44
Radionuclide	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	2	14,154	0.01
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	29	14,154	0.20
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	19	14,154	0.13
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	No	22	14,154	0.16
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	4	14,154	0.03
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	No	93	14,154	0.66
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	Yes	201	14,154	1.42
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	No	20	14,154	0.14
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	Yes	1,214	14,154	8.58
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	21	4,690	0.45
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	2	4,690	0.04
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	42	4,690	0.90
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	11	4,690	0.23
SVOC	SOIL	Calibration	Independent calibration verification criteria not met	No	11	4,690	0.23

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	47	4,690	1.00
SVOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	12	4,690	0.26
SVOC	SOIL	Documentation Issues	Transcription error	No	4	4,690	0.09
SVOC	SOIL	Documentation Issues	Transcription error	Yes	19	4,690	0.41
SVOC	SOIL	Holding Times	Holding times were exceeded	No	47	4,690	1.00
SVOC	SOIL	Holding Times	Holding times were exceeded	Yes	12	4,690	0.26
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	35	4,690	0.75
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	10	4,690	0.21
SVOC	SOIL	LCS	LCS recovery criteria were not met	No	1	4,690	0.02
SVOC	SOIL	Matrices	MS/MSD precision criteria were not met	No	10	4,690	0.21
SVOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	1	4,690	0.02
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	No	41	4,690	0.87
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	25	4,690	0.53
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	109	4,690	2.32
SVOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	11	4,690	0.23
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	18	6,703	0.27
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	2	6,703	0.03
SVOC	WATER	Calculation Errors	Calculation error	No	17	6,703	0.25
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	72	6,703	1.07
SVOC	WATER	Calibration	Independent calibration verification criteria not met	No	24	6,703	0.36
SVOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	33	6,703	0.49
SVOC	WATER	Documentation Issues	No mass spectra were provided	No	1	6,703	0.01
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	71	6,703	1.06
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1	6,703	0.01
SVOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	8	6,703	0.12
SVOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	6,703	0.01
SVOC	WATER	Documentation Issues	Original documentation not provided	No	12	6,703	0.18
SVOC	WATER	Documentation Issues	Record added by the validator	No	327	6,703	4.88

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	WATER	Documentation Issues	Record added by the validator	Yes	2	6,703	0.03
SVOC	WATER	Documentation Issues	Transcription error	No	454	6,703	6.77
SVOC	WATER	Holding Times	Holding times were exceeded	No	457	6,703	6.82
SVOC	WATER	Holding Times	Holding times were exceeded	Yes	1	6,703	0.01
SVOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	3	6,703	0.04
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	No	139	6,703	2.07
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	1	6,703	0.01
SVOC	WATER	LCS	LCS recovery criteria were not met	No	77	6,703	1.15
SVOC	WATER	Other	Lab results not verified due to unsubmitted data	No	55	6,703	0.82
SVOC	WATER	Other	Lab results not verified due to unsubmitted data	Yes	1	6,703	0.01
SVOC	WATER	Other	Sample results were not validated due to re-analysis	No	12	6,703	0.18
SVOC	WATER	Other	See hard copy for further explanation	No	348	6,703	5.19
SVOC	WATER	Other	See hard copy for further explanation	Yes	1	6,703	0.01
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	668	6,703	9.97
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	4	6,703	0.06
SVOC	WATER	Surrogates	Surrogate recovery criteria were not met	No	33	6,703	0.49
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	63	3,511	1.79
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	14	3,511	0.40
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	102	3,511	2.91
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	11	3,511	0.31
VOC	SOIL	Calibration	Independent calibration verification criteria not met	No	5	3,511	0.14
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	No	118	3,511	3.36
VOC	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	5	3,511	0.14
VOC	SOIL	Documentation Issues	Transcription error	No	3	3,511	0.09
VOC	SOIL	Documentation Issues	Transcription error	Yes	1	3,511	0.03
VOC	SOIL	Holding Times	Holding times were exceeded	No	4	3,511	0.11
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	293	3,511	8.35
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	6	3,511	0.17
VOC	SOIL	Matrices	MS/MSD precision criteria were not met	No	121	3,511	3.45
VOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	1	3,511	0.03
VOC	SOIL	Other	Sample results were not validated due to re-analysis	No	35	3,511	1.00

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	5	3,511	0.14
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	No	98	3,511	2.79
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	16	3,511	0.46
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	214	48,379	0.44
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	82	48,379	0.17
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	236	48,379	0.49
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	70	48,379	0.14
VOC	WATER	Calibration	Independent calibration verification criteria not met	No	89	48,379	0.18
VOC	WATER	Calibration	Independent calibration verification criteria not met	Yes	17	48,379	0.04
VOC	WATER	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	3	48,379	0.01
VOC	WATER	Calibration	Result exceeded linear range of measurement system	Yes	14	48,379	0.03
VOC	WATER	Confirmation	Results were not confirmed	No	3	48,379	0.01
VOC	WATER	Confirmation	Results were not confirmed	Yes	2	48,379	0.00
VOC	WATER	Documentation Issues	Information missing from case narrative	No	30	48,379	0.06
VOC	WATER	Documentation Issues	Information missing from case narrative	Yes	1	48,379	0.00
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	754	48,379	1.56
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	69	48,379	0.14
VOC	WATER	Documentation Issues	Missing deliverables (required for validation)	No	61	48,379	0.13
VOC	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	3	48,379	0.01
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	2,228	48,379	4.61
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	172	48,379	0.36
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	64	48,379	0.13
VOC	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	48,379	0.00
VOC	WATER	Documentation Issues	Original documentation not provided	No	234	48,379	0.48
VOC	WATER	Documentation Issues	Original documentation not provided	Yes	10	48,379	0.02
VOC	WATER	Documentation Issues	Record added by the validator	No	183	48,379	0.38
VOC	WATER	Documentation Issues	Record added by the validator	Yes	8	48,379	0.02
VOC	WATER	Documentation Issues	Transcription error	No	2,916	48,379	6.03

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	WATER	Documentation Issues	Transcription error	Yes	488	48,379	1.01
VOC	WATER	Holding Times	Holding times were exceeded	No	2,907	48,379	6.01
VOC	WATER	Holding Times	Holding times were exceeded	Yes	15	48,379	0.03
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	129	48,379	0.27
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	Yes	14	48,379	0.03
VOC	WATER	Internal Standards	Internal standards did not meet criteria	No	139	48,379	0.29
VOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	3	48,379	0.01
VOC	WATER	LCS	LCS recovery criteria were not met	No	825	48,379	1.71
VOC	WATER	LCS	LCS recovery criteria were not met	Yes	106	48,379	0.22
VOC	WATER	Matrices	MS/MSD precision criteria were not met	No	12	48,379	0.02
VOC	WATER	Matrices	MS/MSD precision criteria were not met	Yes	1	48,379	0.00
VOC	WATER	Other	Lab results not verified due to unsubmitted data	No	1	48,379	0.00
VOC	WATER	Other	Sample results were not validated due to re-analysis	No	218	48,379	0.45
VOC	WATER	Other	Sample results were not validated due to re-analysis	Yes	79	48,379	0.16
VOC	WATER	Other	See hard copy for further explanation	No	483	48,379	1.00
VOC	WATER	Other	See hard copy for further explanation	Yes	109	48,379	0.23
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	1,046	48,379	2.16
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	65	48,379	0.13
VOC	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	1	48,379	0.00
VOC	WATER	Sensitivity	Instrument detection limit > the associated RDL	No	2	48,379	0.00
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	No	128	48,379	0.26
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	23	48,379	0.05
Wet Chemistry	SOIL	Blanks	Calibration verification blank contamination	No	4	75	5.33
Wet Chemistry	SOIL	Blanks	Calibration verification blank contamination	Yes	2	75	2.67
Wet Chemistry	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	2	75	2.67
Wet Chemistry	SOIL	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1	75	1.33
Wet Chemistry	SOIL	Documentation Issues	Transcription error	No	5	75	6.67
Wet Chemistry	SOIL	Holding Times	Holding times were exceeded	Yes	5	75	6.67
Wet Chemistry	SOIL	Holding Times	Holding times were grossly exceeded	No	4	75	5.33
Wet Chemistry	SOIL	LCS	LCS recovery criteria were not met	Yes	1	75	1.33
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	2	75	2.67
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	11	75	14.67
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	29	75	38.67
Wet Chemistry	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	1	75	1.33

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chemistry	WATER	Blanks	Calibration verification blank contamination	No	4	6,589	0.06
Wet Chemistry	WATER	Blanks	Method, preparation, or reagent blank contamination	No	1	6,589	0.02
Wet Chemistry	WATER	Calculation Errors	Calculation error	Yes	3	6,589	0.05
Wet Chemistry	WATER	Calculation Errors	Control limits not assigned correctly	Yes	87	6,589	1.32
Wet Chemistry	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	7	6,589	0.11
Wet Chemistry	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	20	6,589	0.30
Wet Chemistry	WATER	Calibration	Result exceeded linear range of measurement system	Yes	8	6,589	0.12
Wet Chemistry	WATER	Documentation Issues	Key data fields incorrect	No	1	6,589	0.02
Wet Chemistry	WATER	Documentation Issues	Key data fields incorrect	Yes	1	6,589	0.02
Wet Chemistry	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	10	6,589	0.15
Wet Chemistry	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	17	6,589	0.26
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	13	6,589	0.20
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	236	6,589	3.58
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	4	6,589	0.06
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	10	6,589	0.15
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	No	26	6,589	0.39
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	Yes	57	6,589	0.87
Wet Chemistry	WATER	Documentation Issues	Transcription error	Yes	108	6,589	1.64
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	No	14	6,589	0.21
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	Yes	61	6,589	0.93
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	No	7	6,589	0.11
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	Yes	4	6,589	0.06
Wet Chemistry	WATER	LCS	LCS recovery criteria were not met	Yes	1	6,589	0.02
Wet Chemistry	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	2	6,589	0.03
Wet Chemistry	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	7	6,589	0.11
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	No	6	6,589	0.09
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	202	6,589	3.07
Wet Chemistry	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	5	6,589	0.08
Wet Chemistry	WATER	Matrices	Site samples were not used for sample matrix QC	No	2	6,589	0.03

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Table A2.3.2.6
SW AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chemistry	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	56	6,589	0.85
Wet Chemistry	WATER	Other	Lab results not verified due to unsubmitted data	Yes	12	6,589	0.18
Wet Chemistry	WATER	Other	Result obtained through dilution	Yes	15	6,589	0.23
Wet Chemistry	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	No	1	6,589	0.02
Wet Chemistry	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	68	6,589	1.03
Wet Chemistry	WATER	Sample Preparation	Samples were not properly preserved in the field	No	7	6,589	0.11
Wet Chemistry	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	256	6,589	3.89

Table A2.3.3.1
WC AEU - CRA Data V&V Summary

Analyte Group	Matrix	Total No. of V&V Records	Total No. of CRA Records	Percent V&V (%)
Dioxins and Furans	SOIL	34	34	100.00
Dioxins and Furans	WATER	14	14	100.00
Herbicide	SOIL	60	63	95.24
Herbicide	WATER	160	330	48.48
Metal	SOIL	2,472	2,482	99.60
Metal	WATER	20,941	25,306	82.75
PCB	SOIL	398	475	83.79
PCB	WATER	686	889	77.17
Pesticide	SOIL	1,088	1,263	86.14
Pesticide	WATER	2,110	3,055	69.07
Radionuclide	SOIL	771	860	89.65
Radionuclide	WATER	5,037	10,078	49.98
SVOC	SOIL	3,520	3,590	98.05
SVOC	WATER	6,669	9,348	71.34
VOC	SOIL	1,854	2,099	88.33
VOC	WATER	10,127	14,426	70.20
Wet Chemistry	SOIL	76	88	86.36
Wet Chemistry	WATER	1,863	2,591	71.90
	Total	**57,880**	**76,991**	**75.18%**

Table A2.3.3.2
WC AEU - Summary of Data Estimated or Undetected Due to V&V Determinations

Analyte Group	Matrix	No. of CRA Data Records Qualified	Total No. of V&V CRA Records	Detect?	Percent Qualified (%)
Herbicide	SOIL	13	60	No	21.67
Herbicide	WATER	36	160	No	22.50
Metal	SOIL	334	2,472	No	13.51
Metal	SOIL	797	2,472	Yes	32.24
Metal	WATER	2,252	20,941	No	10.75
Metal	WATER	2,173	20,941	Yes	10.38
PCB	SOIL	47	398	No	11.81
PCB	SOIL	1	398	Yes	0.25
PCB	WATER	42	686	No	6.12
Pesticide	SOIL	147	1,088	No	13.51
Pesticide	WATER	163	2,110	No	7.73
Radionuclide	SOIL	2	771	Yes	0.26
Radionuclide	WATER	20	5,037	No	0.40
Radionuclide	WATER	42	5,037	Yes	0.83
SVOC	SOIL	638	3,520	No	18.13
SVOC	SOIL	15	3,520	Yes	0.43
SVOC	WATER	370	6,669	No	5.55
VOC	SOIL	272	1,854	No	14.67
VOC	SOIL	19	1,854	Yes	1.02
VOC	WATER	858	10,127	No	8.47
VOC	WATER	41	10,127	Yes	0.40
Wet Chemistry	SOIL	8	76	No	10.53
Wet Chemistry	SOIL	37	76	Yes	48.68
Wet Chemistry	WATER	34	1,863	No	1.83
Wet Chemistry	WATER	97	1,863	Yes	5.21
	Total	**8,458**	**57,880**		**14.61%**

Table A2.3.3.3
WC AEU - Summary of Data Qualified as Undetected Due to Blank Contamination

Analyte Group	Matrix	No. of CRA Records Qualified as Undetected	Total No. of CRA Records with Detected Results[a]	Percent Qualified as Undetected
Metal	WATER	349	10,825	3.22
Metal	SOIL	15	1,821	0.82
VOC	WATER	1	212	0.47
	Total	**365**	**12,858**	**2.84%**

[a] As determined by the laboratory prior to V&V.

Table A2.3.3.4
WC AEU - Summary of Data Rejected During V&V

Analyte Group	Matrix	Total No. of Rejected Records	Total No. of Records	Percent Rejected (%)
Dioxins and Furans	SOIL	0	34	0.00
Dioxins and Furans	WATER	2	27	7.41
Herbicide	SOIL	9	112	8.04
Herbicide	WATER	9	272	3.31
Metal	SOIL	190	4,935	3.85
Metal	WATER	2,009	43,506	4.62
PCB	SOIL	66	791	8.34
PCB	WATER	14	1,449	0.97
Pesticide	SOIL	205	2,275	9.01
Pesticide	WATER	46	4,408	1.04
Radionuclide	SOIL	321	2,093	15.34
Radionuclide	WATER	1,784	10,798	16.52
SVOC	SOIL	568	6,622	8.58
SVOC	WATER	180	13,014	1.38
VOC	SOIL	415	4,542	9.14
VOC	WATER	880	23,041	3.82
Wet Chemistry	SOIL	12	158	7.59
Wet Chemistry	WATER	25	3,741	0.67
	Total	**6,735**	**121,818**	**5.53%**

Table A2.3.3.5
WC AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs

Analyte Group	Matrix	No. of Duplicates Failing RPD/DER Criteria	Total No. of Duplicate Pairs	Percent Failure (%)	Field Duplicate Frequency (%)
Metal	SOIL	34	139	24.46	5.60
Metal	WATER	19	1,030	1.84	4.07
Pesticide	SOIL	0	45	0.00	3.56
Radionuclide	SOIL	3	58	5.17	6.74
Radionuclide	WATER	4	338	1.18	3.35
SVOC	SOIL	0	173	0.00	4.82
VOC	SOIL	1	108	0.93	5.15
VOC	WATER	0	597	0.00	4.14
Wet Chemistry	SOIL	0	9	0.00	10.23
Wet Chemistry	WATER	0	95	0.00	3.67

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Dioxins and Furans	WATER	Documentation Issues	Record added by the validator	No	2	14	14.29
Dioxins and Furans	WATER	Documentation Issues	Transcription error	No	3	14	21.43
Herbicide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	2	60	3.33
Herbicide	SOIL	Holding Times	Holding times were exceeded	No	3	60	5.00
Herbicide	SOIL	Internal Standards	Internal standards did not meet criteria	No	2	60	3.33
Herbicide	SOIL	Other	Sample results were not validated due to re-analysis	No	1	60	1.67
Herbicide	SOIL	Other	See hard copy for further explanation	No	6	60	10.00
Herbicide	WATER	Documentation Issues	Record added by the validator	No	1	160	0.63
Herbicide	WATER	Documentation Issues	Transcription error	No	21	160	13.13
Herbicide	WATER	Holding Times	Holding times were exceeded	No	1	160	0.63
Herbicide	WATER	Internal Standards	Internal standards did not meet criteria	No	1	160	0.63
Herbicide	WATER	Other	See hard copy for further explanation	No	34	160	21.25
Metal	SOIL	Blanks	Calibration verification blank contamination	No	17	2,472	0.69
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	81	2,472	3.28
Metal	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	19	2,472	0.77
Metal	SOIL	Blanks	Negative bias indicated in the blanks	No	18	2,472	0.73
Metal	SOIL	Blanks	Negative bias indicated in the blanks	Yes	42	2,472	1.70
Metal	SOIL	Calibration	Calibration correlation coefficient did not meet requirements	Yes	9	2,472	0.36
Metal	SOIL	Calibration	Continuing calibration verification criteria were not met	No	2	2,472	0.08
Metal	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	8	2,472	0.32
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	No	3	2,472	0.12
Metal	SOIL	Documentation Issues	Missing deliverables (not required for validation)	Yes	20	2,472	0.81
Metal	SOIL	Documentation Issues	Transcription error	No	4	2,472	0.16
Metal	SOIL	Documentation Issues	Transcription error	Yes	57	2,472	2.31
Metal	SOIL	Holding Times	Holding times were exceeded	No	3	2,472	0.12
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	No	1	2,472	0.04
Metal	SOIL	Instrument Set-up	Interference was indicated in the interference check sample	Yes	5	2,472	0.20
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	No	19	2,472	0.77
Metal	SOIL	LCS	CRDL check sample recovery criteria were not met	Yes	19	2,472	0.77
Metal	SOIL	LCS	LCS recovery criteria were not met	No	105	2,472	4.25
Metal	SOIL	LCS	LCS recovery criteria were not met	Yes	374	2,472	15.13
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	No	24	2,472	0.97
Metal	SOIL	LCS	Low level check sample recovery criteria were not met	Yes	5	2,472	0.20
Metal	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	54	2,472	2.18
Metal	SOIL	Matrices	LCS/LCSD precision criteria were not met	Yes	1	2,472	0.04
Metal	SOIL	Matrices	MSA calibration correlation coefficient < 0.995	Yes	2	2,472	0.08
Metal	SOIL	Matrices	Percent solids < 30 percent	No	20	2,472	0.81
Metal	SOIL	Matrices	Percent solids < 30 percent	Yes	152	2,472	6.15
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	No	4	2,472	0.16
Metal	SOIL	Matrices	Post-digestion MS did not meet control criteria	Yes	21	2,472	0.85
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	55	2,472	2.22
Metal	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	168	2,472	6.80
Metal	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	2	2,472	0.08

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	SOIL	Matrices	Serial dilution criteria were not met	Yes	34	2,472	1.38
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	No	6	2,472	0.24
Metal	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	38	2,472	1.54
Metal	SOIL	Other	Result obtained through dilution	Yes	2	2,472	0.08
Metal	SOIL	Other	See hard copy for further explanation	No	30	2,472	1.21
Metal	SOIL	Other	See hard copy for further explanation	Yes	80	2,472	3.24
Metal	WATER	Blanks	Calibration verification blank contamination	No	612	20,941	2.92
Metal	WATER	Blanks	Calibration verification blank contamination	Yes	88	20,941	0.42
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	No	470	20,941	2.24
Metal	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	819	20,941	3.91
Metal	WATER	Blanks	Negative bias indicated in the blanks	No	283	20,941	1.35
Metal	WATER	Blanks	Negative bias indicated in the blanks	Yes	170	20,941	0.81
Metal	WATER	Calculation Errors	Calculation error	No	5	20,941	0.02
Metal	WATER	Calculation Errors	Calculation error	Yes	1	20,941	0.00
Metal	WATER	Calculation Errors	Control limits not assigned correctly	No	19	20,941	0.09
Metal	WATER	Calculation Errors	Control limits not assigned correctly	Yes	16	20,941	0.08
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	No	128	20,941	0.61
Metal	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	4	20,941	0.02
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	No	4	20,941	0.02
Metal	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	8	20,941	0.04
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	No	1	20,941	0.00
Metal	WATER	Calibration	Frequency or sequencing verification criteria not met	Yes	9	20,941	0.04
Metal	WATER	Documentation Issues	Key data fields incorrect	No	127	20,941	0.61
Metal	WATER	Documentation Issues	Key data fields incorrect	Yes	632	20,941	3.02
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	95	20,941	0.45
Metal	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	113	20,941	0.54
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	No	18	20,941	0.09
Metal	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	20	20,941	0.10
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	221	20,941	1.06
Metal	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	366	20,941	1.75
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	2	20,941	0.01
Metal	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	3	20,941	0.01
Metal	WATER	Documentation Issues	Record added by the validator	No	101	20,941	0.48
Metal	WATER	Documentation Issues	Record added by the validator	Yes	120	20,941	0.57
Metal	WATER	Documentation Issues	Reported data does not agree with raw data	No	1	20,941	0.00
Metal	WATER	Documentation Issues	Transcription error	No	357	20,941	1.70
Metal	WATER	Documentation Issues	Transcription error	Yes	362	20,941	1.73

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Metal	WATER	Holding Times	Holding times were exceeded	No	89	20,941	0.43
Metal	WATER	Holding Times	Holding times were exceeded	Yes	46	20,941	0.22
Metal	WATER	Holding Times	Holding times were grossly exceeded	Yes	4	20,941	0.02
Metal	WATER	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	3	20,941	0.01
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	No	5	20,941	0.02
Metal	WATER	Instrument Set-up	Interference was indicated in the interference check sample	Yes	52	20,941	0.25
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	No	181	20,941	0.86
Metal	WATER	LCS	CRDL check sample recovery criteria were not met	Yes	149	20,941	0.71
Metal	WATER	LCS	LCS recovery criteria were not met	No	96	20,941	0.46
Metal	WATER	LCS	LCS recovery criteria were not met	Yes	167	20,941	0.80
Metal	WATER	LCS	Low level check sample recovery criteria were not met	No	98	20,941	0.47
Metal	WATER	LCS	Low level check sample recovery criteria were not met	Yes	147	20,941	0.70
Metal	WATER	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	2	20,941	0.01
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	No	19	20,941	0.09
Metal	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	76	20,941	0.36
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	No	19	20,941	0.09
Metal	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	41	20,941	0.20
Metal	WATER	Matrices	MS/MSD precision criteria were not met	No	8	20,941	0.04
Metal	WATER	Matrices	MSA calibration correlation coefficient < 0.995	Yes	1	20,941	0.00
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	No	247	20,941	1.18
Metal	WATER	Matrices	Post-digestion MS did not meet control criteria	Yes	24	20,941	0.11
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	No	280	20,941	1.34
Metal	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	239	20,941	1.14
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	No	2	20,941	0.01
Metal	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	15	20,941	0.07
Metal	WATER	Matrices	Serial dilution criteria were not met	No	14	20,941	0.07
Metal	WATER	Matrices	Serial dilution criteria were not met	Yes	333	20,941	1.59
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	No	6	20,941	0.03
Metal	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	22	20,941	0.11
Metal	WATER	Other	IDL is older than 3 months from date of analysis	No	236	20,941	1.13
Metal	WATER	Other	IDL is older than 3 months from date of analysis	Yes	476	20,941	2.27
Metal	WATER	Other	Result obtained through dilution	Yes	1	20,941	0.00
Metal	WATER	Other	See hard copy for further explanation	No	14	20,941	0.07
Metal	WATER	Other	See hard copy for further explanation	Yes	34	20,941	0.16
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	No	173	20,941	0.83
Metal	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	318	20,941	1.52
Metal	WATER	Sensitivity	IDL changed due to a significant figure discrepancy	No	5	20,941	0.02
Metal	WATER	Sensitivity	Instrument detection limit > the associated RDL	Yes	1	20,941	0.00
PCB	SOIL	Documentation Issues	Transcription error	No	6	398	1.51
PCB	SOIL	Documentation Issues	Transcription error	Yes	1	398	0.25
PCB	SOIL	Other	See hard copy for further explanation	Yes	3	398	0.75
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	No	47	398	11.81

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
PCB	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	3	398	0.75
PCB	WATER	Documentation Issues	Record added by the validator	No	7	686	1.02
PCB	WATER	Documentation Issues	Transcription error	No	40	686	5.83
PCB	WATER	Holding Times	Holding times were exceeded	No	28	686	4.08
PCB	WATER	Surrogates	Surrogate recovery criteria were not met	No	14	686	2.04
Pesticide	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	1	1,088	0.09
Pesticide	SOIL	Calibration	Continuing calibration verification criteria were not met	No	4	1,088	0.37
Pesticide	SOIL	Documentation Issues	Record added by the validator	No	2	1,088	0.18
Pesticide	SOIL	Documentation Issues	Transcription error	No	20	1,088	1.84
Pesticide	SOIL	Documentation Issues	Transcription error	Yes	1	1,088	0.09
Pesticide	SOIL	Holding Times	Holding times were exceeded	No	3	1,088	0.28
Pesticide	SOIL	Internal Standards	Internal standards did not meet criteria	No	2	1,088	0.18
Pesticide	SOIL	Other	Sample results were not validated due to re-analysis	No	1	1,088	0.09
Pesticide	SOIL	Other	See hard copy for further explanation	No	10	1,088	0.92
Pesticide	SOIL	Surrogates	Surrogate recovery criteria were not met	No	132	1,088	12.13
Pesticide	WATER	Blanks	Method, preparation, or reagent blank contamination	No	5	2,110	0.24
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	No	12	2,110	0.57
Pesticide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	1	2,110	0.05
Pesticide	WATER	Documentation Issues	Record added by the validator	No	21	2,110	1.00
Pesticide	WATER	Documentation Issues	Transcription error	No	33	2,110	1.56
Pesticide	WATER	Documentation Issues	Transcription error	Yes	1	2,110	0.05
Pesticide	WATER	Holding Times	Holding times were exceeded	No	85	2,110	4.03
Pesticide	WATER	Internal Standards	Internal standards did not meet criteria	No	1	2,110	0.05
Pesticide	WATER	Other	See hard copy for further explanation	No	3	2,110	0.14
Pesticide	WATER	Other	See hard copy for further explanation	Yes	2	2,110	0.09
Pesticide	WATER	Surrogates	Surrogate recovery criteria were not met	No	61	2,110	2.89
Radionuclide	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	42	771	5.45
Radionuclide	SOIL	Calculation Errors	Calculation error	Yes	26	771	3.37
Radionuclide	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	17	771	2.20
Radionuclide	SOIL	Documentation Issues	Record added by the validator	Yes	26	771	3.37
Radionuclide	SOIL	Documentation Issues	Results were not included on Data Summary Table	Yes	2	771	0.26
Radionuclide	SOIL	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	67	771	8.69
Radionuclide	SOIL	Documentation Issues	Transcription error	Yes	148	771	19.20
Radionuclide	SOIL	Holding Times	Holding times were grossly exceeded	Yes	15	771	1.95
Radionuclide	SOIL	Instrument Set-up	Detector efficiency did not meet requirements	Yes	64	771	8.30
Radionuclide	SOIL	Instrument Set-up	Resolution criteria were not met	Yes	7	771	0.91
Radionuclide	SOIL	LCS	LCS recovery > +/- 3 sigma	Yes	48	771	6.23
Radionuclide	SOIL	LCS	LCS recovery criteria were not met	Yes	55	771	7.13
Radionuclide	SOIL	LCS	LCS relative percent error criteria not met	Yes	38	771	4.93
Radionuclide	SOIL	Matrices	Recovery criteria were not met	Yes	4	771	0.52
Radionuclide	SOIL	Matrices	Replicate analysis was not performed	Yes	4	771	0.52
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	No	1	771	0.13
Radionuclide	SOIL	Matrices	Replicate precision criteria were not met	Yes	78	771	10.12

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	SOIL	Matrices	Replicate recovery criteria were not met	Yes	13	771	1.69
Radionuclide	SOIL	Other	Lab results not verified due to unsubmitted data	Yes	1	771	0.13
Radionuclide	SOIL	Other	Sample exceeded efficiency curve weight limit	Yes	11	771	1.43
Radionuclide	SOIL	Other	See hard copy for further explanation	Yes	25	771	3.24
Radionuclide	SOIL	Other	Tracer requirements were not met	Yes	1	771	0.13
Radionuclide	SOIL	Sensitivity	Incorrect reported activity or MDA	No	2	771	0.26
Radionuclide	SOIL	Sensitivity	Incorrect reported activity or MDA	Yes	2	771	0.26
Radionuclide	SOIL	Sensitivity	MDA exceeded the RDL	Yes	6	771	0.78
Radionuclide	SOIL	Sensitivity	MDA was calculated by reviewer	Yes	173	771	22.44
Radionuclide	SOIL	Sensitivity	Results considered qualitative not quantitative	Yes	2	771	0.26
Radionuclide	WATER	Blanks	Blank data not submitted	Yes	7	5,037	0.14
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	No	9	5,037	0.18
Radionuclide	WATER	Blanks	Blank recovery criteria were not met	Yes	47	5,037	0.93
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	No	26	5,037	0.52
Radionuclide	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	165	5,037	3.28
Radionuclide	WATER	Calculation Errors	Calculation error	No	12	5,037	0.24
Radionuclide	WATER	Calculation Errors	Calculation error	Yes	7	5,037	0.14
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	No	5	5,037	0.10
Radionuclide	WATER	Calibration	Calibration counting statistics did not meet criteria	Yes	2	5,037	0.04
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	No	67	5,037	1.33
Radionuclide	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	203	5,037	4.03
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	No	2	5,037	0.04
Radionuclide	WATER	Documentation Issues	Information missing from case narrative	Yes	2	5,037	0.04
Radionuclide	WATER	Documentation Issues	Key data fields incorrect	Yes	1	5,037	0.02
Radionuclide	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	2	5,037	0.04
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	No	6	5,037	0.12
Radionuclide	WATER	Documentation Issues	Missing deliverables (required for validation)	Yes	9	5,037	0.18
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	54	5,037	1.07
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	60	5,037	1.19
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	No	8	5,037	0.16
Radionuclide	WATER	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	14	5,037	0.28
Radionuclide	WATER	Documentation Issues	Record added by the validator	Yes	40	5,037	0.79
Radionuclide	WATER	Documentation Issues	Sample analysis was not requested	Yes	8	5,037	0.16
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	No	5	5,037	0.10
Radionuclide	WATER	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	306	5,037	6.08
Radionuclide	WATER	Documentation Issues	Transcription error	No	170	5,037	3.38
Radionuclide	WATER	Documentation Issues	Transcription error	Yes	214	5,037	4.25
Radionuclide	WATER	Holding Times	Holding times were exceeded	No	83	5,037	1.65
Radionuclide	WATER	Holding Times	Holding times were exceeded	Yes	167	5,037	3.32

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	No	13	5,037	0.26
Radionuclide	WATER	Holding Times	Holding times were grossly exceeded	Yes	19	5,037	0.38
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	No	8	5,037	0.16
Radionuclide	WATER	Instrument Set-up	Resolution criteria were not met	Yes	20	5,037	0.40
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	No	14	5,037	0.28
Radionuclide	WATER	LCS	Expected LCS value not submitted/verifiable	Yes	53	5,037	1.05
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	No	91	5,037	1.81
Radionuclide	WATER	LCS	LCS recovery > +/- 3 sigma	Yes	117	5,037	2.32
Radionuclide	WATER	LCS	LCS recovery criteria were not met	No	14	5,037	0.28
Radionuclide	WATER	LCS	LCS recovery criteria were not met	Yes	29	5,037	0.58
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	No	52	5,037	1.03
Radionuclide	WATER	LCS	LCS relative percent error criteria not met	Yes	133	5,037	2.64
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	No	12	5,037	0.24
Radionuclide	WATER	Matrices	Duplicate analysis was not performed	Yes	3	5,037	0.06
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	No	2	5,037	0.04
Radionuclide	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	7	5,037	0.14
Radionuclide	WATER	Matrices	Laboratory duplicate was not analyzed	No	1	5,037	0.02
Radionuclide	WATER	Matrices	Recovery criteria were not met	No	6	5,037	0.12
Radionuclide	WATER	Matrices	Recovery criteria were not met	Yes	8	5,037	0.16
Radionuclide	WATER	Matrices	Replicate analysis was not performed	No	5	5,037	0.10
Radionuclide	WATER	Matrices	Replicate analysis was not performed	Yes	31	5,037	0.62
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	No	62	5,037	1.23
Radionuclide	WATER	Matrices	Replicate precision criteria were not met	Yes	147	5,037	2.92
Radionuclide	WATER	Matrices	Replicate recovery criteria were not met	Yes	1	5,037	0.02
Radionuclide	WATER	Other	Lab results not verified due to unsubmitted data	No	1	5,037	0.02
Radionuclide	WATER	Other	Lab results not verified due to unsubmitted data	Yes	13	5,037	0.26
Radionuclide	WATER	Other	QC sample does not meet method requirements	No	11	5,037	0.22
Radionuclide	WATER	Other	QC sample does not meet method requirements	Yes	8	5,037	0.16
Radionuclide	WATER	Other	Sample exceeded efficiency curve weight limit	Yes	1	5,037	0.02
Radionuclide	WATER	Other	See hard copy for further explanation	No	140	5,037	2.78
Radionuclide	WATER	Other	See hard copy for further explanation	Yes	215	5,037	4.27
Radionuclide	WATER	Other	Tracer requirements were not met	No	8	5,037	0.16
Radionuclide	WATER	Other	Tracer requirements were not met	Yes	13	5,037	0.26
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	No	12	5,037	0.24
Radionuclide	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	6	5,037	0.12
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	No	4	5,037	0.08
Radionuclide	WATER	Sensitivity	Incorrect reported activity or MDA	Yes	19	5,037	0.38
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	No	22	5,037	0.44
Radionuclide	WATER	Sensitivity	MDA exceeded the RDL	Yes	59	5,037	1.17
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	No	14	5,037	0.28
Radionuclide	WATER	Sensitivity	MDA was calculated by reviewer	Yes	558	5,037	11.08
SVOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	12	3,520	0.34
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	10	3,520	0.28

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
SVOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	8	3,520	0.23
SVOC	SOIL	Documentation Issues	Transcription error	No	7	3,520	0.20
SVOC	SOIL	Holding Times	Holding times were exceeded	No	165	3,520	4.69
SVOC	SOIL	Holding Times	Holding times were exceeded	Yes	12	3,520	0.34
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	149	3,520	4.23
SVOC	SOIL	Internal Standards	Internal standards did not meet criteria	Yes	10	3,520	0.28
SVOC	SOIL	Matrices	Percent solids < 30 percent	Yes	10	3,520	0.28
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	No	58	3,520	1.65
SVOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	1	3,520	0.03
SVOC	SOIL	Other	See hard copy for further explanation	No	329	3,520	9.35
SVOC	SOIL	Other	See hard copy for further explanation	Yes	23	3,520	0.65
SVOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	25	6,669	0.37
SVOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	48	6,669	0.72
SVOC	WATER	Calibration	Independent calibration verification criteria not met	No	1	6,669	0.01
SVOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	3	6,669	0.04
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	23	6,669	0.34
SVOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1	6,669	0.01
SVOC	WATER	Documentation Issues	Record added by the validator	No	41	6,669	0.61
SVOC	WATER	Documentation Issues	Transcription error	No	9	6,669	0.13
SVOC	WATER	Holding Times	Holding times were exceeded	No	92	6,669	1.38
SVOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	18	6,669	0.27
SVOC	WATER	Internal Standards	Internal standards did not meet criteria	No	46	6,669	0.69
SVOC	WATER	LCS	LCS recovery criteria were not met	No	3	6,669	0.04
SVOC	WATER	Other	See hard copy for further explanation	No	160	6,669	2.40
SVOC	WATER	Other	See hard copy for further explanation	Yes	2	6,669	0.03
SVOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	12	6,669	0.18
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	54	1,854	2.91
VOC	SOIL	Blanks	Method, preparation, or reagent blank contamination	Yes	1	1,854	0.05
VOC	SOIL	Calculation Errors	Calculation error	No	131	1,854	7.07
VOC	SOIL	Calculation Errors	Calculation error	Yes	4	1,854	0.22
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	No	5	1,854	0.27
VOC	SOIL	Calibration	Continuing calibration verification criteria were not met	Yes	20	1,854	1.08
VOC	SOIL	Confirmation	Results were not confirmed	No	1	1,854	0.05
VOC	SOIL	Documentation Issues	Transcription error	No	71	1,854	3.83
VOC	SOIL	Documentation Issues	Transcription error	Yes	1	1,854	0.05
VOC	SOIL	Holding Times	Holding times were exceeded	No	113	1,854	6.09
VOC	SOIL	Holding Times	Holding times were exceeded	Yes	5	1,854	0.27
VOC	SOIL	Internal Standards	Internal standards did not meet criteria	No	118	1,854	6.36
VOC	SOIL	Matrices	MS/MSD precision criteria were not met	Yes	1	1,854	0.05
VOC	SOIL	Matrices	Percent solids < 30 percent	Yes	10	1,854	0.54
VOC	SOIL	Other	Sample results were not validated due to re-analysis	No	100	1,854	5.39

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Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect ?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
VOC	SOIL	Other	Sample results were not validated due to re-analysis	Yes	6	1,854	0.32
VOC	SOIL	Other	See hard copy for further explanation	No	24	1,854	1.29
VOC	SOIL	Other	See hard copy for further explanation	Yes	1	1,854	0.05
VOC	SOIL	Surrogates	Surrogate recovery criteria were not met	Yes	1	1,854	0.05
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	No	119	10,127	1.18
VOC	WATER	Blanks	Method, preparation, or reagent blank contamination	Yes	21	10,127	0.21
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	No	77	10,127	0.76
VOC	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	13	10,127	0.13
VOC	WATER	Calibration	Independent calibration verification criteria not met	No	8	10,127	0.08
VOC	WATER	Calibration	Independent calibration verification criteria not met	Yes	3	10,127	0.03
VOC	WATER	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	1	10,127	0.01
VOC	WATER	Calibration	Result exceeded linear range of measurement system	Yes	1	10,127	0.01
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	No	54	10,127	0.53
VOC	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	3	10,127	0.03
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	No	409	10,127	4.04
VOC	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	26	10,127	0.26
VOC	WATER	Documentation Issues	Record added by the validator	No	228	10,127	2.25
VOC	WATER	Documentation Issues	Record added by the validator	Yes	3	10,127	0.03
VOC	WATER	Documentation Issues	Transcription error	No	229	10,127	2.26
VOC	WATER	Documentation Issues	Transcription error	Yes	4	10,127	0.04
VOC	WATER	Holding Times	Holding times were exceeded	No	435	10,127	4.30
VOC	WATER	Holding Times	Holding times were exceeded	Yes	6	10,127	0.06
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	No	304	10,127	3.00
VOC	WATER	Instrument Set-up	Instrument tune criteria were not met	Yes	23	10,127	0.23
VOC	WATER	Internal Standards	Internal standards did not meet criteria	No	213	10,127	2.10
VOC	WATER	Internal Standards	Internal standards did not meet criteria	Yes	1	10,127	0.01
VOC	WATER	LCS	LCS recovery criteria were not met	No	41	10,127	0.40
VOC	WATER	LCS	LCS recovery criteria were not met	Yes	5	10,127	0.05
VOC	WATER	Matrices	MS/MSD precision criteria were not met	No	4	10,127	0.04
VOC	WATER	Other	See hard copy for further explanation	No	10	10,127	0.10
VOC	WATER	Other	See hard copy for further explanation	Yes	4	10,127	0.04
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	No	212	10,127	2.09
VOC	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	8	10,127	0.08
VOC	WATER	Surrogates	Surrogate recovery criteria were not met	Yes	4	10,127	0.04
Wet Chemistry	SOIL	Blanks	Method, preparation, or reagent blank contamination	No	1	76	1.32
Wet Chemistry	SOIL	Documentation Issues	Record added by the validator	No	1	76	1.32
Wet Chemistry	SOIL	Documentation Issues	Record added by the validator	Yes	4	76	5.26
Wet Chemistry	SOIL	Holding Times	Holding times were exceeded	No	3	76	3.95
Wet Chemistry	SOIL	Holding Times	Holding times were exceeded	Yes	9	76	11.84
Wet Chemistry	SOIL	Holding Times	Holding times were grossly exceeded	No	1	76	1.32

Table A2.3.3.6
WC AEU - Summary of V&V Observations

Analyte Group	Matrix	QC Category	V&V Observation	Detect?	No. of Qualified Results	Total No. of V&V Records	Percent Qualified (%)
Wet Chemistry	SOIL	Matrices	Duplicate sample precision criteria were not met	Yes	2	76	2.63
Wet Chemistry	SOIL	Matrices	Percent solids < 30 percent	Yes	7	76	9.21
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	No	3	76	3.95
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery criteria were not met	Yes	4	76	5.26
Wet Chemistry	SOIL	Matrices	Predigestion MS recovery was < 30 percent	Yes	15	76	19.74
Wet Chemistry	SOIL	Other	IDL is older than 3 months from date of analysis	Yes	1	76	1.32
Wet Chemistry	WATER	Blanks	Calibration verification blank contamination	No	1	1,863	0.05
Wet Chemistry	WATER	Calibration	Calibration correlation coefficient did not meet requirements	Yes	2	1,863	0.11
Wet Chemistry	WATER	Calibration	Continuing calibration verification criteria were not met	Yes	2	1,863	0.11
Wet Chemistry	WATER	Calibration	Result exceeded linear range of measurement system	Yes	1	1,863	0.05
Wet Chemistry	WATER	Documentation Issues	Missing deliverables (not required for validation)	Yes	3	1,863	0.16
Wet Chemistry	WATER	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	19	1,863	1.02
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	No	79	1,863	4.24
Wet Chemistry	WATER	Documentation Issues	Record added by the validator	Yes	69	1,863	3.70
Wet Chemistry	WATER	Documentation Issues	Transcription error	No	7	1,863	0.38
Wet Chemistry	WATER	Documentation Issues	Transcription error	Yes	25	1,863	1.34
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	No	17	1,863	0.91
Wet Chemistry	WATER	Holding Times	Holding times were exceeded	Yes	25	1,863	1.34
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	No	6	1,863	0.32
Wet Chemistry	WATER	Holding Times	Holding times were grossly exceeded	Yes	4	1,863	0.21
Wet Chemistry	WATER	LCS	LCS recovery criteria were not met	No	2	1,863	0.11
Wet Chemistry	WATER	Matrices	Duplicate sample precision criteria were not met	Yes	3	1,863	0.16
Wet Chemistry	WATER	Matrices	LCS/LCSD precision criteria were not met	Yes	3	1,863	0.16
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	No	8	1,863	0.43
Wet Chemistry	WATER	Matrices	Predigestion MS recovery criteria were not met	Yes	33	1,863	1.77
Wet Chemistry	WATER	Matrices	Predigestion MS recovery was < 30 percent	Yes	3	1,863	0.16
Wet Chemistry	WATER	Matrices	Site samples were not used for sample matrix QC	Yes	3	1,863	0.16
Wet Chemistry	WATER	Other	Lab results not verified due to unsubmitted data	Yes	19	1,863	1.02
Wet Chemistry	WATER	Other	Result obtained through dilution	Yes	11	1,863	0.59
Wet Chemistry	WATER	Other	See hard copy for further explanation	No	1	1,863	0.05
Wet Chemistry	WATER	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	10	1,863	0.54
Wet Chemistry	WATER	Sample Preparation	Samples were not properly preserved in the field	Yes	21	1,863	1.13

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

VOLUME 15B2: ATTACHMENT 3

Statistical Analyses and Professional Judgment

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ACRONYMS AND ABBREVIATIONS

CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ESL	ecological screening level
EU	Exposure Unit
IHSS	Individual Hazardous Substance Site
MDC	maximum detected concentration
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
UCL	upper confidence limit
UTL	upper tolerance limit

1.0 INTRODUCTION

This attachment presents the results for the statistical analyses and professional judgment evaluation used to select ecological contaminants of potential concern (ECOPCs) as part of the Ecological Risk Assessment (ERA) for three of the seven Aquatic Exposure Units (AEUs) at the Rocky Flats Environmental Technology Site (RFETS): North Walnut Creek AEU (NW AEU), South Walnut Creek AEU (SW AEU), and Woman Creek AEU (WC AEU). The other four AEUs are addressed in Appendix A, Volume 15B1 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation-Remedial Investigation (RI)/Corrective Measures Study (CMS)-Feasibility Study (FS) Report (hereafter referred to as the RI/FS Report). The methods used to perform the statistical analysis and to develop the professional judgment sections are described in Appendix A, Volume 2, Section 2.0 of the RI/FS Report and follow the Final Comprehensive Risk Assessment (CRA) Work Plan and Methodology, Revision 1 (DOE 2005).

2.0 RESULTS OF STATISTICAL COMPARISONS TO BACKGROUND FOR THE ROCK CREEK DRAINAGE EXPOSURE UNIT

The results of the statistical background comparisons for inorganic and radionuclide ecological contaminants of interest (ECOIs) in surface water (total concentration), surface water (dissolved concentration), and sediment samples collected from the NW AEU, SW AEU, and WC AEU are presented in this section. Box plots are provided for analytes that were carried forward into the statistical comparison step and are presented in Figures A3.2.NW AEU.1 to A3.2.NW AEU.41 for the NW AEU, in Figures A3.2.SW AEU.1 to A3.2.SW AEU.35 for the SW AEU, and in Figures A3.2.WC AEU.1 to A3.2.WC AEU.35 for the WC AEU.[1] The box plots display several reference points: 1) the line inside the box is the median; 2) the lower edge of the box is the 25th percentile; 3) the upper edge of the box is the 75th percentile; 4) the upper lines (called whiskers) are drawn to the greatest value that is less than or equal to 1.5 times the inter-quartile range (the interquartile range is between the 75th and 25th percentiles); 5) the lower whiskers are drawn to the lowest value that is greater than or equal to 1.5 times the inter-quartile range; and 6) solid circles are data points greater or less than the whiskers.

Surface water and sediment ECOIs with concentrations in the NW AEU, SWS AEU, and WC AEU that are statistically greater than background (or those where background comparisons were not performed) are carried through to the upper-bound exposure point

[1] Statistical background comparisons are not performed for analytes if: 1) the background concentrations are nondetections; 2) background data are unavailable; 3) the analyte has low detection frequency in the RCEU or background data set (less than 20 percent); or 4) the analyte is an organic compound. Box plots are not provided for these analytes. However, these analytes are carried forward into the professional judgment evaluation, as applicable.

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concentration (EPC) –ecological screening level (ESL) comparison step of the ECOPC selection processes.

ECOIs with concentrations that are not statistically greater than background are not identified as ECOPCs and are not evaluated further.

2.1 NWAEU

2.1.1 Surface Water Data (Total Concentrations) Used in the ERA

In surface water, aluminum, ammonia, barium, beryllium, cobalt, cyanide, fluoride, lithium, selenium, strontium, tin, vanadium, americium-241, plutonium-239/240, radium-226, radium-228, uranium-233/234, uranium-235, and uranium-238 have MDCs (total concentrations) that exceed their ESL and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. Bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and Aroclor-1254 have MDCs (total concentrations) greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of NW AEU surface water (total) data to background data is presented in Table A3.2.NW AEU.1, while summary statistics for background and NW AEU surface water (total) data are provided in Table A3.2.NW AEU.2.

For surface water total concentrations, the results of the statistical comparisons of the NW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Barium
- Fluoride
- Lithium
- Strontium
- Vanadium
- Americum-241
- Plutonium-239/240
- Uranium-233/234
- Uranium-235
- Uranium-238

Not Statistically Greater than Background at the 0.1 Significance Level

- Radium-226

Background Comparison not Performed[1]

- Ammonia
- Beryllium
- Cobalt
- Cyanide
- Selenium
- Tin
- Radium-228
- Bis(2-ethylhexyl)phthalate
- di-n-butylphthalate
- Aroclor-1254

2.1.2 Surface Water Data (Dissolved Concentrations) Used in the ERA

In surface water, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, and zinc have MDCs (dissolved concentrations) that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. With respect to dissolved organics in surface water, no analytes have MDCs greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of NW AEU surface water (dissolved) data to background data is presented in Table A3.2.NW AEU.3, while summary statistics for background and NW AEU surface water (dissolved) data are provided in Table A3.2.NW AEU.4.

For surface water dissolved concentrations, the results of the statistical comparisons of the NW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Manganese

Not Statistically Greater than Background at the 0.1 Significance Level

- Copper
- Iron
- Lead

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- Zinc

***Background Comparison not Performed*[1]**

- Cadmium
- Chromium
- Nickel
- Silver

2.1.3 Sediment Data Used in the ERA

In sediment, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc have MDCs that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. 2-methylnaphthalene, 4,4'-DDT, acenaphthene, anthracene, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, Aroclor-1254, phenanthrene, and pyrene have MDCs that exceed their ESLs and detection frequencies greater than 5 percent. The statistical comparison of NW AEU sediment data to background data is presented in Table A3.2.NW AEU.5, while summary statistics for background and NW AEU sediment data are provided in Table A3.2.NW AEU.6.

For sediment, the results of the statistical comparisons of the NW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Arsenic
- Barium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Nickel

- Selenium
- Zinc

Not Statistically Greater than Background at the 0.1 Significance Level

- None

Background Comparison not Performed[1]

- Antimony
- Cadmium
- Fluoride
- Mercury
- Silver
- 2-Methylnaphthalene
- 4,4'-DDT
- Acenaphthene
- Anthracene
- Atrazine
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Bis(2-ethylhexyl)phthalate
- Carbazole
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Fluorene

- Indeno(1,2,3-cd)pyrene
- Naphthalene
- Aroclor-1254
- Phenanthrene
- Pyrene

2.2 SW AEU

2.2.1 Surface Water Data (Total Concentrations) Used in the ERA

In surface water, aluminum, ammonia, antimony, barium, beryllium, cyanide, fluoride, lithium, nitrite, selenium, vanadium, plutonium-239/240, radium-226, uranium-233/234, and uranium-238 have MDCs (total concentrations) that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. 1,1,2-trichloro-1,2,2-trifluoroethane, 4,4'-DDT, and bis(2-ethylhexyl)phthalate have MDCs (total concentrations) greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of SW AEU surface water (total) data to background data is presented in Table A3.2.SW AEU.1, while summary statistics for background and SW AEU surface water (total) data are provided in Table A3.2.SW AEU.2.

For surface water total concentrations, the results of the statistical comparisons of the SW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Barium
- Fluoride
- Lithium
- Plutonium-239/240
- Uranium-233/234
- Uranium-238

Not Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Vanadium
- Radium-226

Background Comparison not Performed[1]

- Ammonia
- Antimony
- Beryllium
- Cyanide
- Nitrite
- Selenium
- 1,1,2-Trichloro-1,2,2-trifluoroethane
- 4,4'-DDT
- Bis(2-ethylhexyl)phthalate

2.2.2 Surface Water Data (Dissolved Concentrations) Used in the ERA

In surface water, cadmium, copper, iron, lead, silver, and zinc have MDCs (dissolved concentrations) that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. With respect to dissolved organics in surface water, no analytes have MDCs greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of SW AEU surface water (dissolved) data to background data is presented in Table A3.2.SW AEU.3, while summary statistics for background and SW AEU surface water (dissolved) data are provided in Table A3.2.SW AEU.4.

For surface water dissolved concentrations, the results of the statistical comparisons of the SW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- None

Not Statistically Greater than Background at the 0.1 Significance Level

- Copper
- Iron
- Zinc

Background Comparison not Performed[1]

- Cadmium
- Lead

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- Silver

2.2.3 Sediment Data Used in the ERA

In sediment, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc have MDCs that exceeded their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. Acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, bromomethane, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, Aroclor-1254, Aroclor-1260, phenanthrene, and pyrene have MDCs that exceed their ESLs and detection frequencies greater than 5 percent. The statistical comparison of SW AEU sediment data to background data is presented in Table A3.2.SW AEU.5, while summary statistics for background and SW AEU sediment data are provided in Table A3.2.SW AEU.6.

For sediment, the results of the statistical comparisons of the SW AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Arsenic
- Barium
- Chromium
- Copper
- Iron
- Lead
- Nickel
- Zinc

Not Statistically Greater than Background at the 0.1 Significance Level

- Manganese

Background Comparison not Performed[1]

- Antimony
- Cadmium

- Fluoride
- Mercury
- Selenium
- Silver
- Acenaphthene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Bis(2-ethylhexyl)phthalate
- Bromomethane
- Carbazole
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(1,2,3-cd)pyrene
- Aroclor-1254
- Aroclor-1260
- Phenanthrene
- Pyrene

2.3 WC AEU

2.3.1 Surface Water Data (Total Concentrations) Used in the ERA

In surface water, aluminum, ammonia, barium, beryllium, cobalt, lithium, selenium, thallium, vanadium, americium-241, plutonium-239/240, uranium-233/234, and uranium-238 have MDCs (total concentrations) that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. With respect to total organics in surface water, no analytes have MDCs greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of WC AEU surface water (total) data to background data is presented in Table A3.2.WC AEU.1, while summary statistics for background and WC AEU surface water (total) data are provided in Table A3.2.WC AEU.2.

For surface water total concentrations, the results of the statistical comparisons of the WC AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Barium
- Lithium
- Americum-241
- Plutonium-239/240
- Uranium-233/234
- Uranium-238

Not Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Vanadium

Background Comparison not Performed[1]

- Ammonia
- Beryllium
- Cobalt
- Selenium
- Thallium

2.3.2 Surface Water Data (Dissolved Concentrations) Used in the ERA

In surface water, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc have MDCs (dissolved concentrations) that exceed their ESLs and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. With respect to dissolved organics in surface water, no analytes have MDCs greater than their ESLs and detection frequencies greater than 5 percent. The statistical comparison of WC AEU surface water (dissolved) data to background data is presented in Table A3.2.WC AEU.3, while summary statistics for background and WC AEU surface water (dissolved) data are provided in Table A3.2.WC AEU.4.

For surface water dissolved concentrations, the results of the statistical comparisons of the WC AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- None

Not Statistically Greater than Background at the 0.1 Significance Level

- Copper
- Iron
- Lead
- Manganese
- Zinc

Background Comparison not Performed[1]

- Cadmium
- Mercury
- Silver

2.3.3 Sediment Data Used in the ERA

In sediment, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc have MDCs that exceeded their ESLs for the WC AEU and detection frequencies greater than 5 percent. These ECOIs were carried forward into the statistical background comparison. 2-butanone, 4-methylphenol, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, heptachlor, indeno(1,2,3-cd)pyrene, Aroclor-1254, phenanthrene, and pyrene have MDCs that exceed their ESLs and detection frequencies greater than 5 percent. The statistical comparison of WC AEU sediment data to background data is presented in

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Table A.3.2.WC AEU.5, while summary statistics for background and WC AEU sediment data are provided in Table A.3.2.WC AEU.6.

For sediment, the results of the statistical comparisons of the WC AEU data to background data indicate the following:

Statistically Greater than Background at the 0.1 Significance Level

- Aluminum
- Arsenic
- Barium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Nickel
- Selenium
- Zinc

Not Statistically Greater than Background at the 0.1 Significance Level

- None

Background Comparison not Performed[1]

- Antimony
- Cadmium
- Fluoride
- Mercury
- Silver
- 2-Butanone
- 4-Methylphenol
- Acenaphthene

- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Chrysene
- Fluoranthene
- Heptachlor
- Indeno(1,2,3-cd)pyrene
- Aroclor-1254
- Phenanthrene
- Pyrene

3.0 UPPER-BOUND EXPOSURE POINT CONCENTRATION COMPARISON TO ECOLOGICAL SCREENING LEVELS

ECOIs in surface water (total and dissolved concentrations) and sediment with concentrations that are statistically greater than background, or background comparisons were not performed, are evaluated further by comparing the AEU EPCs to the ESLs. The EPCs are the 95 percent upper confidence limits (UCLs) of the 90th percentile (upper tolerance limit [UTL]), or the MDC if the UTL is greater than the MDC.

3.1 NW AEU

3.1.1 Surface Water Data (Total Concentrations)

The UTLs for aluminum, ammonia, cyanide, lithium, selenium, vanadium, radium-228, and Aroclor-1254 are greater than their ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.1.2 Surface Water Data (Dissolved Concentrations)

The UTLs for aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc are greater than their ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.1.3 Sediment Data

The UTLs for aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, manganese, mercury, nickel, selenium, silver, zinc, 2-methylnaphthalene, 4,4'-DDT, acenaphthene, anthracene, atrazine, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, Aroclor-1254, phenanthrene, and pyrene are greater than tESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.2 SW AEU

3.2.1 Surface Water Data (Total Concentrations)

The UTLs for ammonia, cyanide, and 4,4'-DDT are greater than their ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.2.2 Surface Water Data (Dissolved Concentrations)

The UTLs for cadmium and silver are greater than their ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.2.3 Sediment Data

The UTLs for aluminum, antimony, barium, cadmium, copper, fluoride, lead, nickel, silver, zinc, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bromomethane, carbazole, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, Aroclor-1254, Aroclor-1260, phenanthrene, and pyrene are greater than ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.3 WC AEU

3.3.1 Surface Water Data (Total Concentrations)

The UTL for ammonia is greater than its ESLs and was carried forward into the professional judgment evaluation screening step (Section 4.0).

3.3.2 Surface Water Data (Dissolved Concentrations)

The UTLs for cadmium and silver are greater than their ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

3.3.3 Sediment Data

The UTLs for aluminum, antimony, barium, cadmium, copper, fluoride, iron, lead, mercury, nickel, selenium, silver, zinc, 4-methylphenol, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, heptachlor, indeno(1,2,3-cd)pyrene, Aroclor-1254, phenanthrene, and pyrene are greater than ESLs and were carried forward into the professional judgment evaluation screening step (Section 4.0).

4.0 PROFESSIONAL JUDGMENT

This section presents the results of the professional judgment step of the ECOPC selection processes for the ERA. Based on the weight of evidence evaluated in the professional judgment step, ECOIs are either included for further evaluation as ECOPCs in the risk characterization step, or excluded from further evaluation.

For the EU human health risk assessments and ERAs, the professional judgment evaluation takes into account the following lines of evidence: process knowledge, spatial trends, pattern recognition, comparison to RFETS background and regional background data sets, and risk potential. However, for many of the EUs that comprise the AEUs presented in this volume, the ECOPC selection process indicates many metals and organic analytes are ECOPCs in surface soil. Furthermore, the presence of organic analytes in environmental media is typically of anthropogenic origin. Therefore, considering runoff is a transport mechanism whereby surface water and sediment within the AEU may be impacted by ECOPCs or other ECOIs in EU surface soil, all ECOIs that pass through the EPC/tESL screen for surface water (total and dissolved concentrations) and sediment are considered ECOPCs, and are further evaluated in the risk characterizations for each AEU.

5.0 REFERENCES

DOE, 2005. Final Comprehensive Risk Assessment Work Plan and Methodology, Rocky Flats Environmental Technology Site, Golden, Colorado. Revision 1. September.

TABLES

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Table A3.2.NW AEU.1
Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			NW AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	166	NONPARAMETRIC	82	674	NONPARAMETRIC	96	WRS	4.29E-12	Yes
Ammonia	1	0	0	205	NONPARAMETRIC	68	N/A	N/A	N/A
Barium	172	NONPARAMETRIC	78	676	NONPARAMETRIC	99	WRS	0	Yes
Beryllium	167	NONPARAMETRIC	13	956	NONPARAMETRIC	46	N/A	N/A	N/A
Cobalt	171	NONPARAMETRIC	17	676	NONPARAMETRIC	56	N/A	N/A	N/A
Cyanide	128	NONPARAMETRIC	5	148	NONPARAMETRIC	17	N/A	N/A	N/A
Fluoride	118	NONPARAMETRIC	95	194	NONPARAMETRIC	82	WRS	6.19E-09	Yes
Lithium	166	NONPARAMETRIC	49	592	NONPARAMETRIC	93	WRS	0	Yes
Selenium	162	NONPARAMETRIC	14	673	NONPARAMETRIC	42	N/A	N/A	N/A
Strontium	168	NONPARAMETRIC	80	648	NONPARAMETRIC	100	WRS	0	Yes
Tin	161	NONPARAMETRIC	12	571	NONPARAMETRIC	13	N/A	N/A	N/A
Vanadium	171	NONPARAMETRIC	34	675	NONPARAMETRIC	71	WRS	5.14E-06	Yes
Americium-241	101	NONPARAMETRIC	100	1303	NONPARAMETRIC	100	WRS	3.08E-14	Yes
Plutonium-239/240	107	NONPARAMETRIC	100	1336	NONPARAMETRIC	100	WRS	3.44E-15	Yes
Radium-226	5	NORMAL	100	12	LOGNORMAL	100	WRS	0.542	No
Radium-228	N/A	N/A	N/A	3	0	100	N/A	N/A	N/A
Uranium-233/234	77	NONPARAMETRIC	100	1492	NONPARAMETRIC	100	WRS	0	Yes
Uranium-235	74	NONPARAMETRIC	100	1474	NONPARAMETRIC	100	WRS	4.79E-08	Yes
Uranium-238	77	NONPARAMETRIC	100	1492	NONPARAMETRIC	100	WRS	0	Yes

WRS = Wilcoxon Rank Sum

N/A = not applicable; site and/or background detection frequency less than 20%.

Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.NW AEU.2
Summary Statistics for Surface Water, Total Analyses (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)[a]

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/L	166	0.026	129	3.39	12.5	674	0.007	442	10.0	26.1
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	205	0	16.5	1.79	3.06
Barium	mg/L	172	0.009	0.630	0.079	0.079	676	1.50E-04	4.52	0.170	0.236
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	956	1.00E-05	0.027	5.78E-04	0.001
Cobalt	mg/L	171	2.90E-04	0.019	0.005	0.008	676	1.70E-04	0.253	0.004	0.012
Cyanide	mg/L	128	0.002	0.040	0.048	0.443	148	0	0.146	0.008	0.015
Fluoride	mg/L	118	0.100	1.00	0.335	0.125	194	0.100	2.90	0.635	0.583
Lithium	mg/L	166	0.001	0.154	0.015	0.022	592	8.00E-05	2.97	0.065	0.217
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	673	4.20E-04	0.035	0.002	0.004
Strontium	mg/L	168	0.028	0.955	0.199	0.159	648	2.00E-04	8.59	0.488	0.774
Tin	mg/L	161	9.90E-04	0.180	0.027	0.058	571	5.50E-04	0.315	0.006	0.017
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	675	1.30E-04	0.892	0.022	0.052
Americium-241	pCi/L	101	-0.010	0.060	0.005	0.009	1303	-0.043	84.0	0.294	2.71
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	1336	-0.110	259	0.617	7.96
Radium-226	pCi/L	5	-0.100	4.90	1.76	2.06	12	0.110	21.0	2.62	5.86
Radium-228	pCi/L	N/A	N/A	N/A	N/A	N/A	3	10.0	28.0	17.3	9.45
Uranium-233/234	pCi/L	77	-0.056	5.10	0.479	0.747	1492	-0.028	1,161	6.36	39.2
Uranium-235	pCi/L	74	-0.021	0.290	0.047	0.066	1474	-0.120	31.0	0.228	1.16
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	1492	-0.017	1,214	4.69	33.8
bis(2-ethylhexyl)phthalate	ug/L	N/A	N/A	N/A	N/A	N/A	206	0.300	200	8.27	21.4
Di-n-butylphthalate	ug/L	N/A	N/A	N/A	N/A	N/A	207	0.200	11.0	3.83	1.75
Aroclor-1254	ug/L	N/A	N/A	N/A	N/A	N/A	119	0.260	3.30	0.573	0.399

[a] Statistics are computed using one-half the reported values for non-detects.

N/A - Not Available

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Table A3.2.NW AEU.3
Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			NW AEU (excluding background samples)					
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	Statistically Greater Than Background?
Cadmium	**136**	**NONPARAMETRIC**	**7**	**533**	**NONPARAMETRIC**	**23**	**N/A**	**N/A**	**N/A**
Chromium	**136**	**NONPARAMETRIC**	**5**	**246**	**NONPARAMETRIC**	**24**	**N/A**	**N/A**	**N/A**
Copper	138	NONPARAMETRIC	33	233	NONPARAMETRIC	43	WRS	1.000	No
Iron	137	LOGNORMAL	80	239	NONPARAMETRIC	69	WRS	1.00	No
Lead	133	NONPARAMETRIC	24	245	NONPARAMETRIC	31	WRS	0.986	No
Manganese	**139**	**LOGNORMAL**	**81**	**250**	**LOGNORMAL**	**84**	**t-Test_LN**	**0.041**	**Yes**
Nickel	**134**	**NONPARAMETRIC**	**7**	**243**	**NONPARAMETRIC**	**27**	**N/A**	**N/A**	**N/A**
Silver	**141**	**NONPARAMETRIC**	**6**	**529**	**NONPARAMETRIC**	**9**	**N/A**	**N/A**	**N/A**
Zinc	138	NONPARAMETRIC	57	244	NONPARAMETRIC	61	WRS	0.931	No

WRS = Wilcoxon Rank Sum
t-Test_N = Student's t-test using normal data
N/A = not applicable; site and/or background detection frequency less than 20%.
Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.NW AEU.4
Summary Statistics for Surface Water, Dissolved Analyses (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)[a]

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	533	1.60E-05	0.020	6.93E-04	0.002
Chromium	mg/L	136	0.002	0.015	0.003	0.002	246	2.70E-04	0.087	0.004	0.010
Copper	mg/L	138	0.001	0.026	0.006	0.005	233	9.70E-04	0.205	0.006	0.018
Iron	mg/L	137	0.010	72.8	0.724	6.21	239	0.005	9.57	0.132	0.700
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	245	1.50E-04	0.111	0.003	0.012
Manganese	mg/L	139	1.00E-03	1.45	0.052	0.163	250	6.60E-04	2.13	0.087	0.205
Nickel	mg/L	134	0.001	0.082	0.009	0.010	243	3.00E-04	0.170	0.006	0.012
Silver	mg/L	141	0.002	0.022	0.003	0.003	529	2.00E-05	0.032	8.32E-04	0.002
Zinc	mg/L	138	0.002	2.30	0.033	0.197	244	0.002	0.831	0.020	0.065

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

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Table A3.2.NW AEU.5
Statistical Distribution and Comparison to Background for Sediment (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			NW AEU (excluding background samples)			Test	1-p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	55	GAMMA	100	111	GAMMA	100	WRS	4.07E-07	Yes
Antimony	47	LOGNORMAL	11	98	NONPARAMETRIC	15	N/A	N/A	N/A
Arsenic	55	GAMMA	89	111	NORMAL	98	WRS	2.96E-13	Yes
Barium	54	GAMMA	100	111	NORMAL	100	WRS	7.68E-07	Yes
Cadmium	48	LOGNORMAL	10	110	NONPARAMETRIC	44	N/A	N/A	N/A
Chromium	55	GAMMA	85	111	GAMMA	96	WRS	1.40E-05	Yes
Copper	55	GAMMA	80	111	NONPARAMETRIC	98	WRS	3.49E-09	Yes
Fluoride	N/A	N/A	N/A	21	GAMMA	57	N/A	N/A	N/A
Iron	55	GAMMA	100	111	NONPARAMETRIC	100	WRS	5.41E-10	Yes
Lead	55	LOGNORMAL	100	111	NONPARAMETRIC	100	WRS	6.28E-08	Yes
Manganese	55	GAMMA	100	111	NONPARAMETRIC	100	WRS	2.34E-06	Yes
Mercury	46	NONPARAMETRIC	4	102	NONPARAMETRIC	42	N/A	N/A	N/A
Nickel	53	GAMMA	72	111	NORMAL	92	WRS	7.34E-12	Yes
Selenium	54	NONPARAMETRIC	28	110	NONPARAMETRIC	26	WRS	3.98E-05	Yes
Silver	48	NONPARAMETRIC	6	106	NONPARAMETRIC	15	N/A	N/A	N/A
Zinc	55	NONPARAMETRIC	98	111	LOGNORMAL	100	WRS	9.13E-12	Yes

WRS = Wilcoxon Rank Sum

N/A = not applicable; site and/or background detection frequency less than 20%.

Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

Table A3.2.NW AEU.6
Summary Statistics for Sediment (excluding background samples)
North Walnut Creek Aquatic Exposure Unit (NW AEU)[a]

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/kg	55	811	25,200	6,791	5,603	111	1,290	49,000	12,173	7,841
Antimony	mg/kg	47	1.00	12.4	3.64	3.21	98	0.230	41.4	5.06	8.24
Arsenic	mg/kg	55	0.270	8.70	2.43	1.92	111	0.570	12.0	5.39	2.28
Barium	mg/kg	54	10.6	260	78.9	58.8	111	22.0	390	128	65.5
Cadmium	mg/kg	48	0.410	1.30	0.525	0.345	110	0.050	8.30	0.817	1.04
Chromium	mg/kg	55	1.50	30.4	8.78	7.87	111	2.00	66.5	14.0	9.36
Copper	mg/kg	55	2.20	36.7	10.8	8.43	111	5.60	77.6	18.7	9.86
Fluoride	mg/kg	N/A	N/A	N/A	N/A	N/A	21	2.38	16.7	3.30	3.56
Iron	mg/kg	55	1,040	31,400	9,740	6,739	111	4,770	55,000	16,652	7,150
Lead	mg/kg	55	2.60	68.8	13.3	12.4	111	4.70	234	23.6	23.3
Manganese	mg/kg	55	9.00	1,280	238	216	111	72.0	1,760	373	277
Mercury	mg/kg	46	0.034	0.050	0.077	0.061	102	0.016	0.470	0.081	0.083
Nickel	mg/kg	53	1.20	25.6	6.93	5.32	111	3.20	34.0	14.7	6.77
Selenium	mg/kg	54	0.100	3.20	0.458	0.634	110	0.380	2.40	0.611	0.513
Silver	mg/kg	48	1.40	3.40	0.737	0.654	106	0.090	5.00	0.757	0.762
Zinc	mg/kg	55	6.50	720	72.2	129	111	19.2	704	120	111
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	46.0	2,000	367	324
4,4'-DDT	ug/kg	N/A	N/A	N/A	N/A	N/A	79	2.90	4.90	11.0	11.9
Acenaphthene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	24.0	620	253	144
Anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	20.0	970	241	176
Atrazine	ug/kg	N/A	N/A	N/A	N/A	N/A	1	120	120	120	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	26.0	1,400	306	322
Benzo(a)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	23.0	1,300	330	314
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	35.0	900	319	279
Benzo(k)fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	35.0	1,200	330	300
bis(2-ethylhexyl)phthalate	ug/kg	N/A	N/A	N/A	N/A	N/A	104	1.00	47,000	868	4,647
Carbazole	ug/kg	N/A	N/A	N/A	N/A	N/A	30	20.0	300	184	119
Chrysene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	22.0	1,500	320	343
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	41.0	330	346	260
Fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	44.0	3,100	494	547
Fluorene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	21.0	650	337	271
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	23.0	890	309	281
Naphthalene	ug/kg	N/A	N/A	N/A	N/A	N/A	106	1.10	320	287	234
Arochlor-1254	ug/kg	N/A	N/A	N/A	N/A	N/A	124	7.30	5,200	166	479
Phenanthrene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	26.0	3,300	419	522
Pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	104	37.0	3,900	495	574

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

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Table A3.2.SW AEU.1
Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			SW AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	166	NONPARAMETRIC	82	1582	NONPARAMETRIC	85	WRS	0.991	No
Ammonia	**1**	**0**	**0**	**2581**	**NONPARAMETRIC**	**91**	**N/A**	**N/A**	**N/A**
Antimony	**169**	**NONPARAMETRIC**	**10**	**1606**	**NONPARAMETRIC**	**31**	**N/A**	**N/A**	**N/A**
Barium	**172**	**NONPARAMETRIC**	**78**	**1600**	**NONPARAMETRIC**	**98**	**WRS**	**5.46E-08**	**Yes**
Beryllium	**167**	**NONPARAMETRIC**	**13**	**1840**	**NONPARAMETRIC**	**25**	**N/A**	**N/A**	**N/A**
Cyanide	**128**	**NONPARAMETRIC**	**5**	**179**	**NONPARAMETRIC**	**11**	**N/A**	**N/A**	**N/A**
Fluoride	**118**	**NONPARAMETRIC**	**95**	**576**	**NONPARAMETRIC**	**95**	**WRS**	**0**	**Yes**
Lithium	**166**	**NONPARAMETRIC**	**49**	**1156**	**NONPARAMETRIC**	**88**	**WRS**	**7.88E-15**	**Yes**
Nitrite	**77**	**NONPARAMETRIC**	**3**	**N/A**	**N/A**	**93**	**N/A**	**N/A**	**N/A**
Selenium	**162**	**NONPARAMETRIC**	**14**	**1599**	**NONPARAMETRIC**	**35**	**N/A**	**N/A**	**N/A**
Vanadium	171	NONPARAMETRIC	34	1596	NONPARAMETRIC	58	WRS	0.720	No
Plutonium-239/240	**107**	**NONPARAMETRIC**	**100**	**2732**	**NONPARAMETRIC**	**100**	**WRS**	**0**	**Yes**
Radium-226	5	NORMAL	100	34	NONPARAMETRIC	100	WRS	0.762	No
Uranium-233/234	**77**	**NONPARAMETRIC**	**100**	**2118**	**NONPARAMETRIC**	**100**	**WRS**	**1.57E-08**	**Yes**
Uranium-238	**77**	**NONPARAMETRIC**	**100**	**2118**	**NONPARAMETRIC**	**100**	**WRS**	**1.30E-12**	**Yes**

WRS = Wilcoxon Rank Sum
N/A = not applicable; site and/or background detection frequency less than 20%.
Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.SW AEU.2
Summary Statistics for Surface Water, Total Analyses (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)[a]

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/L	166	0.026	129	3.39	12.5	1582	0.009	325	3.49	13.0
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	2581	0	50.0	7.91	9.47
Antimony	mg/L	169	4.10E-04	0.055	0.015	0.028	1606	2.80E-04	0.604	0.014	0.036
Barium	mg/L	172	0.009	0.630	0.079	0.079	1600	2.20E-04	2.30	0.124	0.141
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	1840	2.00E-05	0.016	4.76E-04	6.46E-04
Cyanide	mg/L	128	0.002	0.040	0.048	0.443	179	0.003	0.061	0.006	0.007
Fluoride	mg/L	118	0.100	1.00	0.335	0.125	576	0.050	9.60	0.766	0.507
Lithium	mg/L	166	0.001	0.154	0.015	0.022	1156	3.90E-04	2.83	0.020	0.100
Nitrite	mg/L	77	0.020	0.058	0.016	0.010	759	0.020	6.60	0.632	0.928
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	1599	3.00E-04	0.034	0.003	0.009
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	1596	1.60E-04	0.527	0.011	0.028
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	2732	-0.190	90.0	0.357	3.59
Radium-226	pCi/L	5	-0.100	4.90	1.76	2.06	34	-0.190	3.00	0.369	0.520
Uranium-233/234	pCi/L	77	-0.056	5.10	0.479	0.747	2118	-0.157	211	1.33	5.18
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	2118	-0.504	170	1.22	4.40
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	N/A	N/A	N/A	N/A	N/A	88	1.31	39.0	2.32	4.09
4,4'-DDT	ug/L	N/A	N/A	N/A	N/A	N/A	72	0.011	0.580	0.067	0.072
bis(2-ethylhexyl)phthalate	ug/L	N/A	N/A	N/A	N/A	N/A	153	0.500	98.0	5.28	8.19

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

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Table A3.2.SW AEU.3
Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			SW AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Cadmium	**136**	**NONPARAMETRIC**	**7**	**1113**	**NONPARAMETRIC**	**15**	N/A	N/A	N/A
Copper	138	NONPARAMETRIC	33	836	NONPARAMETRIC	37	WRS	1.00	No
Iron	137	LOGNORMAL	80	838	NONPARAMETRIC	44	WRS	1.00	No
Lead	**133**	**NONPARAMETRIC**	**24**	**849**	**NONPARAMETRIC**	**17**	N/A	N/A	N/A
Silver	**141**	**NONPARAMETRIC**	**6**	**1286**	**NONPARAMETRIC**	**5**	N/A	N/A	N/A
Zinc	138	NONPARAMETRIC	57	838	NONPARAMETRIC	51	WRS	0.523	No

WRS = Wilcoxon Rank Sum

N/A = not applicable; site and/or background detection frequency less than 20%.

Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.SW AEU.4
Summary Statistics for Surface Water, Dissolved Analyses (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)[a]

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	1113	5.00E-05	0.031	0.001	0.002
Copper	mg/L	138	0.001	0.026	0.006	0.005	836	3.10E-04	0.044	0.002	0.003
Iron	mg/L	137	0.010	72.8	0.724	6.21	838	0.003	1.55	0.033	0.101
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	849	1.10E-04	0.041	0.001	0.005
Silver	mg/L	141	0.002	0.022	0.003	0.003	1286	1.40E-05	0.033	9.29E-04	0.001
Zinc	mg/L	138	0.002	2.30	0.033	0.197	838	0.002	0.760	0.035	0.067

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

Table A3.2.SW AEU.5
Statistical Distribution and Comparison to Background for Sediment (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			SW AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	**55**	**GAMMA**	**100**	**126**	**NONPARAMETRIC**	**100**	**WRS**	**0.005**	**Yes**
Antimony	**47**	**LOGNORMAL**	**11**	**118**	**NONPARAMETRIC**	**23**	**N/A**	**N/A**	**N/A**
Arsenic	**55**	**GAMMA**	**89**	**125**	**NONPARAMETRIC**	**95**	**WRS**	**2.13E-07**	**Yes**
Barium	**54**	**GAMMA**	**100**	**126**	**NONPARAMETRIC**	**100**	**WRS**	**0.006**	**Yes**
Cadmium	**48**	**LOGNORMAL**	**10**	**126**	**NONPARAMETRIC**	**49**	**N/A**	**N/A**	**N/A**
Chromium	**55**	**GAMMA**	**85**	**126**	**GAMMA**	**94**	**WRS**	**8.13E-06**	**Yes**
Copper	**55**	**GAMMA**	**80**	**126**	**NONPARAMETRIC**	**95**	**WRS**	**4.26E-07**	**Yes**
Fluoride	**N/A**	**N/A**	**N/A**	**16**	**NONPARAMETRIC**	**50**	**N/A**	**N/A**	**N/A**
Iron	**55**	**GAMMA**	**100**	**126**	**NORMAL**	**100**	**WRS**	**0.000**	**Yes**
Lead	**55**	**LOGNORMAL**	**100**	**126**	**LOGNORMAL**	**100**	**t-Test_LN**	**1.54E-05**	**Yes**
Manganese	55	GAMMA	100	126	NORMAL	100	WRS	4.74E-01	No
Mercury	**46**	**NONPARAMETRIC**	**4**	**107**	**NONPARAMETRIC**	**33**	**N/A**	**N/A**	**N/A**
Nickel	**53**	**GAMMA**	**72**	**126**	**NONPARAMETRIC**	**94**	**WRS**	**4.72E-08**	**Yes**
Selenium	**54**	**NONPARAMETRIC**	**28**	**125**	**LOGNORMAL**	**11**	**N/A**	**N/A**	**N/A**
Silver	**48**	**NONPARAMETRIC**	**6**	**124**	**NONPARAMETRIC**	**26**	**N/A**	**N/A**	**N/A**
Zinc	**55**	**NONPARAMETRIC**	**98**	**126**	**NONPARAMETRIC**	**100**	**WRS**	**7.18E-13**	**Yes**

WRS = Wilcoxon Rank Sum
t-Test_LN = Student's t-test using lognormal transformed data
N/A = not applicable; site and/or background detection frequency less than 20%.
Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

Table A3.2.SW AEU.6
Summary Statistics for Sediment (excluding background samples)
South Walnut Creek Aquatic Exposure Unit (SW AEU)[a]

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/kg	55	811	25,200	6,791	5,603	126	763	29,000	9,238	6,650
Antimony	mg/kg	47	1.00	12.4	3.64	3.21	118	0.270	25.6	3.39	4.58
Arsenic	mg/kg	55	0.270	8.70	2.43	1.92	125	0.690	21.6	4.35	2.75
Barium	mg/kg	54	10.6	260	78.9	58.8	126	7.20	240	101.1	59.9
Cadmium	mg/kg	48	0.410	1.30	0.525	0.345	126	0.036	44.00	1.030	3.934
Chromium	mg/kg	55	1.50	30.4	8.78	7.87	126	1.30	140.0	14.7	13.82
Copper	mg/kg	55	2.20	36.7	10.8	8.43	126	4.30	324	20.2	30.3
Fluoride	mg/kg	N/A	N/A	N/A	N/A	N/A	16	0.831	9.27	2.41	2.67
Iron	mg/kg	55	1,040	31,400	9,740	6,739	126	1,680	24,000	12,228	5,002
Lead	mg/kg	55	2.60	68.8	13.3	12.4	126	2.90	170	28.5	25.0
Manganese	mg/kg	55	9.00	1280.0	237.61	215.76	126	39.10	639	199.9	92.4
Mercury	mg/kg	46	0.034	0.05	0.077	0.061	107	0.013	1.70	0.064	0.163
Nickel	mg/kg	53	1.20	25.60	6.925	5.316	126	2.900	216.0	13.99	19.54
Selenium	mg/kg	54	0.10	3	00.5	1	125	00.3	4	0	0
Silver	mg/kg	48	1.40	03.4	1	1	124	00.2	3100.0	28	278
Zinc	mg/kg	55	0,007	0,720	72.2	128.8	126	18.60	888.00	166.47	167.11
Acenaphthene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	26.0	180	235	126
Anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	19.0	430	213	130
Benzo(a)anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	25.0	1400	294	284
Benzo(a)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	41.0	1300	327	275
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	43.0	1100	300	279
Benzo(k)fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	31.0	920	311	285
bis(2-ethylhexyl)phthalate	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	28.0	25000	1169	3104
Bromomethane	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	02.0	5	22	101
Carbazole	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	25.0	290	186	85
Chrysene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	23.0	1400	332	296
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	21.0	360	304	269
Fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	33.0	2700	540	526
Fluorene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	21.0	0,180	317	272
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	30.0	910	277	276
Arochlor-1254	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	27.00	3100.00	181.4	380
Arochlor-1260	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	53.0	2000	114	210.2
Phenanthrene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	35.0	1800	373	338
Pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	N/A	20.0	1,700	466	395

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

Table A3.2.WC AEU.1
Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			WC AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	166	NONPARAMETRIC	82	583	NONPARAMETRIC	90	WRS	0.256	No
Ammonia	**1**	**0**	**0**	**84**	**NONPARAMETRIC**	**38**	**N/A**	**N/A**	**N/A**
Barium	**172**	**NONPARAMETRIC**	**78**	**585**	**NONPARAMETRIC**	**97**	**WRS**	**0**	**Yes**
Beryllium	**167**	**NONPARAMETRIC**	**13**	**653**	**NONPARAMETRIC**	**23**	**N/A**	**N/A**	**N/A**
Cobalt	**171**	**NONPARAMETRIC**	**17**	**582**	**NONPARAMETRIC**	**33**	**N/A**	**N/A**	**N/A**
Lithium	**166**	**NONPARAMETRIC**	**49**	**532**	**NONPARAMETRIC**	**80**	**WRS**	**4.42E-06**	**Yes**
Selenium	**162**	**NONPARAMETRIC**	**14**	**570**	**NONPARAMETRIC**	**26**	**N/A**	**N/A**	**N/A**
Thallium	**166**	**NONPARAMETRIC**	**6**	**581**	**NONPARAMETRIC**	**6**	**N/A**	**N/A**	**N/A**
Vanadium	171	NONPARAMETRIC	34	582	NONPARAMETRIC	54	WRS	1.000	No
Americium-241	**101**	**NONPARAMETRIC**	**100**	**1097**	**NONPARAMETRIC**	**100**	**WRS**	**3.54E-05**	**Yes**
Plutonium-239/240	**107**	**NONPARAMETRIC**	**100**	**1138**	**NONPARAMETRIC**	**100**	**N/A**	**0.000**	**Yes**
Uranium-233/234	**77**	**NONPARAMETRIC**	**100**	**949**	**NONPARAMETRIC**	**100**	**N/A**	**0.000**	**Yes**
Uranium-238	**77**	**NONPARAMETRIC**	**100**	**949**	**NONPARAMETRIC**	**100**	**N/A**	**0.000**	**Yes**

WRS = Wilcoxon Rank Sum
N/A = not applicable; site and/or background detection frequency less than 20%.
Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.WC AEU.2
Summary Statistics for Surface Water, Total Analyses (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)[a]

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/L	166	0.026	129	3.39	12.5	583	0.009	415	7.11	30.2
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	84	0.070	15.0	0.569	1.77
Barium	mg/L	172	0.009	0.630	0.079	0.079	585	0.018	2.56	0.145	0.184
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	653	3.00E-05	0.026	6.73E-04	0.002
Cobalt	mg/L	171	2.90E-04	0.019	0.005	0.008	582	1.70E-04	0.112	0.003	0.008
Lithium	mg/L	166	0.001	0.154	0.015	0.022	532	0.001	0.277	0.012	0.019
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	570	4.60E-04	0.049	0.006	0.094
Thallium	mg/L	166	2.40E-04	0.007	0.003	0.012	581	2.30E-04	0.020	0.006	0.108
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	582	2.20E-04	0.747	0.015	0.056
Americium-241	pCi/L	101	-0.010	0.060	0.005	0.009	1097	-0.018	48.0	0.177	1.79
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	1138	-0.023	250	1.15	10.5
Uranium-233/234	pCi/L	77	-0.056	5.10	0.479	0.747	949	-0.143	194	1.77	7.70
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	949	-0.134	138	1.83	6.60

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

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Table A3.2.WC AEU.3
Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			WC AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Cadmium	**136**	**NONPARAMETRIC**	**7**	**351**	**NONPARAMETRIC**	**13**	N/A	N/A	N/A
Copper	138	NONPARAMETRIC	33	276	NONPARAMETRIC	39	WRS	1.000	No
Iron	137	LOGNORMAL	80	287	NONPARAMETRIC	65	WRS	1.00	No
Lead	133	NONPARAMETRIC	24	277	NONPARAMETRIC	35	WRS	0.992	No
Manganese	139	LOGNORMAL	81	296	LOGNORMAL	90	t-Test_LN	0.631	No
Mercury	**135**	**NONPARAMETRIC**	**7**	**271**	**NONPARAMETRIC**	**6**	N/A	N/A	N/A
Silver	**141**	**NONPARAMETRIC**	**6**	**353**	**NONPARAMETRIC**	**7**	N/A	N/A	N/A
Zinc	138	NONPARAMETRIC	57	281	NONPARAMETRIC	56	WRS	1.000	No

WRS = Wilcoxon Rank Sum
t-Test_LN = Student's t-test using lognormal transformed data
N/A = not applicable; site and/or background detection frequency less than 20%.
Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.WC AEU.4
Summary Statistics for Surface Water, Dissolved Analyses (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)[a]

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	351	5.00E-05	0.027	9.86E-04	0.002
Copper	mg/L	138	0.001	0.026	0.006	0.005	276	4.90E-04	0.023	0.003	0.003
Iron	mg/L	137	0.010	72.8	0.724	6.21	287	0.003	9.02	0.095	0.568
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	277	1.00E-04	0.027	0.002	0.005
Manganese	mg/L	139	1.00E-03	1.45	0.052	0.163	296	8.80E-04	1.77	0.047	0.138
Mercury	mg/L	135	2.20E-04	0.005	1.48E-04	4.06E-04	271	5.20E-05	1.00E-03	1.06E-04	8.94E-05
Silver	mg/L	141	0.002	0.022	0.003	0.003	353	1.50E-04	0.006	0.001	0.001
Zinc	mg/L	138	0.002	2.30	0.033	0.197	281	0.002	0.516	0.019	0.050

[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

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Table A3.2.WC AEU.5
Statistical Distribution and Comparison to Background for Sediment (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)

Analyte	Statistical Distribution Testing Results						Background Comparison Test		
	Background			WC AEU (excluding background samples)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	55	GAMMA	100	71	GAMMA	100	WRS	1.61E-05	Yes
Antimony	47	LOGNORMAL	11	66	NONPARAMETRIC	11	N/A	N/A	N/A
Arsenic	55	GAMMA	89	71	NONPARAMETRIC	99	WRS	1.48E-09	Yes
Barium	54	GAMMA	100	71	GAMMA	99	WRS	2.81E-06	Yes
Cadmium	48	LOGNORMAL	10	67	NONPARAMETRIC	31	N/A	N/A	N/A
Chromium	55	GAMMA	85	71	GAMMA	99	WRS	1.74E-04	Yes
Copper	55	GAMMA	80	71	LOGNORMAL	94	WRS	1.57E-06	Yes
Fluoride	N/A	N/A	N/A	4	NONPARAMETRIC	25	N/A	N/A	N/A
Iron	55	GAMMA	100	71	NORMAL	100	WRS	5.44E-07	Yes
Lead	55	LOGNORMAL	100	71	GAMMA	100	WRS	4.32E-09	Yes
Manganese	55	GAMMA	100	71	GAMMA	100	WRS	9.63E-04	Yes
Mercury	46	NONPARAMETRIC	4	69	NONPARAMETRIC	25	N/A	N/A	N/A
Nickel	53	GAMMA	72	71	NORMAL	89	WRS	3.34E-08	Yes
Selenium	54	NONPARAMETRIC	28	64	LOGNORMAL	42	WRS	2.82E-05	Yes
Silver	48	NONPARAMETRIC	6	68	NONPARAMETRIC	16	N/A	N/A	N/A
Zinc	55	NONPARAMETRIC	98	71	NONPARAMETRIC	100	WRS	3.34E-07	Yes

WRS = Wilcoxon Rank Sum

N/A = not applicable; site and/or background detection frequency less than 20%.

Bold = indicate ECOIs retained for further consideration in the upper-bound EPC comparison step.

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Table A3.2.WC AEU.6
Summary Statistics for Sediment (excluding background samples)
Woman Creek Aquatic Exposure Unit (WC AEU)[a]

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation	Total Samples	Minimum Detected Concentration	Maximum Detected Concentration	Mean Detected Concentration	Standard Deviation
Aluminum	mg/kg	55	811	25,200	6,791	5,603	71	1,560	31,000	11,119	6,611
Antimony	mg/kg	47	1.00	12.4	3.64	3.21	66	0.820	51.3	6.42	9.80
Arsenic	mg/kg	55	0.270	8.70	2.43	1.92	71	0.480	27.9	5.15	3.82
Barium	mg/kg	54	10.6	260	78.9	58.8	71	14.6	404	138	79.1
Cadmium	mg/kg	48	0.410	1.30	0.525	0.345	67	0.130	3.60	0.663	0.610
Chromium	mg/kg	55	1.50	30.4	8.78	7.87	71	2.90	70.1	13.1	9.39
Copper	mg/kg	55	2.20	36.7	10.8	8.43	71	2.70	212	23.7	32.6
Fluoride	mg/kg	N/A	N/A	N/A	N/A	N/A	4	20.3	20.3	5.93	9.58
Iron	mg/kg	55	1,040	31,400	9,740	6,739	71	3,030	38,800	16,132	7,533
Lead	mg/kg	55	2.60	68.8	13.3	12.4	71	4.90	118	26.9	18.2
Manganese	mg/kg	55	9.00	1,280	238	216	71	53.0	1,580	321	228
Mercury	mg/kg	46	0.034	0.050	0.077	0.061	69	0.015	3.80	0.165	0.500
Nickel	mg/kg	53	1.20	25.6	6.93	5.32	71	2.20	33.0	13.9	7.34
Selenium	mg/kg	54	0.100	3.20	0.458	0.634	64	0.330	3.80	0.659	0.650
Silver	mg/kg	48	1.40	3.40	0.737	0.654	68	0.850	7.70	0.938	1.19
Zinc	mg/kg	55	6.50	720	72.2	129	71	10.6	2,080	161	288
2-Butanone	ug/kg	N/A	N/A	N/A	N/A	N/A	44	3.00	380	21.0	61.1
4-Methylphenol	ug/kg	N/A	N/A	N/A	N/A	N/A	49	93.0	510	317	192
Acenaphthene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	74.0	510	294	153
Anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	90.0	470	297	153
Benzo(a)anthracene	ug/kg	N/A	N/A	N/A	N/A	N/A	54	22.0	1200	299	236
Benzo(a)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	37.0	970	305	210
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	45.0	630	313	191
Benzo(k)fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	72.0	690	310	192
Chrysene	ug/kg	N/A	N/A	N/A	N/A	N/A	50	41.0	1,200	288	221
Fluoranthene	ug/kg	N/A	N/A	N/A	N/A	N/A	50	31.0	2,900	310	412
Heptachlor	ug/kg	N/A	N/A	N/A	N/A	N/A	52	0	0	9.04	9.54
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	49	24.0	500	314	179
Arochlor-1254	ug/kg	N/A	N/A	N/A	N/A	N/A	57	26.0	250	161	192
Phenanthrene	ug/kg	N/A	N/A	N/A	N/A	N/A	50	24.0	2,900	321	406
Pyrene	ug/kg	N/A	N/A	N/A	N/A	N/A	50	45.0	3,100	343	443

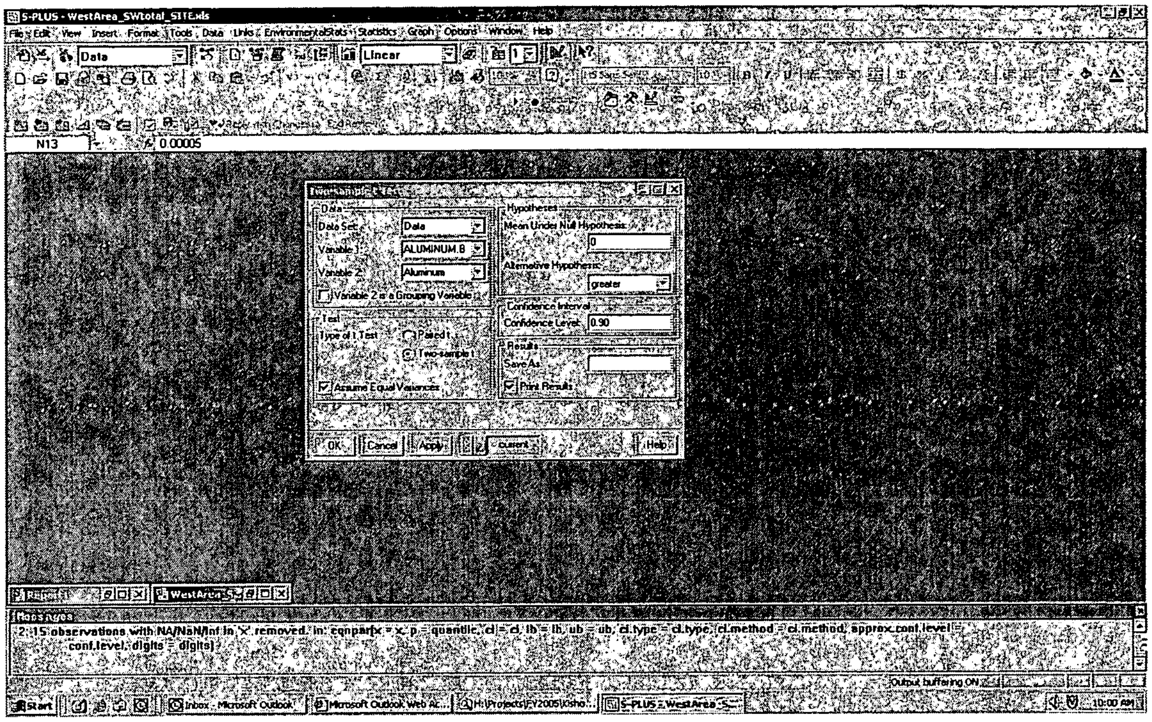
[a] Statistics are computed using one-half the reported values for non-detects.
N/A - Not Available

FIGURES

Figure A3.2.1 ProUCL Output

Data File	H:\Projects\FY2005\SiteData\WestArea\WestArea_SS_SITE.xls	
Variable:	Aluminum	
Raw Statistics		
Number of Observations	10	
Number of Missing Data	0	
Number of Valid Observations	10	
Number of Distinct Observations	7	
Minimum	8200	
Maximum	18000	
Mean	13520	
Standard Deviation	3168.1751	
Variance	10037333	
Coefficient of Variation	0.2343325	
Skewness	-0.065174	
Too Few Distinct Observations?	NO	
Normal Statistics		
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9587479	
Shapiro-Wilk 5% Critical Value	0.842	
5% Normality Test Result	NORMAL	Data are normal at 5% significance level
95% Student's-t UCL	15356.531	
Gamma Statistics		
k hat	19.081819	
k star (bias corrected)	13.42394	
Theta hat	708.52786	
Theta star	1007.1559	
nu hat	381.63637	
nu star	268.47879	
5% Approximate Chi Square Value	231.52659	
Adjusted Level of Significance	0.0267	
Adjusted Chi Square Value	225.5588	
Anderson-Darling Test Statistic	0.2323412	
Anderson-Darling 5% Critical Value	0.7245968	
Anderson-Darling 5% Gamma Test Result	AD GAMMA	Data follow gamma distribution at 5% signifcance level.
Kolmogrov-Smirnov Test Statistic	0.1322589	
Kolmogrov-Smirnov 5% Critical Value	0.2662122	
Kolmogrov-Smirnov 5% Gamma Test Result	KS GAMMA	Data follow gamma distribution at 5% signifcance level
5% Gamma Test Result	GAMMA	Data follow gamma distribution at 5% signifcance level
95% Approximate Gamma UCL	15677.825	
95% Adjusted Gamma UCL	16092.626	
Lognormal Statistics		
Minimum of log data	9.0118894	
Maximum of log data	9.798127	
Mean of log data	9.4854936	
Standard Deviation of log data	0.2473439	
Variance of log data	0.061179	
Lilliefors Test Statisitic	N/R	Shapiro Wilk method yields a more accurate result
Lilliefors 5% Critical Value	N/R	Shapiro Wilk method yields a more accurate result
Shapiro-Wilk Test Statisitic	0.9485927	
Shapiro-Wilk 5% Critical Value	0.842	
5% Lognormality Test Result	LOGNORMAL	Data are lognormal at 5% significance level
MLE Mean	13576.33	
MLE Standard Deviation	3410.0427	
MLE Coefficient of Variation	0.2511756	
MLE Skewness	0.7693733	
MLE Median	13167.324	
MLE 80% Quantile	16228.093	
MLE 90% Quantile	18093.906	
MLE 95% Quantile	19778.965	
MLE 99% Quantile	23407.586	
MVU Estimate of Median	13127.096	
MVU Estimate of Mean	13533.936	
MVU Estimate of Standard Deviation	3364.1695	
MVU Estimate of SE of Mean	1063.7119	
95% H-UCL	15910.591	
95% Chebyshev (MVUE) UCL	18170.549	
97.5% Chebyshev (MVUE) UCL	20176.815	
99% Chebyshev (MVUE) UCL	24117.737	
Non-parametric Statisitics		
95% CLT UCL	15167.921	
95% Adjusted-CLT UCL	15145.858	
95% Modified-t UCL	15353.09	
95% Jackknife UCL	15356.531	
95% Chebyshev (Mean, Sd) UCL	17887.028	-
97.5% Chebyshev (Mean, Sd) UCL	19776.644	
99% Chebyshev (Mean, Sd) UCL	23488.43	
Bootstrap Statistics		
Number of Bootstrap Runs	2000	
95% Standard Bootstrap UCL	15053.705	
95% Bootstrap-t UCL	15497.1	
95% Hall's Bootstrap UCL	15420.872	
95% Percentile Bootstrap UCL	15020	
95% BCA Bootstrap UCL	15000	
Recommendations		
Human Inspection Recommended?	NO	
Appropriate Distribution	NORMAL	
1st Recommended UCL	15356.531	95% Student's-t UCL
2nd Recommended UCL		
3rd Recommended UCL		
Recommended UCL > Max Data Value		
Recommendation Warning!	NONE	
Alternative UCL	NONE	

Figure A3.2.2 Example of Student's t-test Dialog Box



Results of Hypothesis Test

Null Hypothesis:	difference in means = 0
Alternative Hypothesis	True difference in means is greater than 0
Test Name:	Standard Two-Sample t-Test
Estimated Parameter(s):	mean of x = 0.7035975 mean of y = 9.656868
Data:	x: ALUMINUM.BKGD in Data, and y: Aluminum in Data
Test Statistic:	t = -4.171769
Test Statistic Parameter:	df = 148
P-value:	0.9999743
90 percent Confidence Interval	LCL = -11.71601 UCL = NA

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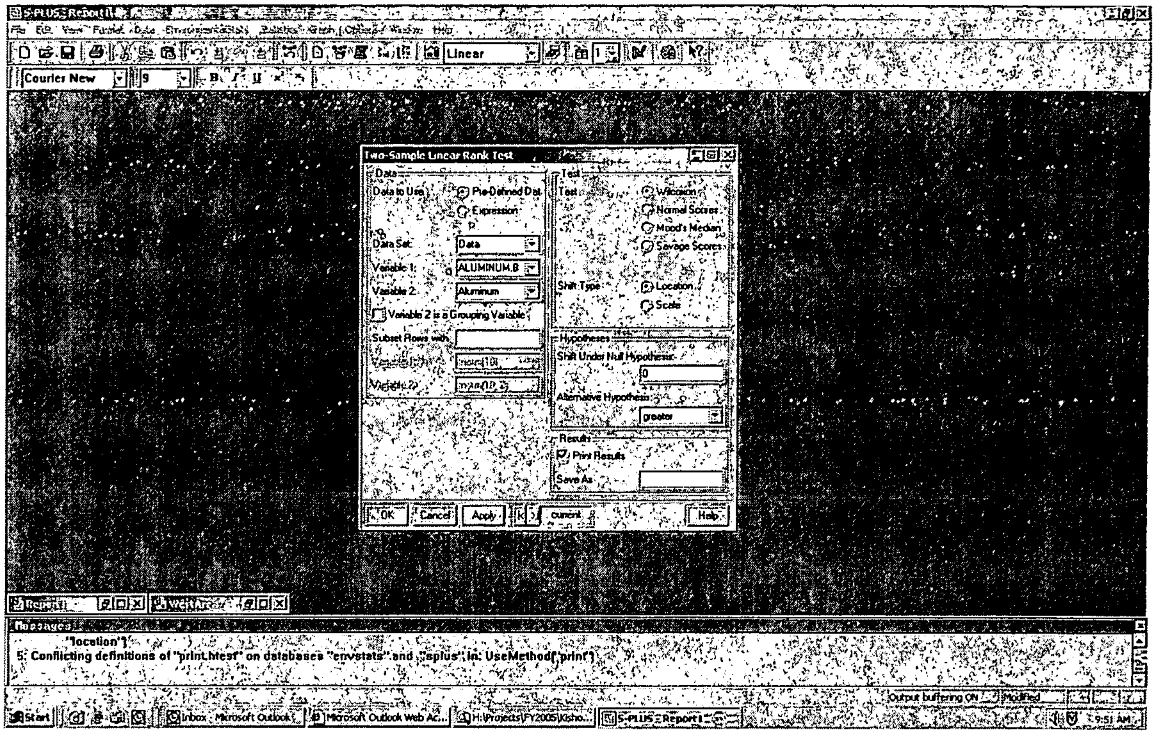
Figure A3.2.3 Example of Wilcoxon Rank Sum Dialog Box



Results of Hypothesis Test

Null Hypothesis:	Fy(t) = Fx(t)
Alternative Hypothesis:	Fy(t) > Fx(t) for at least one t
Test Name:	Two-Sample Linear Rank Test: Wilcoxon Rank Sum Test Based on Normal Approximation
Data:	x = ALUMINUM.BKGD y = Aluminum
Parent of Data:	Data
Sample Sizes:	nx = 99 ny = 51
Number NA/NaN/Inf's:	x = 15 y = 63
Test Statistic:	z = -6.848628
P-value:	1

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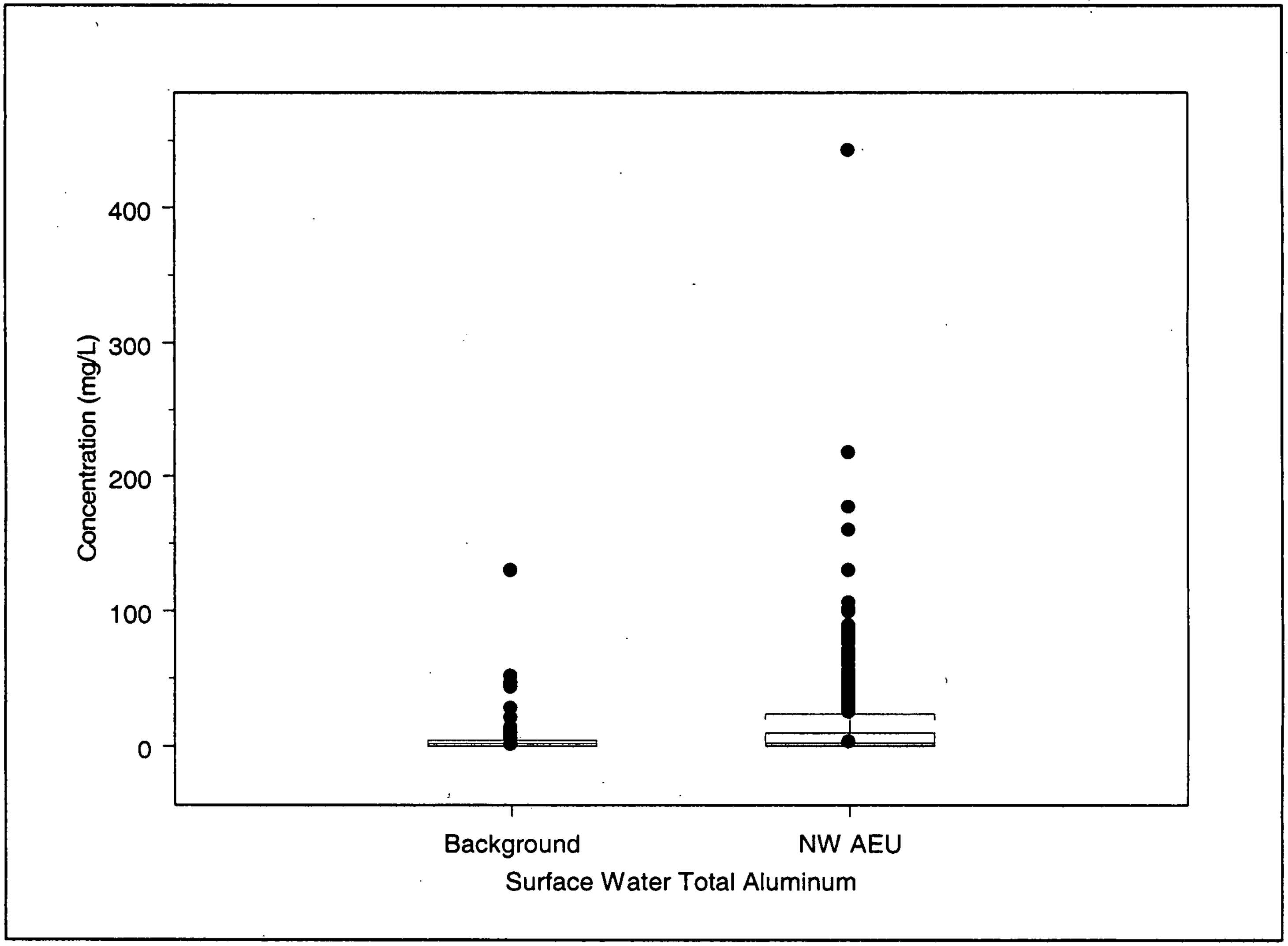
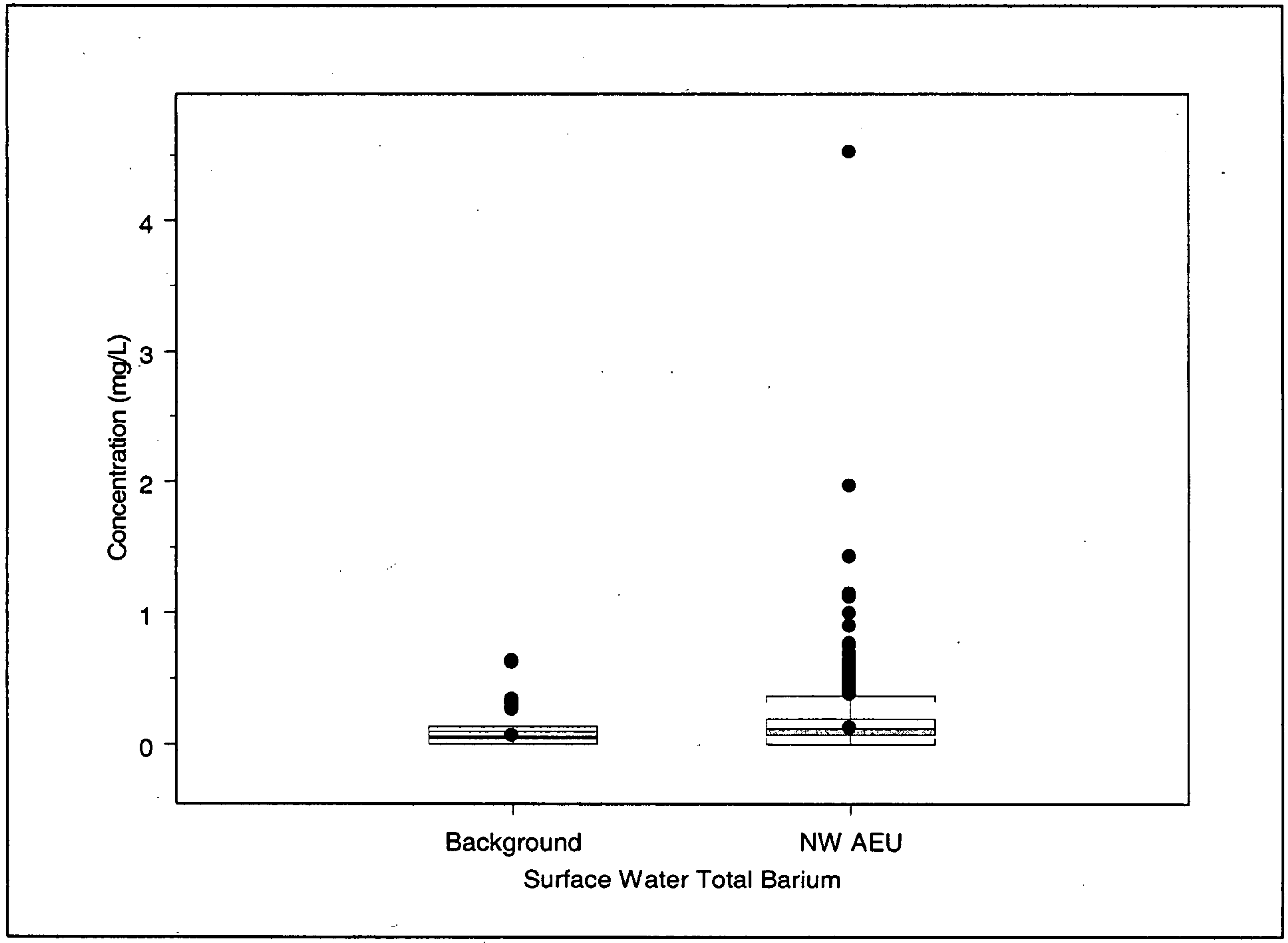
Figure A3.[illegible]W AEU.1
NW AEU Surface Water Total Box Plots for Aluminum



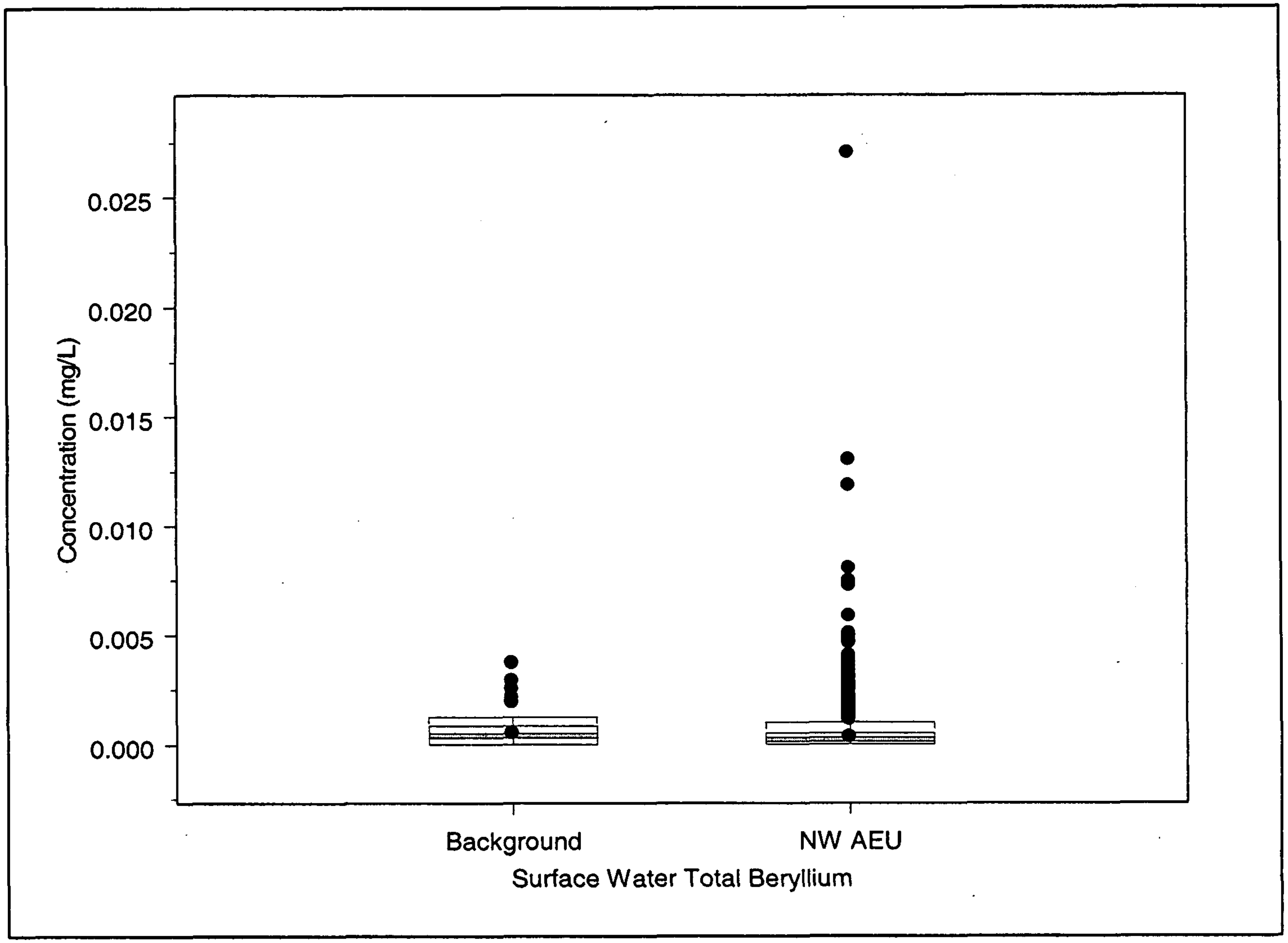
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.2
NW AEU Surface Water Total Box Plots for Barium



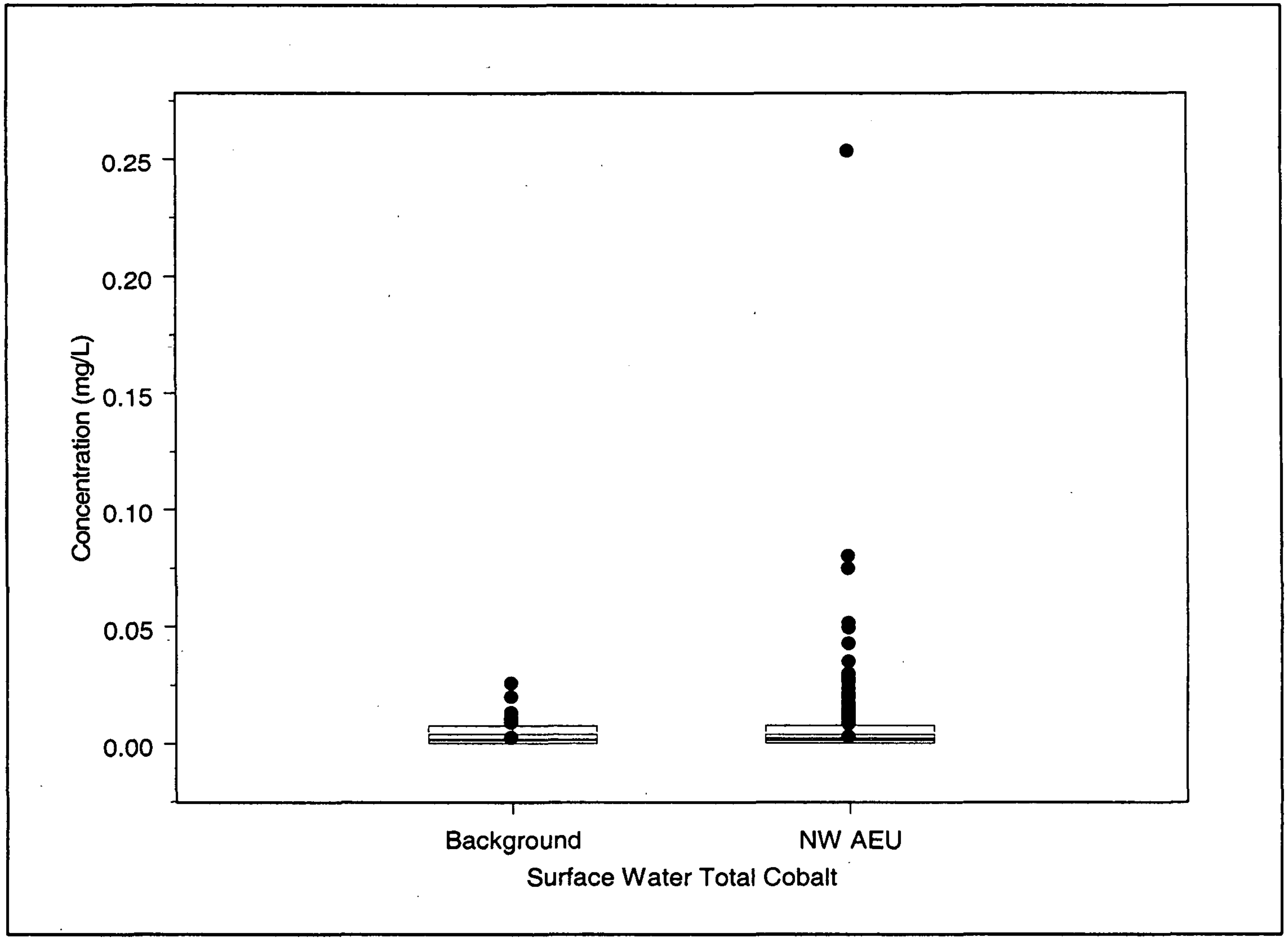
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3[illegible]W AEU.3
NW AEU Surface Water Total Box Plots for Beryllium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.4
NW AEU Surface Water Total Box Plots for Cobalt



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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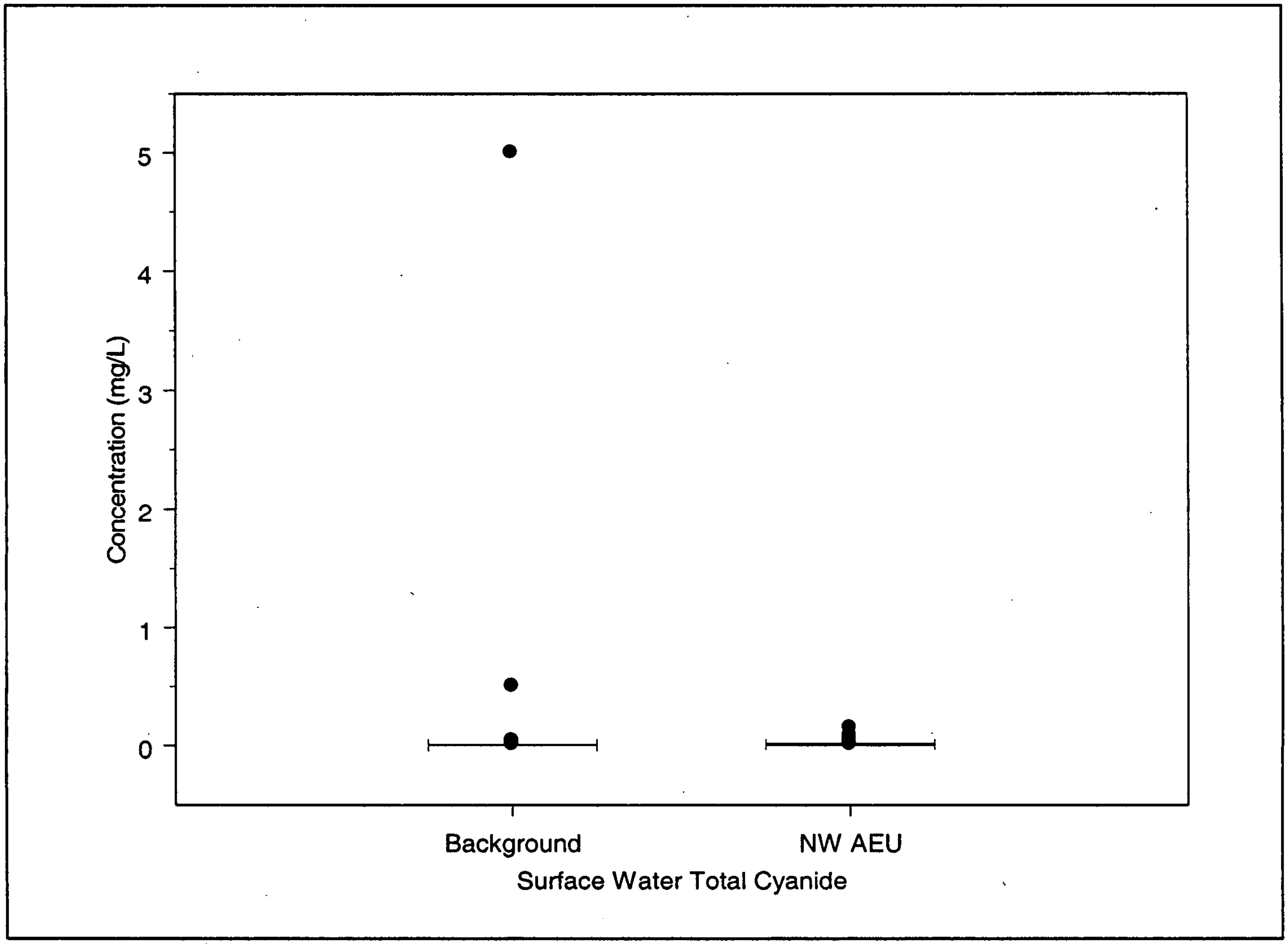
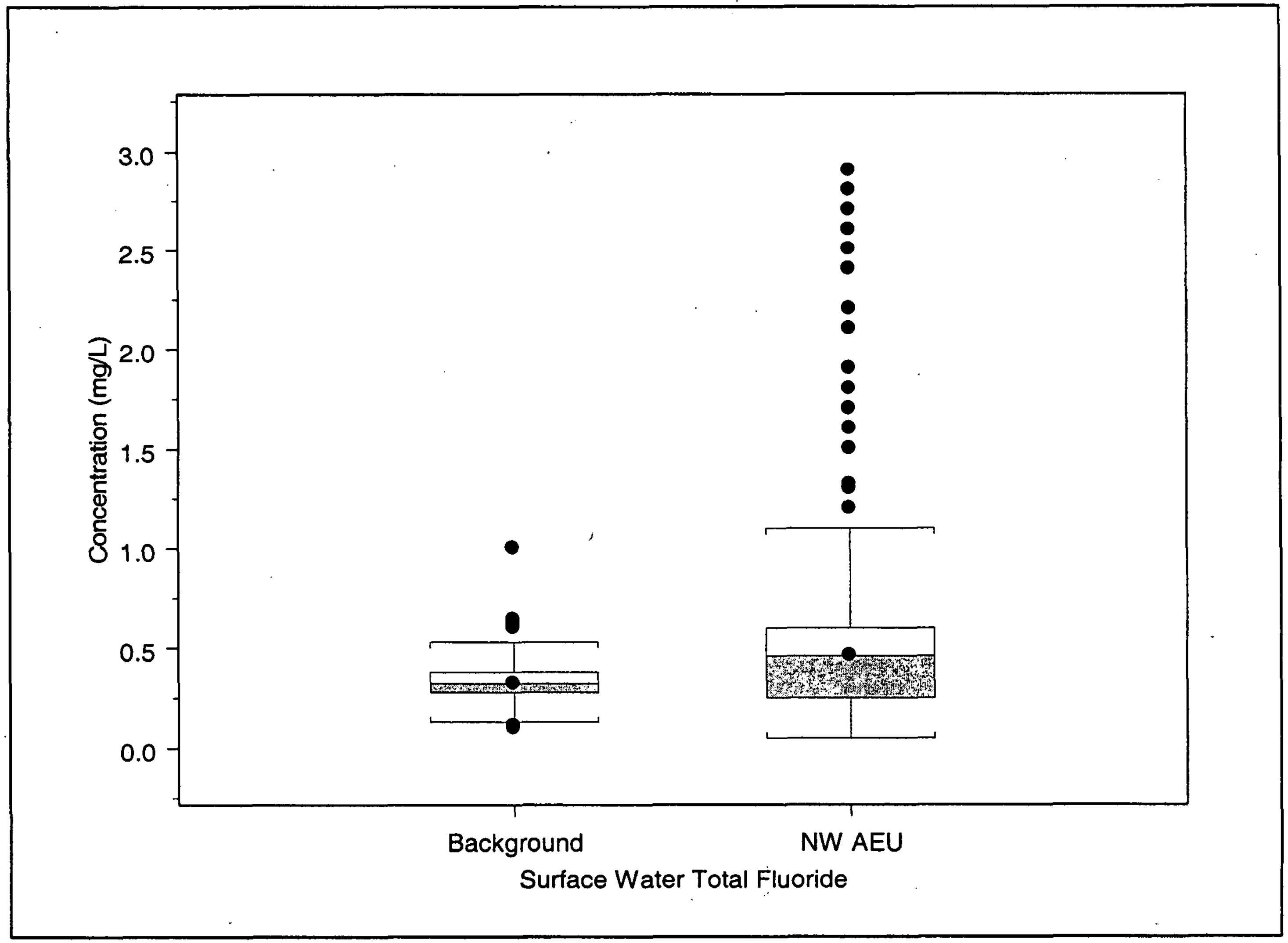
Figure A3.2.NW AEU.5
NW AEU Surface Water Total Box Plots for Cyanide



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]NW AEU.6
NW AEU Surface Water Total Box Plots for Fluoride



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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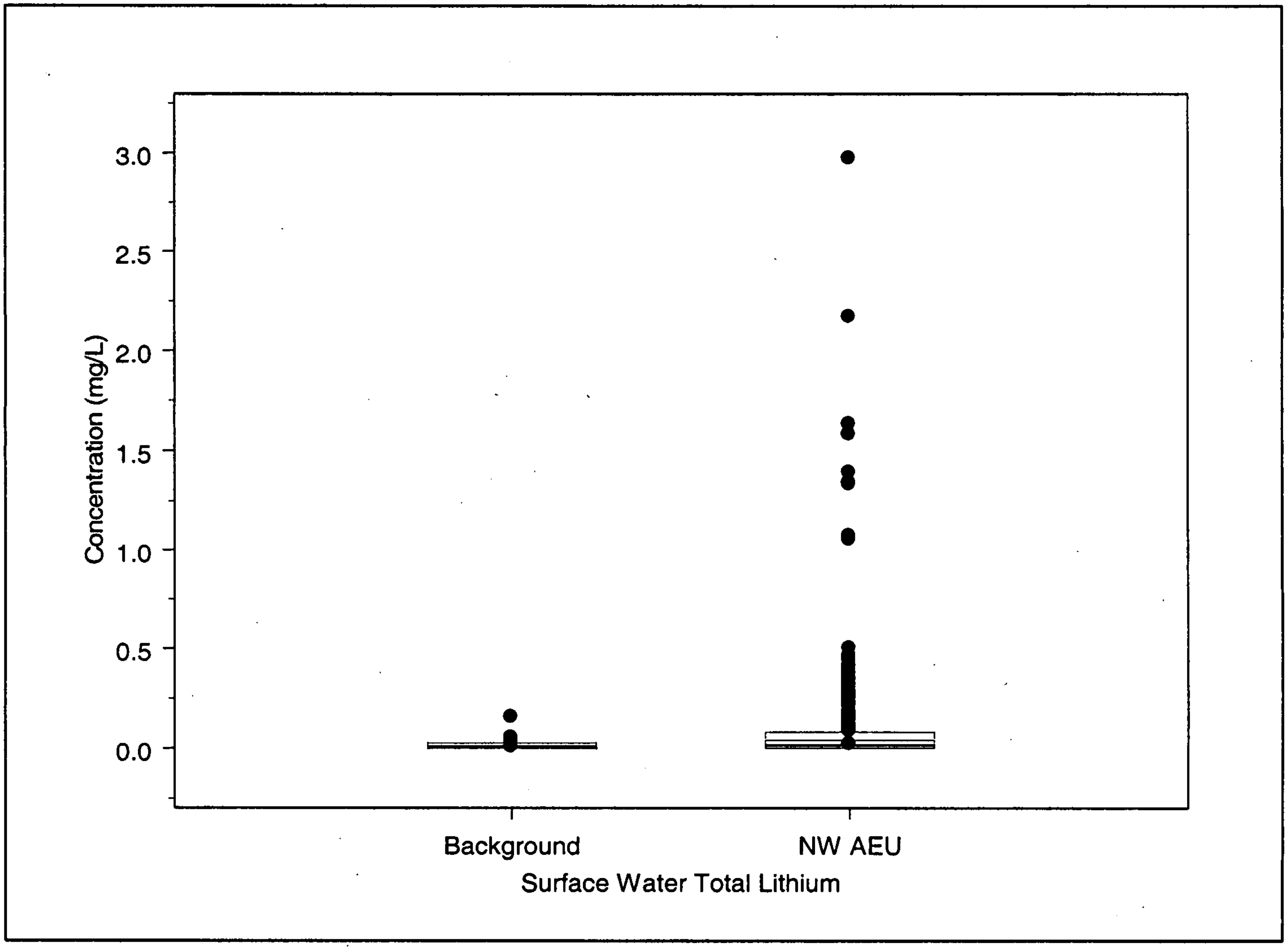
Figure A3.2.NW AEU.7
NW AEU Surface Water Total Box Plots for Lithium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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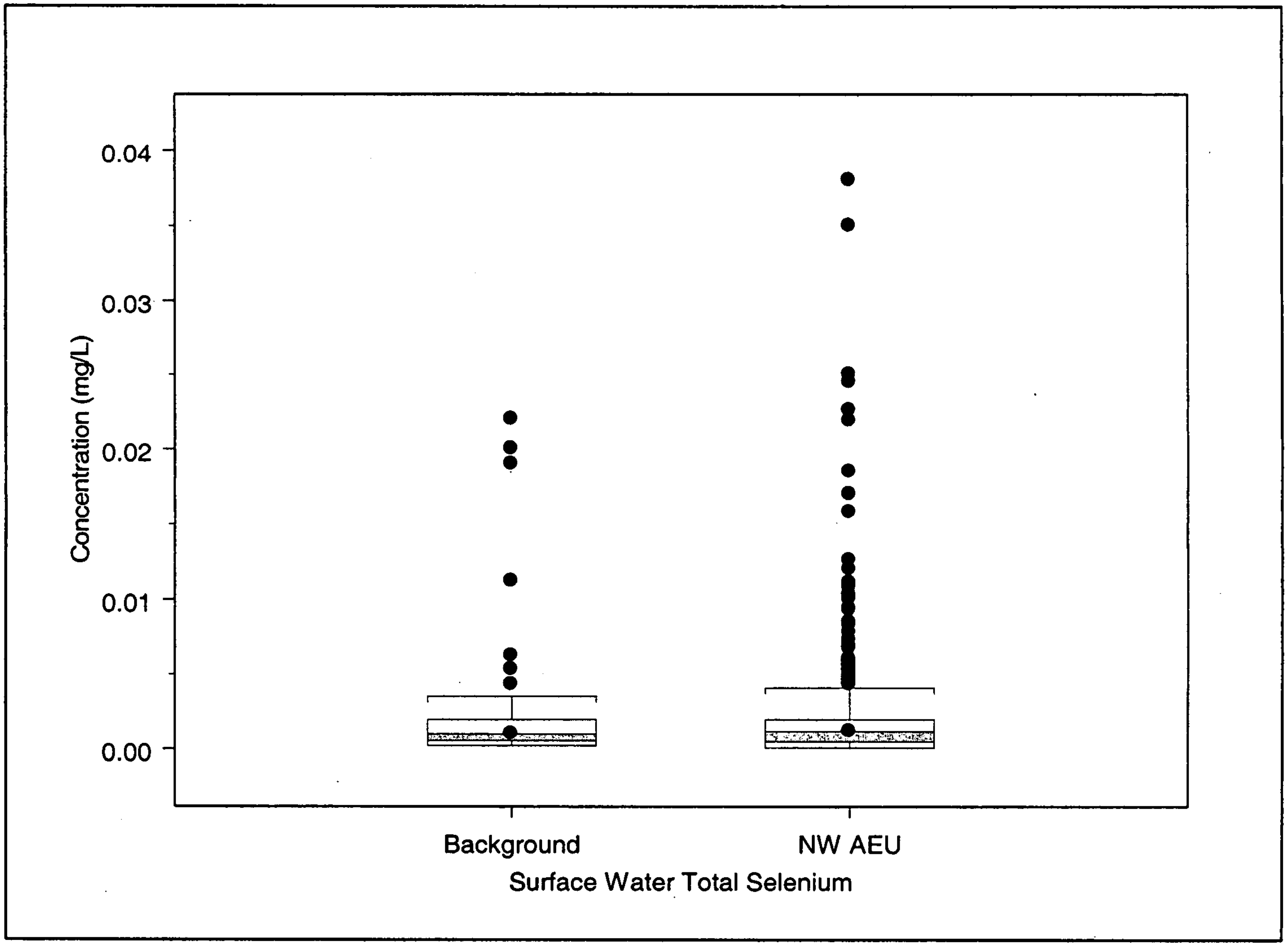
Figure A3.NW AEU.8
NW AEU Surface Water Total Box Plots for Selenium

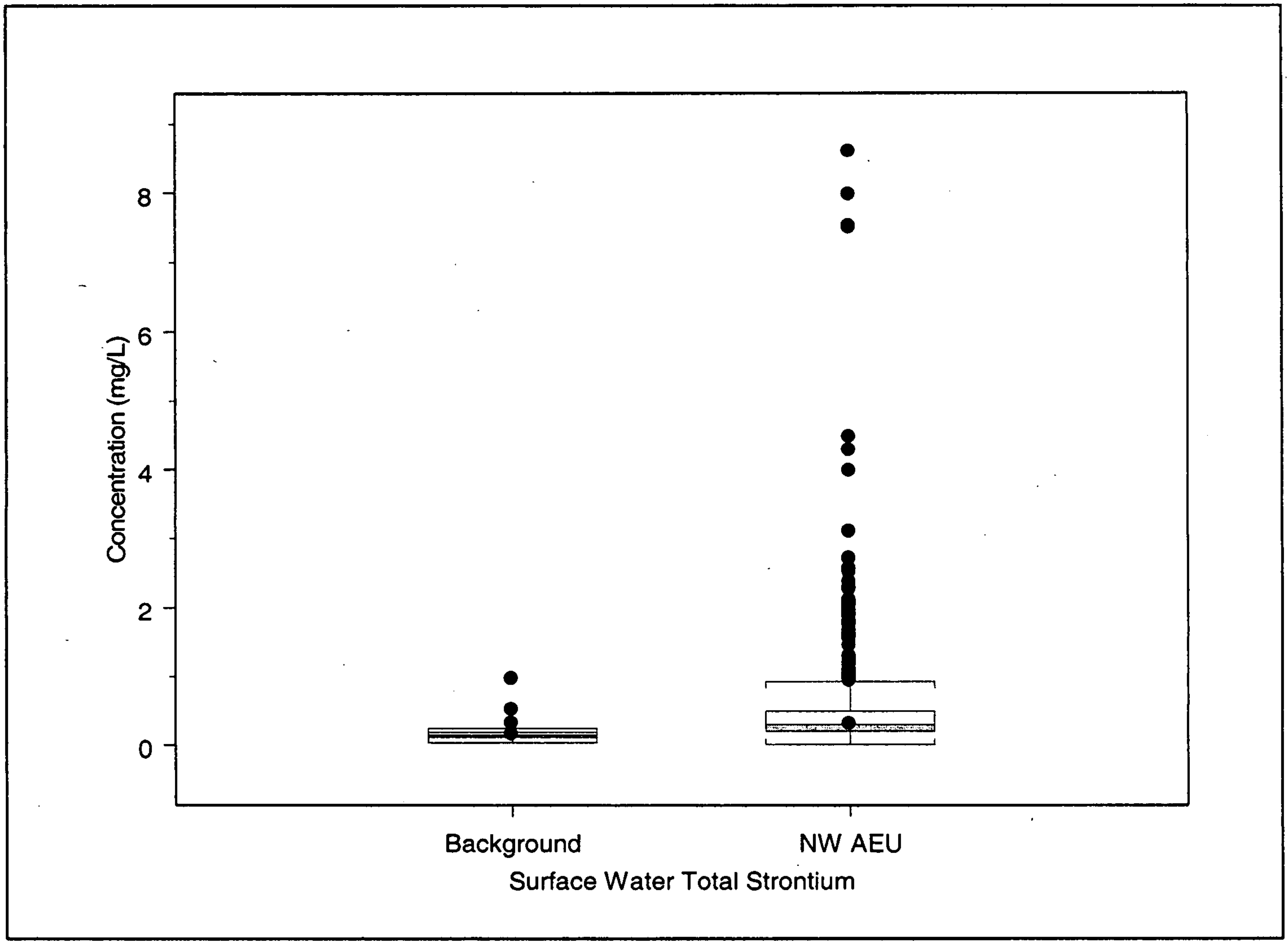


Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

617

Figure A3[illegible]NW AEU.9

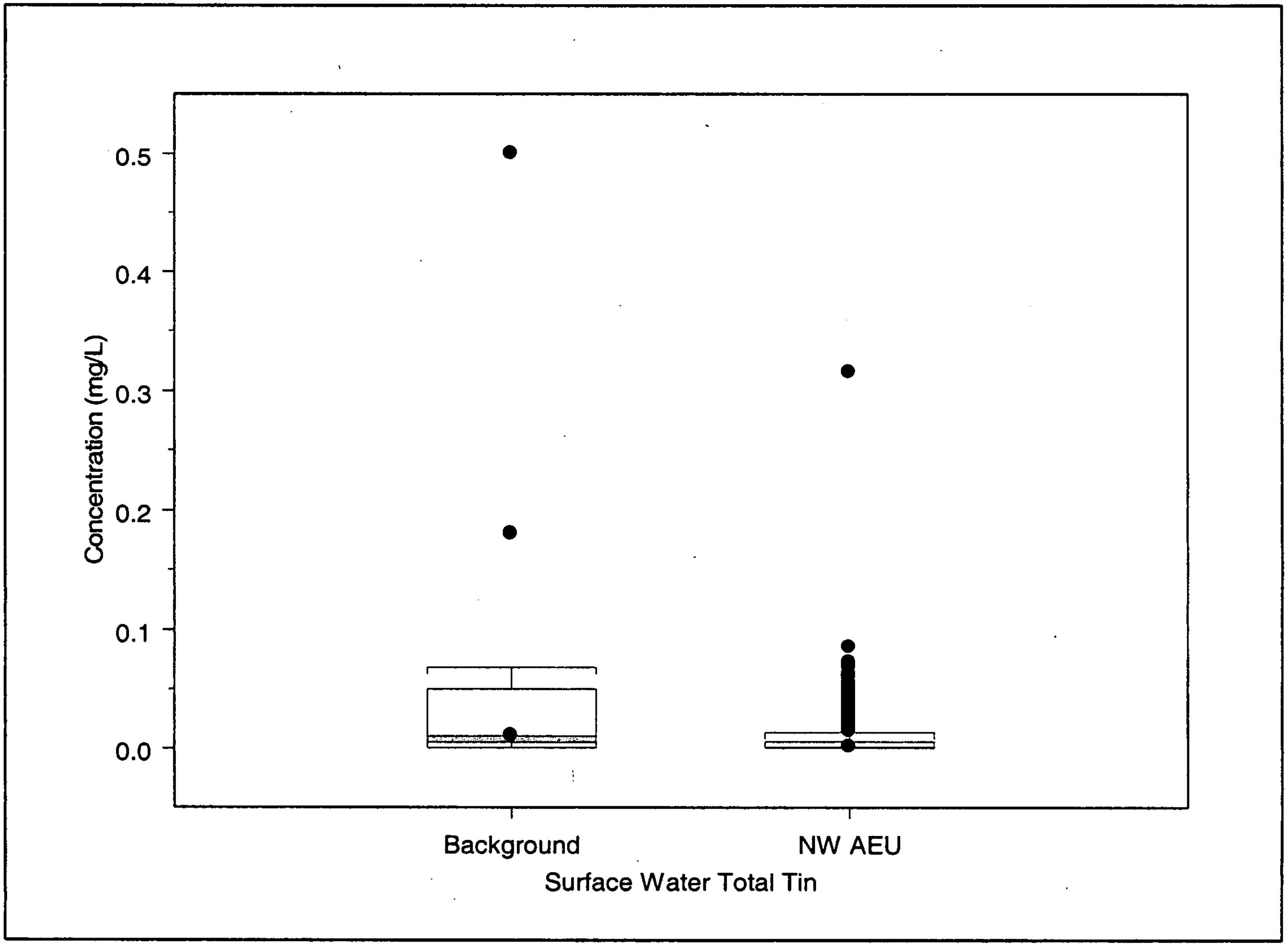
NW AEU Surface Water Total Box Plots for Strontium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

6/8

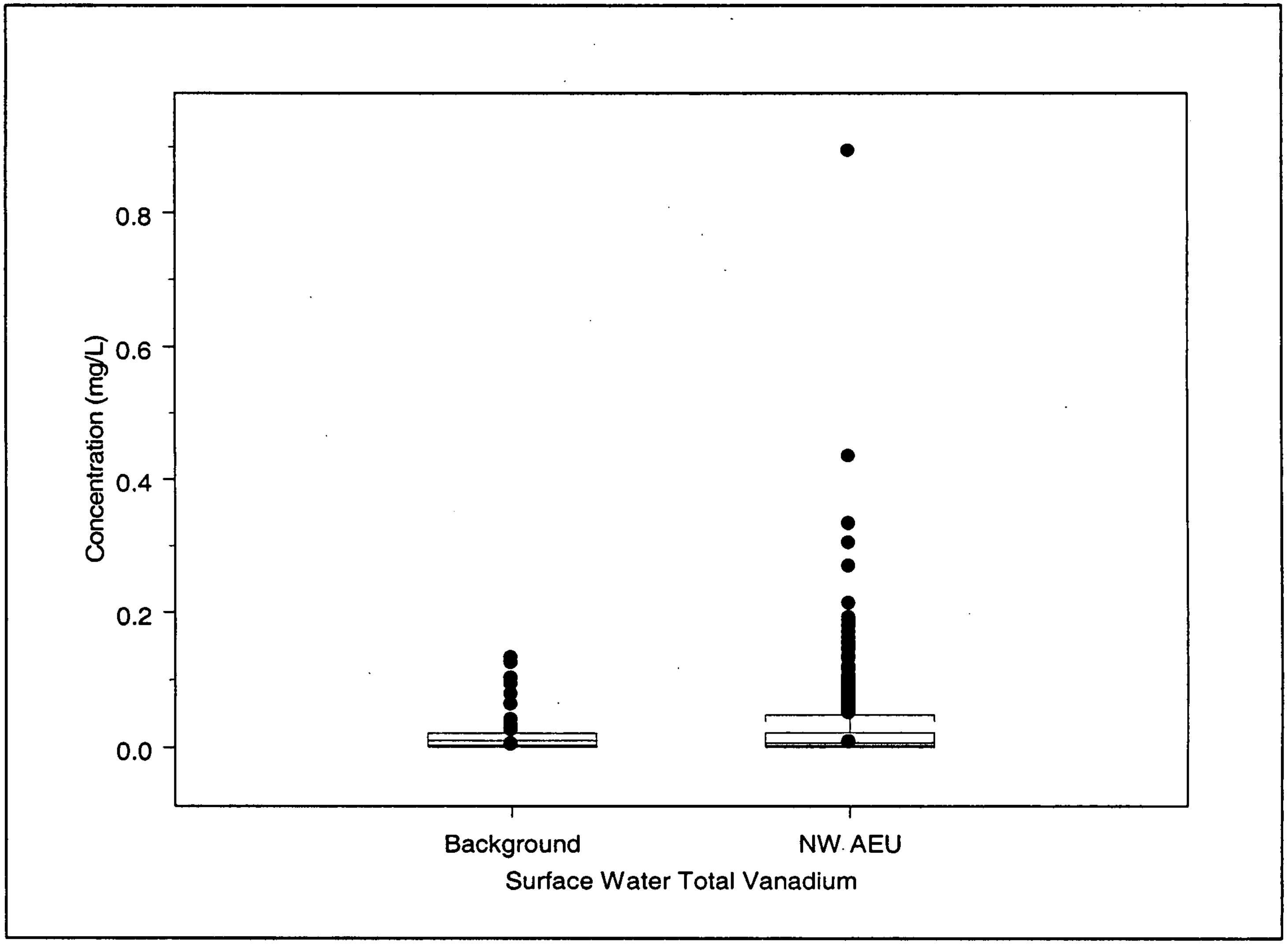
Figure A3.[illegible]W AEU.10
NW AEU Surface Water Total Box Plots for Tin



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

6/9

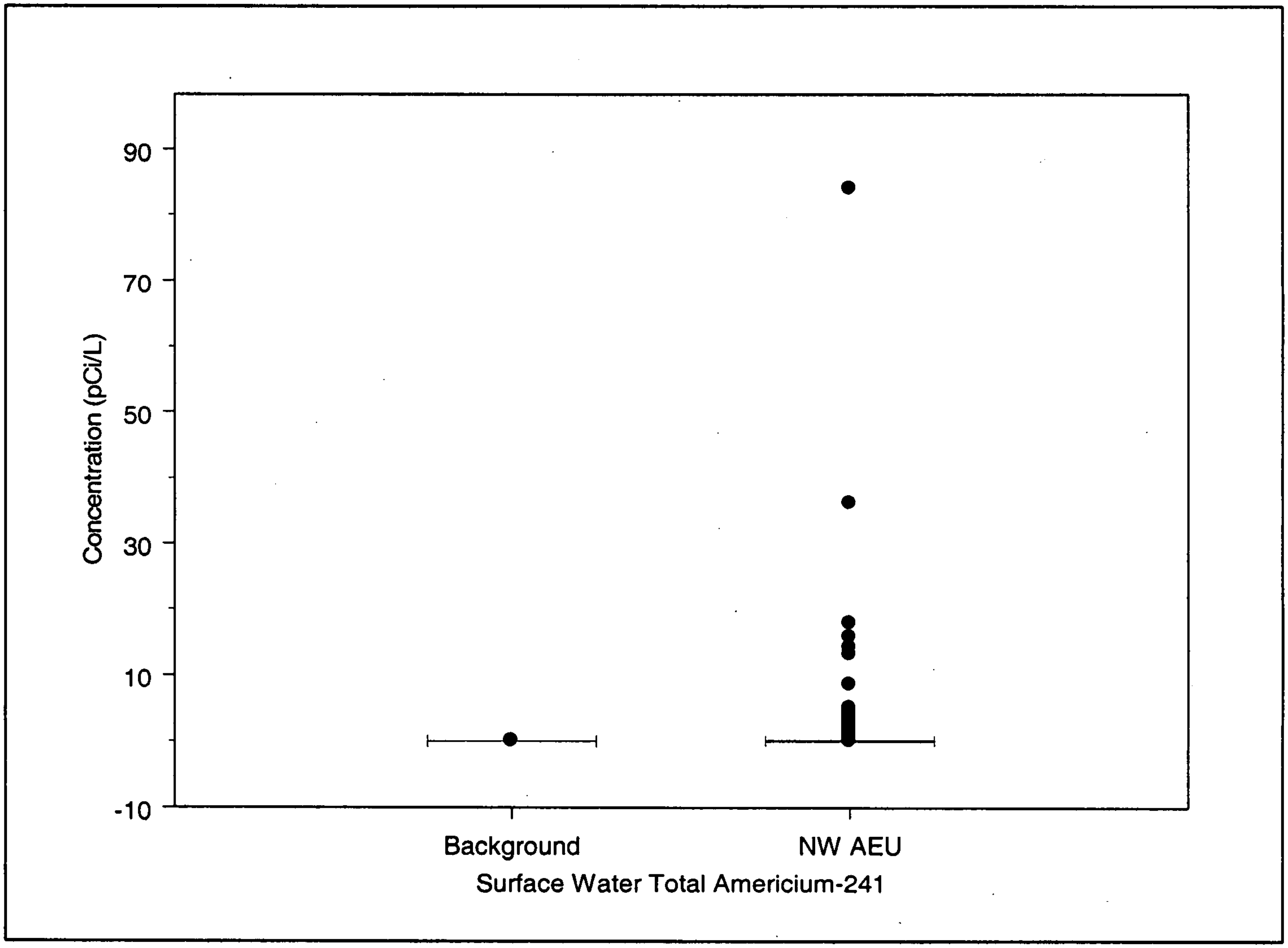
Figure A3.2.NW AEU.11
NW AEU Surface Water Total Box Plots for Vanadium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

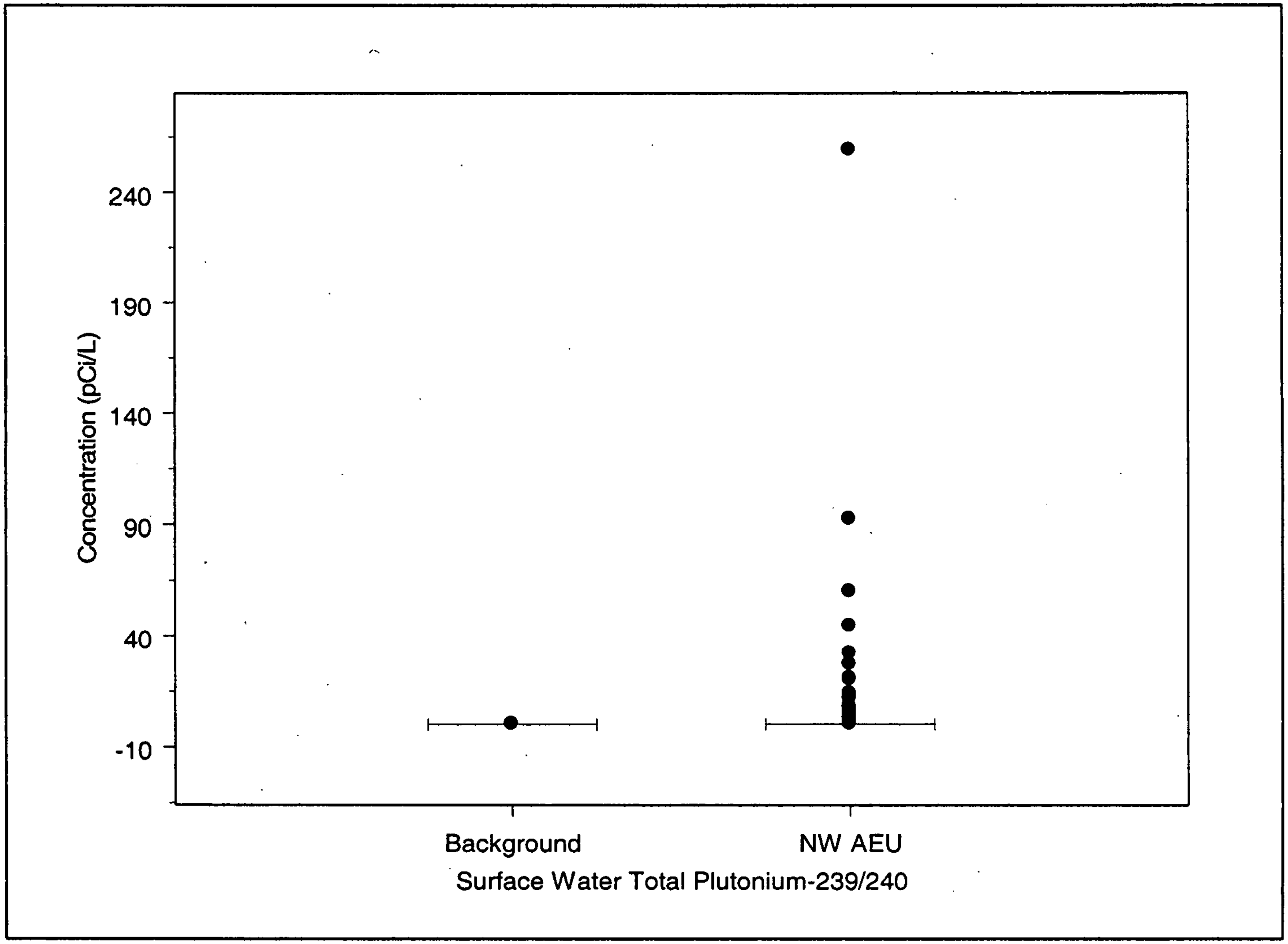
620

Figure A3.[illegible]W AEU.12
NW AEU Surface Water Total Box Plots for Americium-241



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

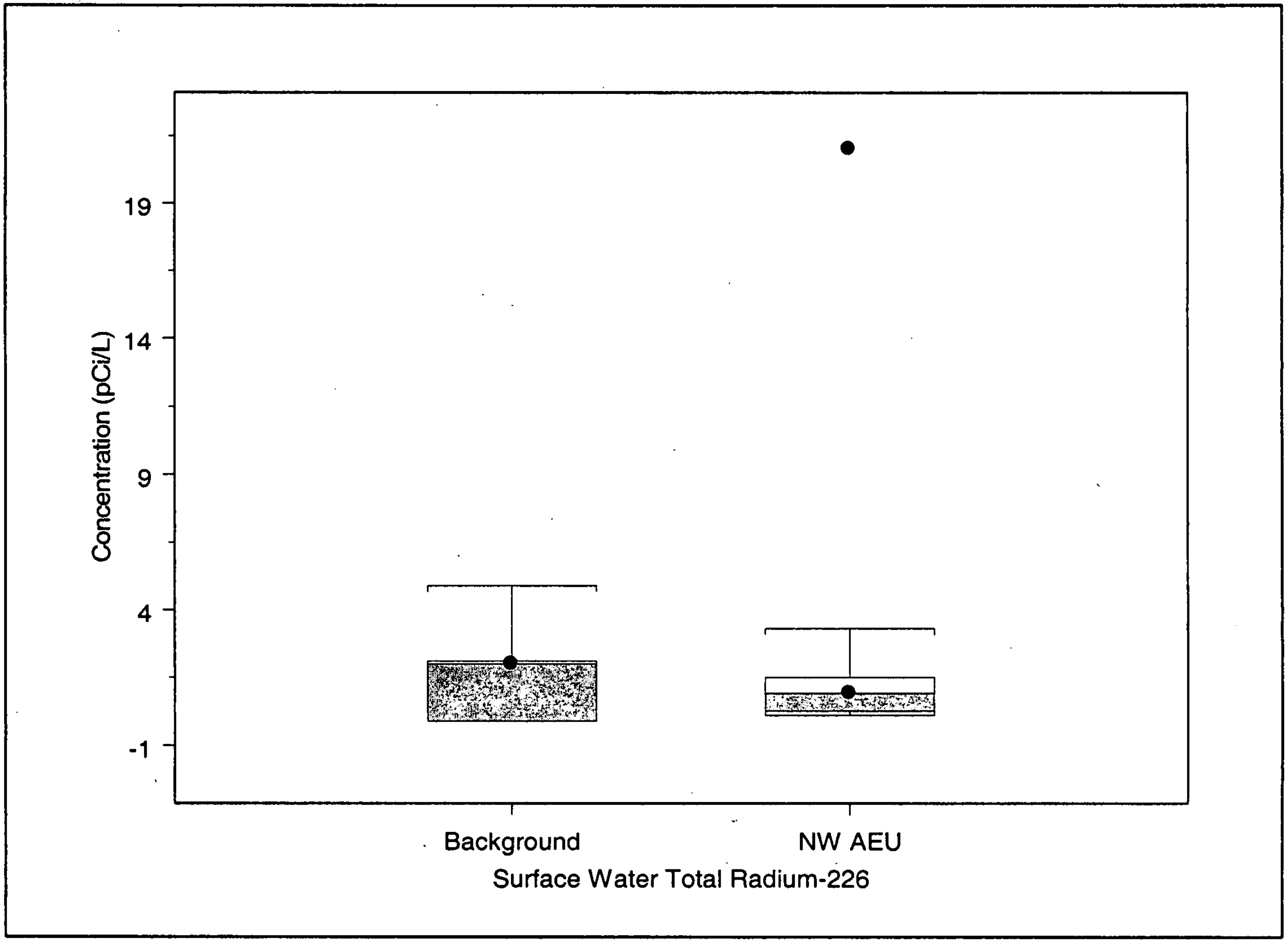
Figure A3.[illegible]W AEU.13
NW AEU Surface Water Total Box Plots for Plutonium-239/240



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

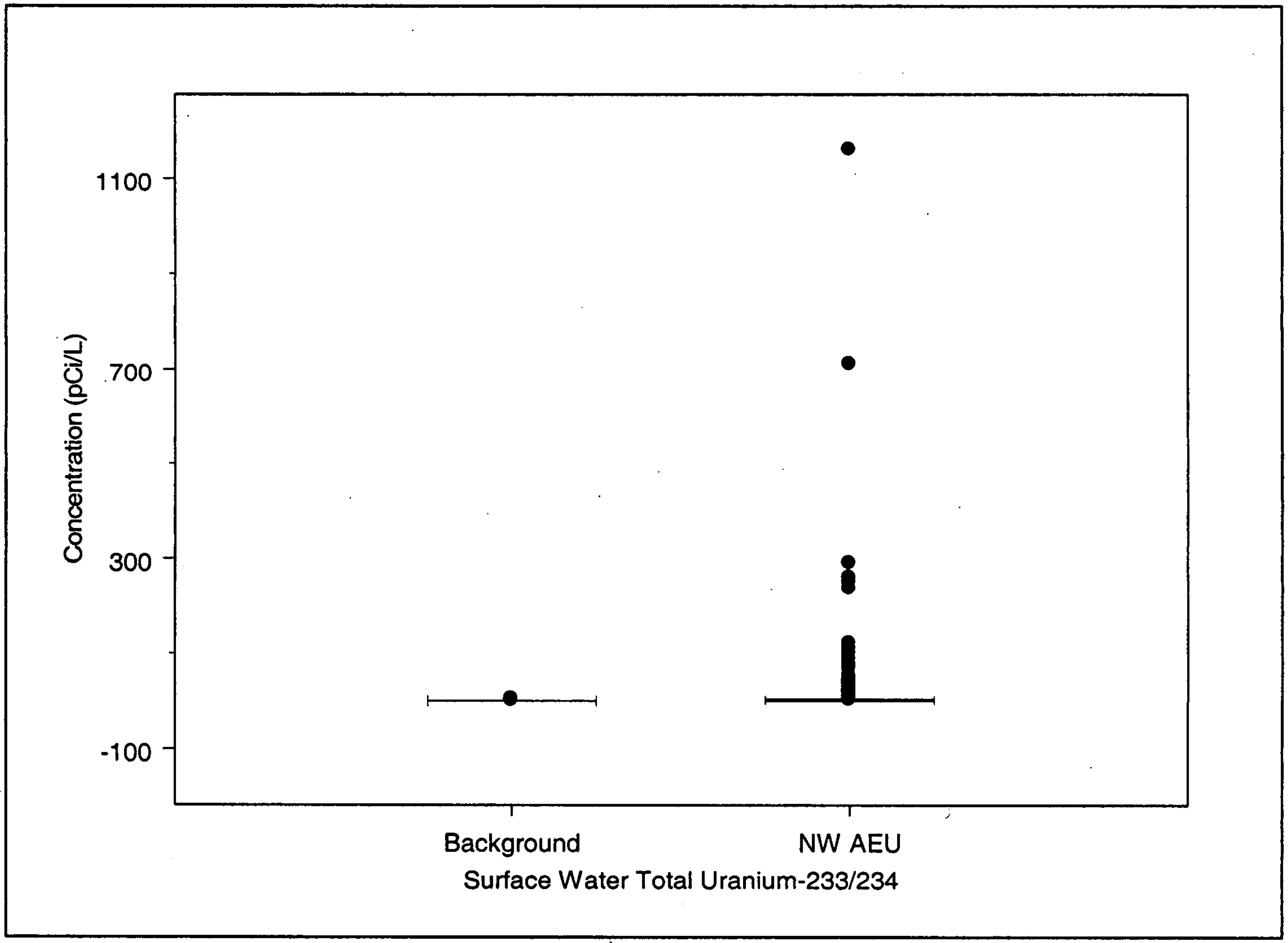
622

Figure A3.2.NW AEU.14
NW AEU Surface Water Total Box Plots for Radium-226



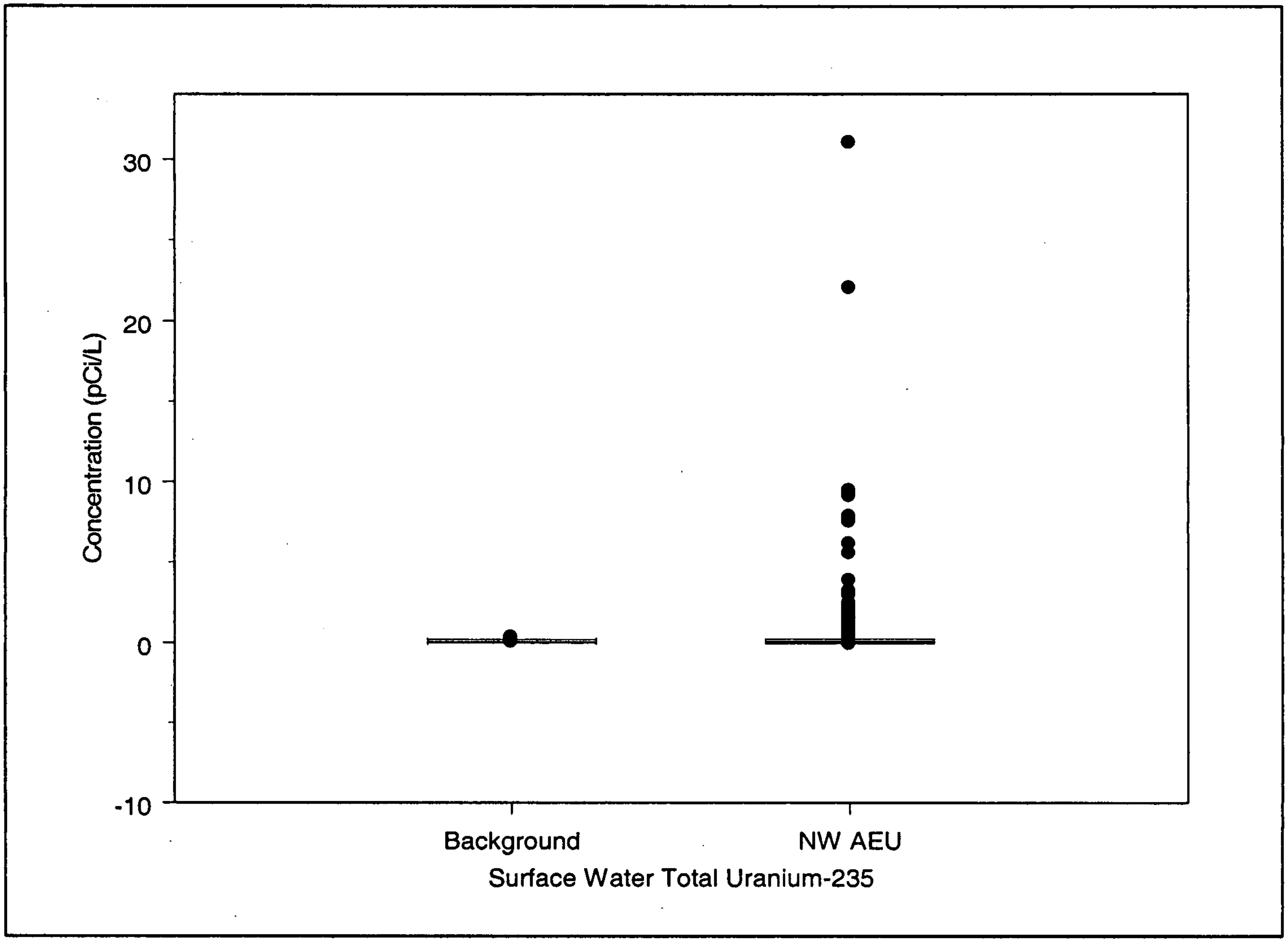
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.15
NW AEU Surface Water Total Box Plots for Uranium-233/234



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

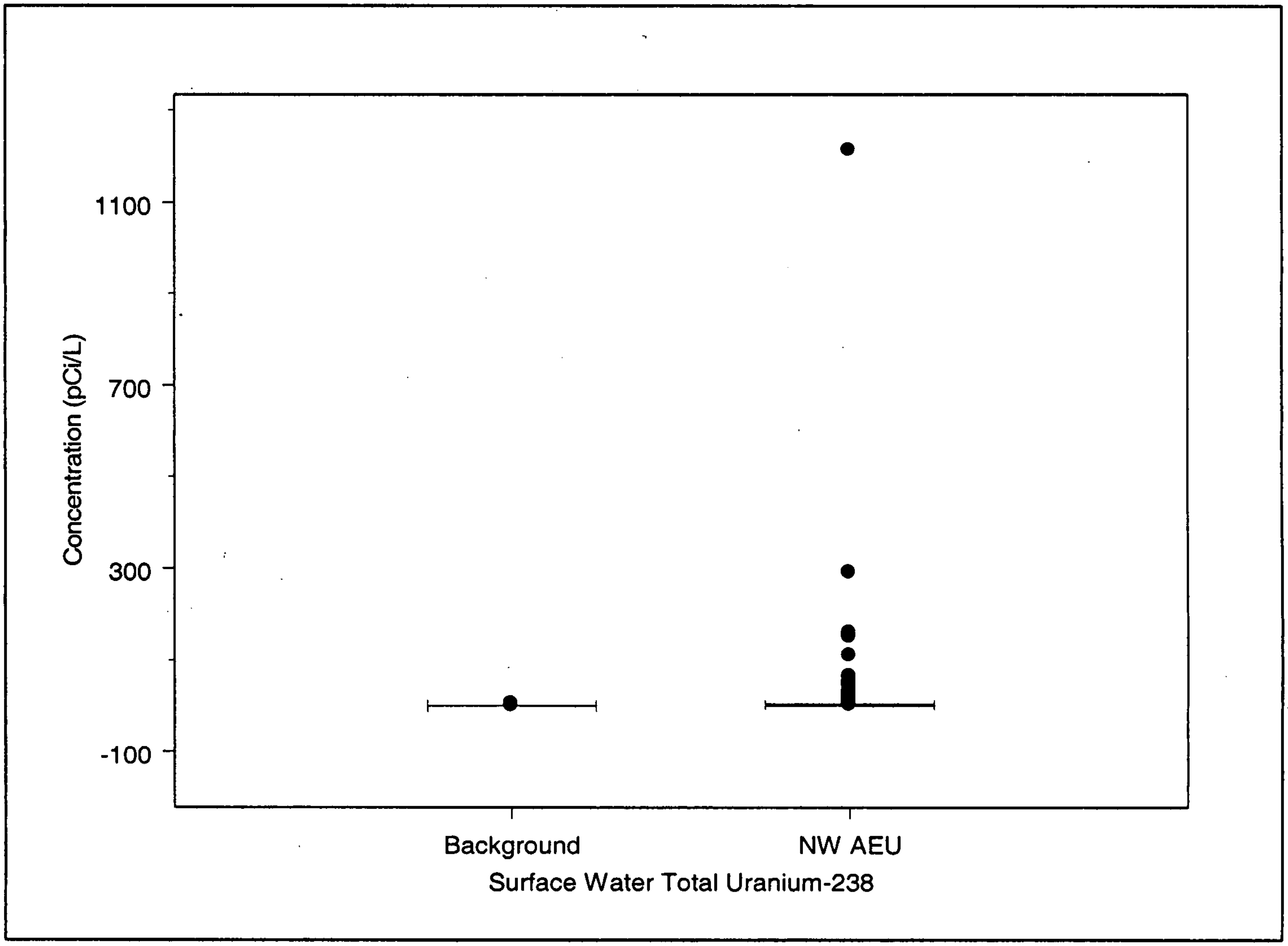
Figure A3.2.NW AEU.16
NW AEU Surface Water Total Box Plots for Uranium-235



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

625

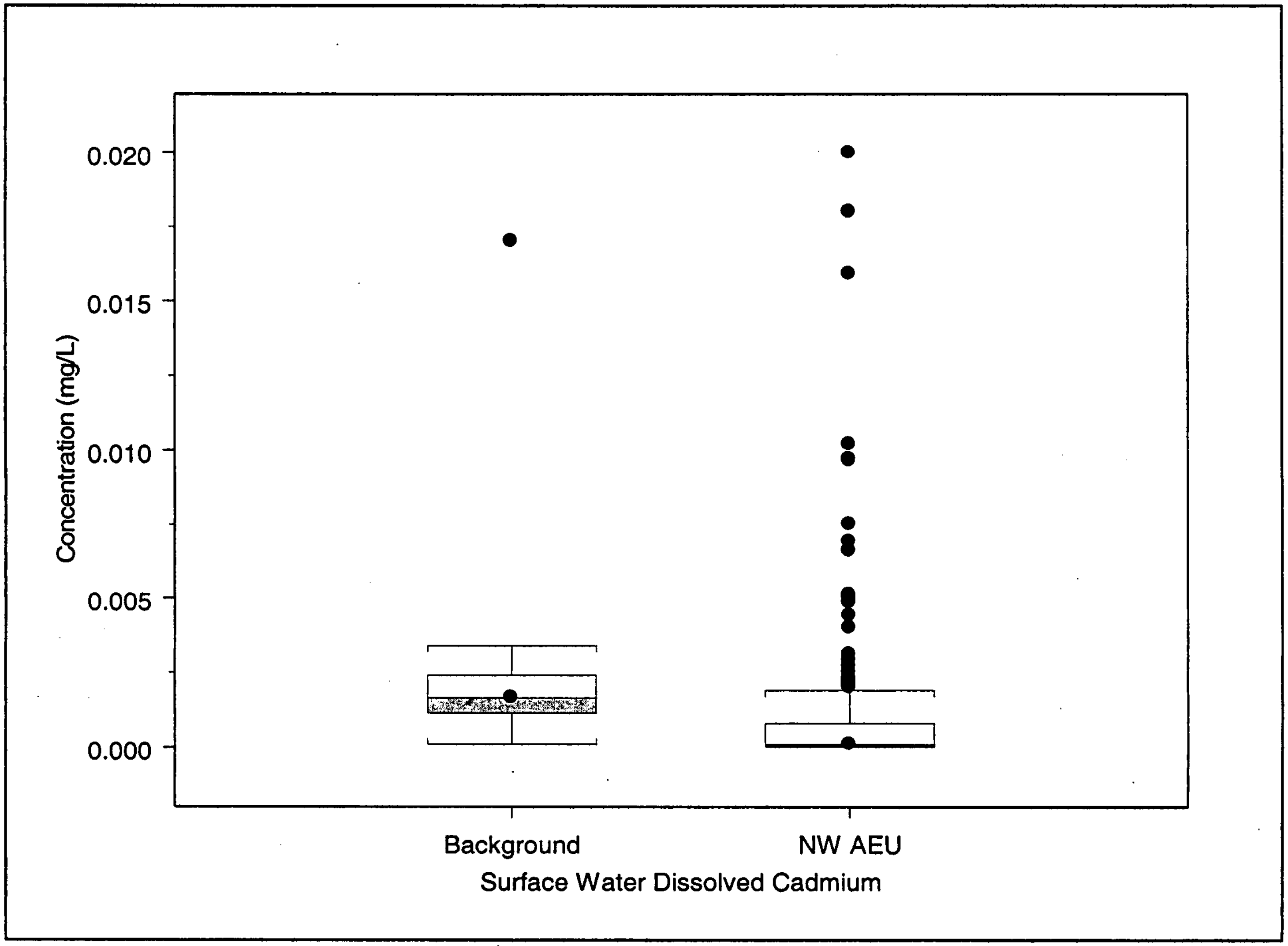
Figure A3.[illegible]W AEU.17
NW AEU Surface Water Total Box Plots for Uranium-238



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

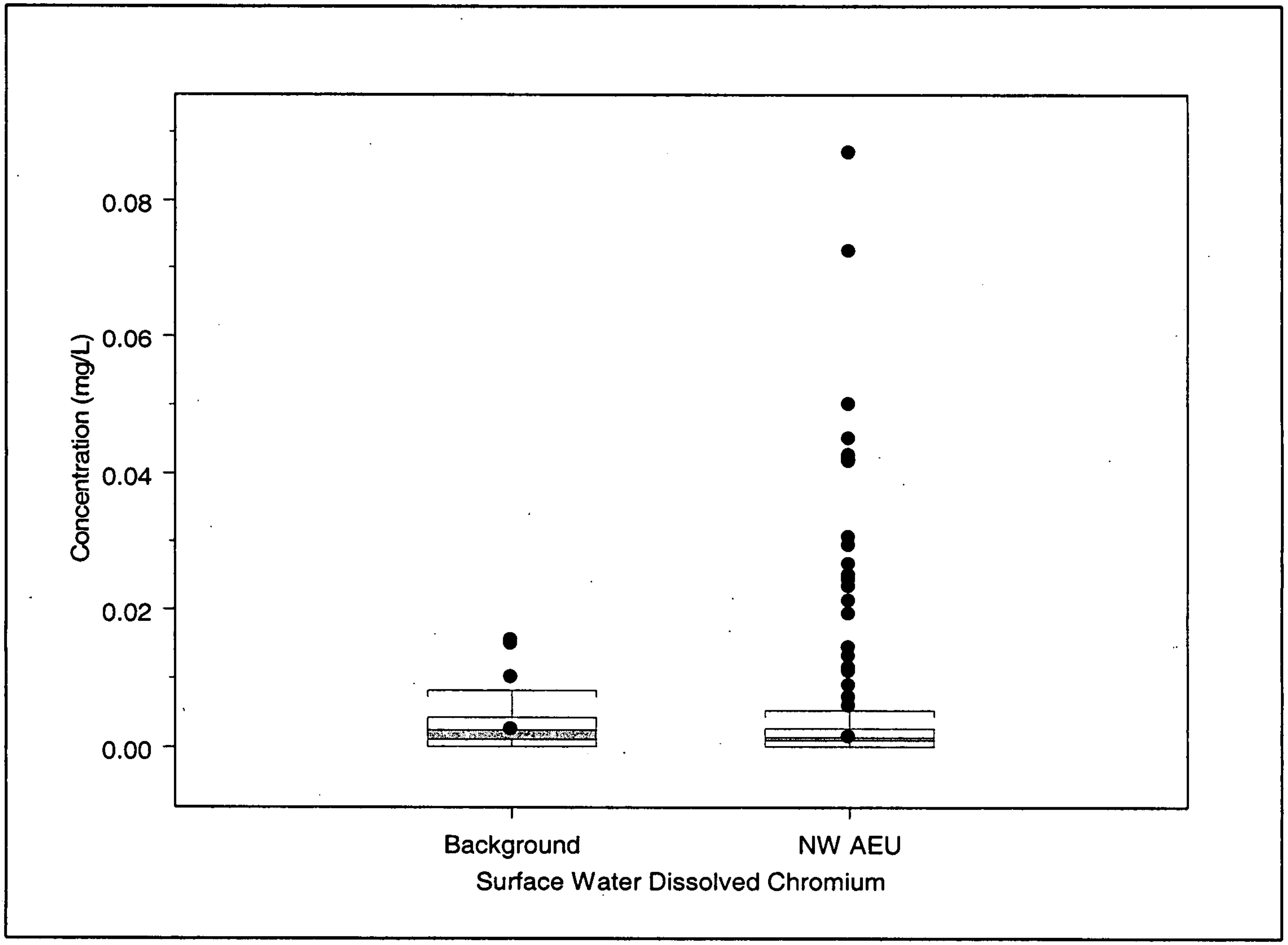
626

Figure A3.[illegible]W AEU.18
NW AEU Surface Water Dissolved Box Plots for Cadmium



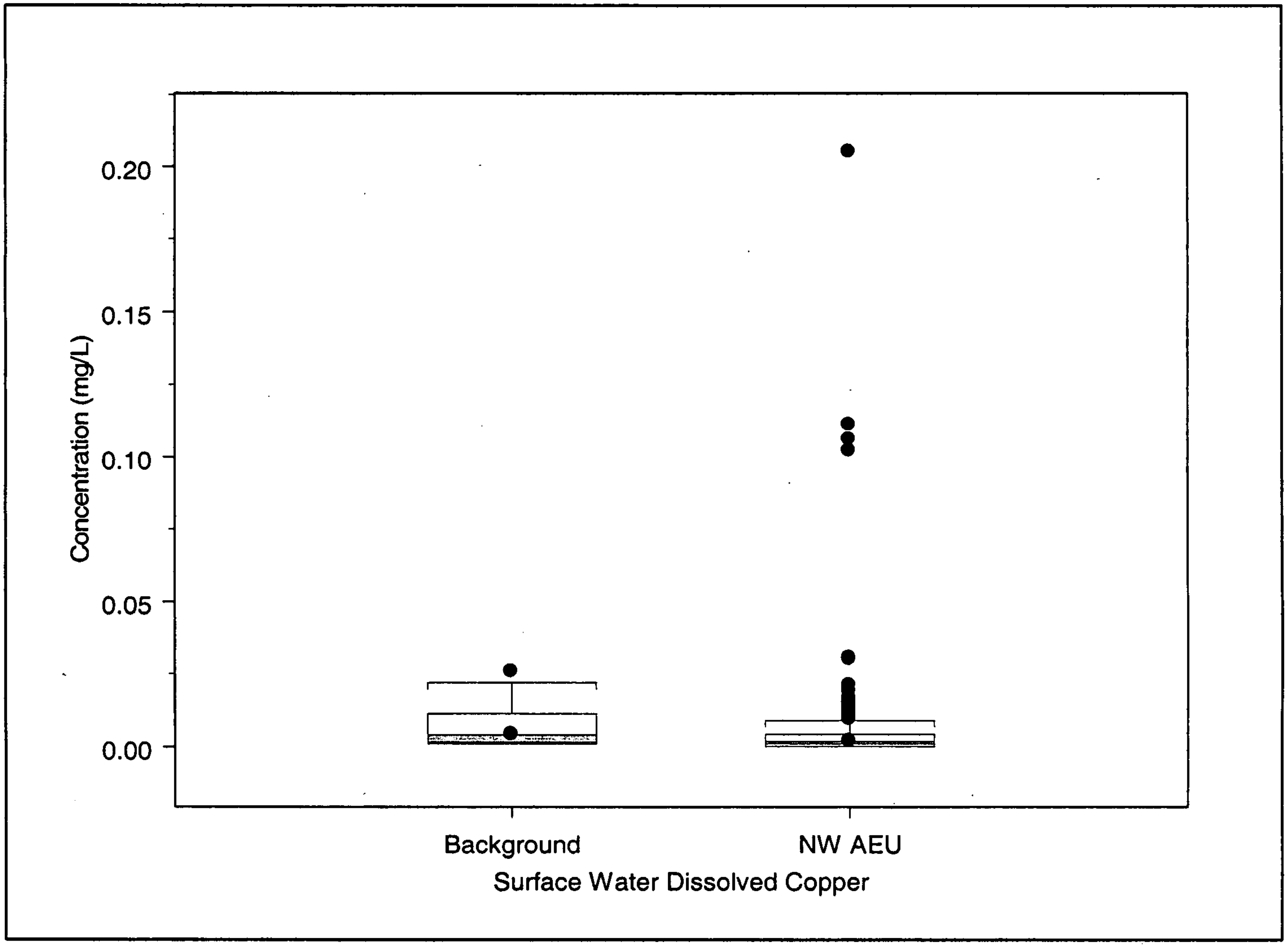
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.19
NW AEU Surface Water Dissolved Box Plots for Chromium



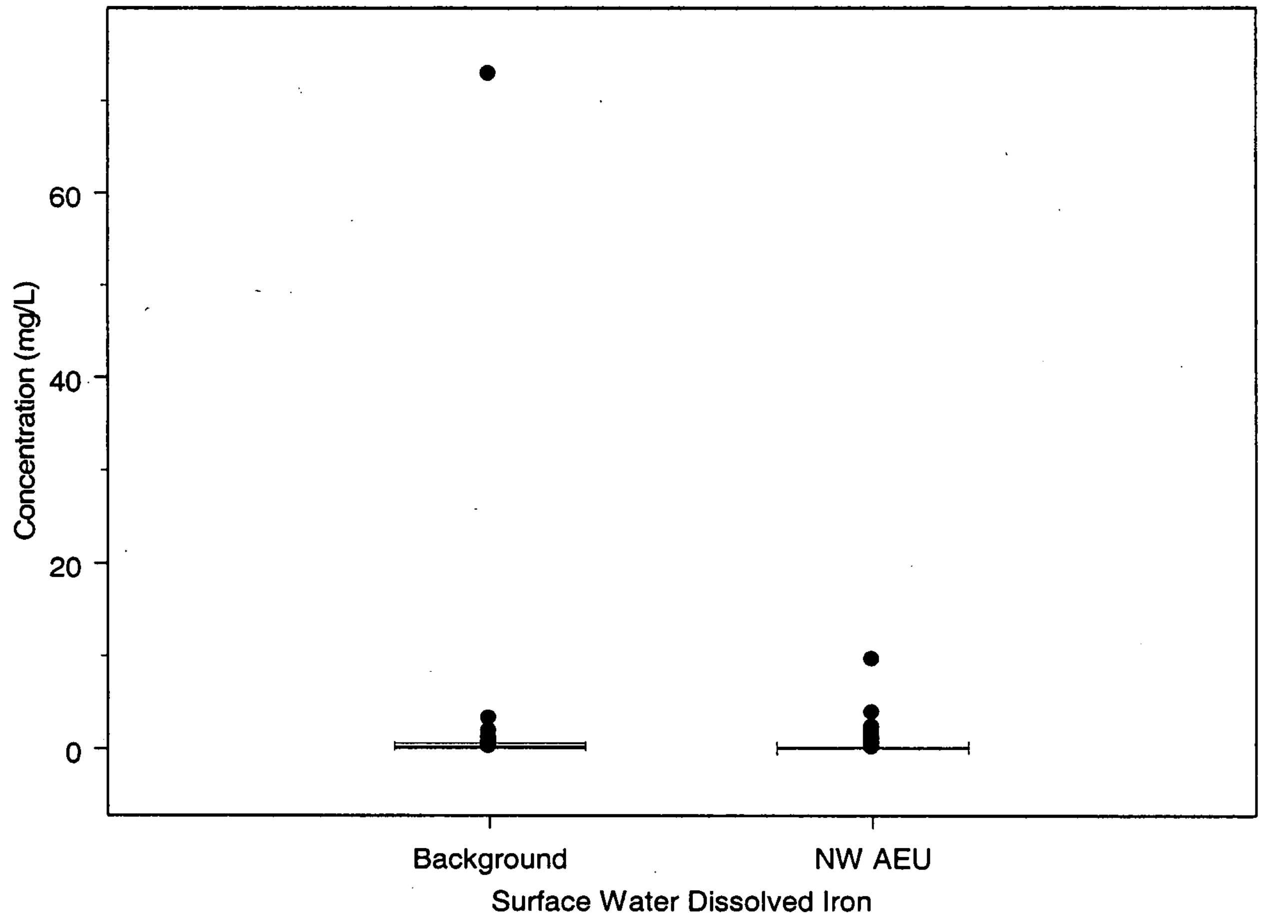
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.20
NW AEU Surface Water Dissolved Box Plots for Copper



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

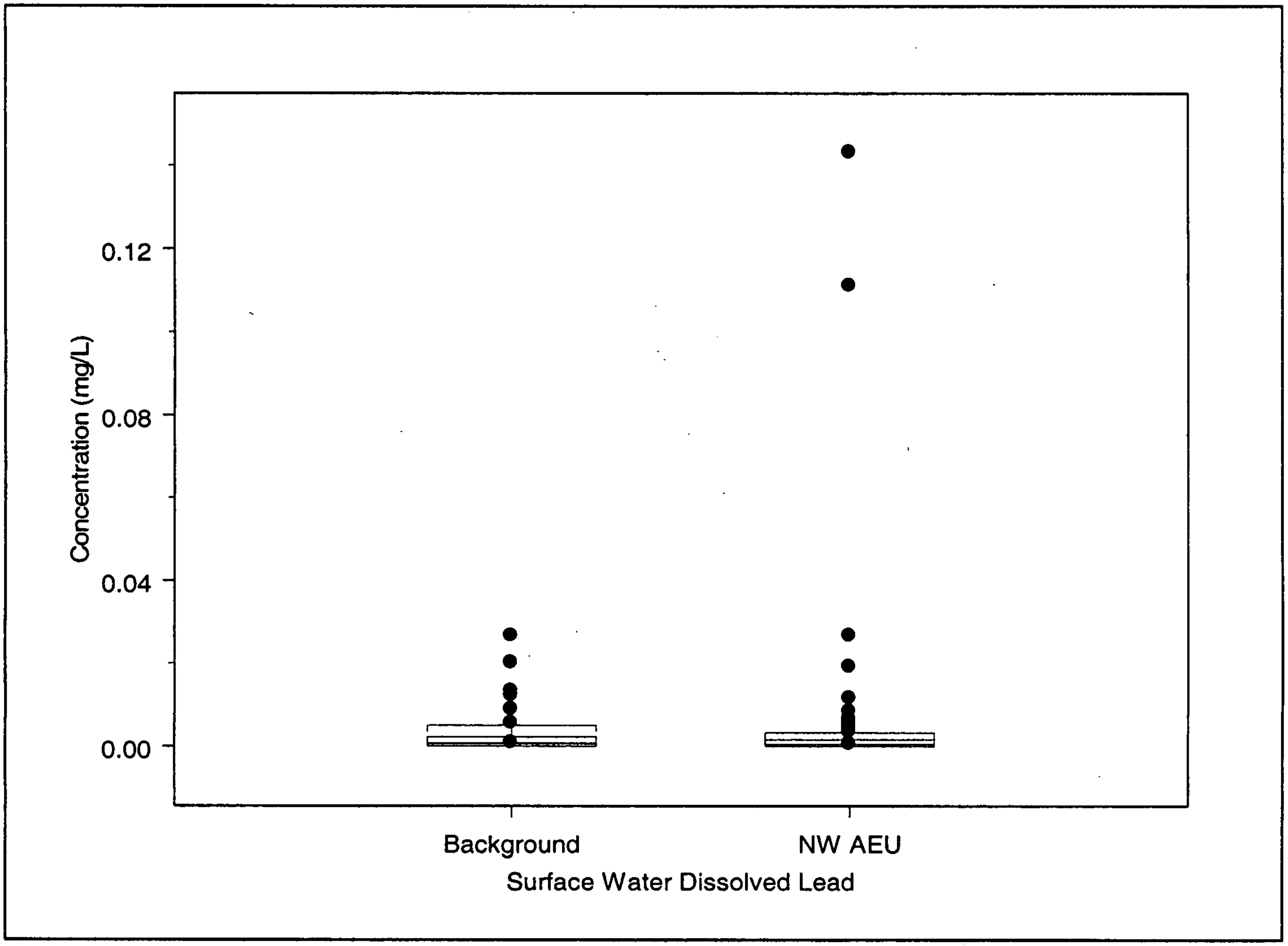
Figure A3.2.NW AEU.21
NW AEU Surface Water Dissolved Box Plots for Iron



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

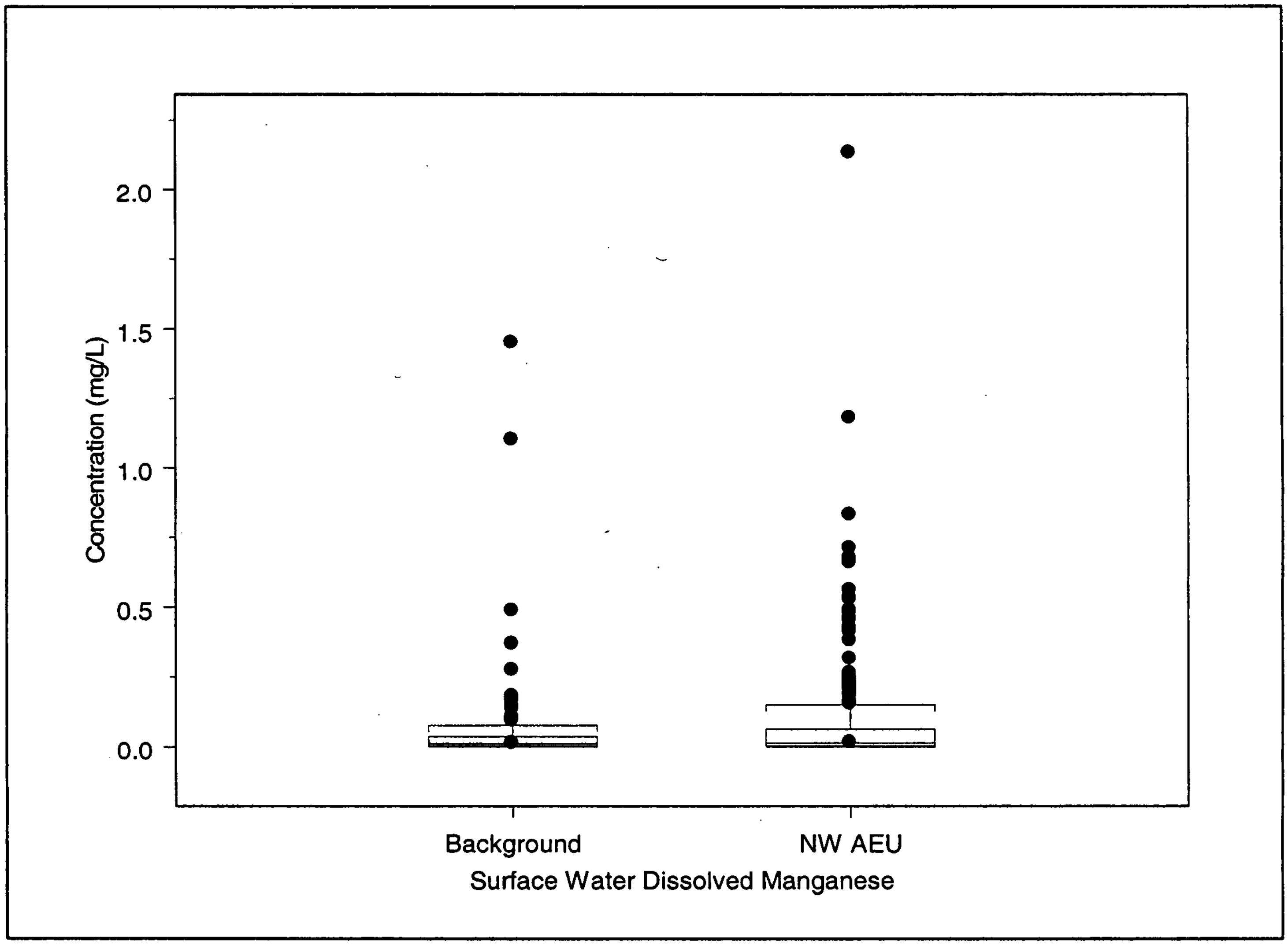
630

Figure A3.[illegible]W AEU.22
NW AEU Surface Water Dissolved Box Plots for Lead



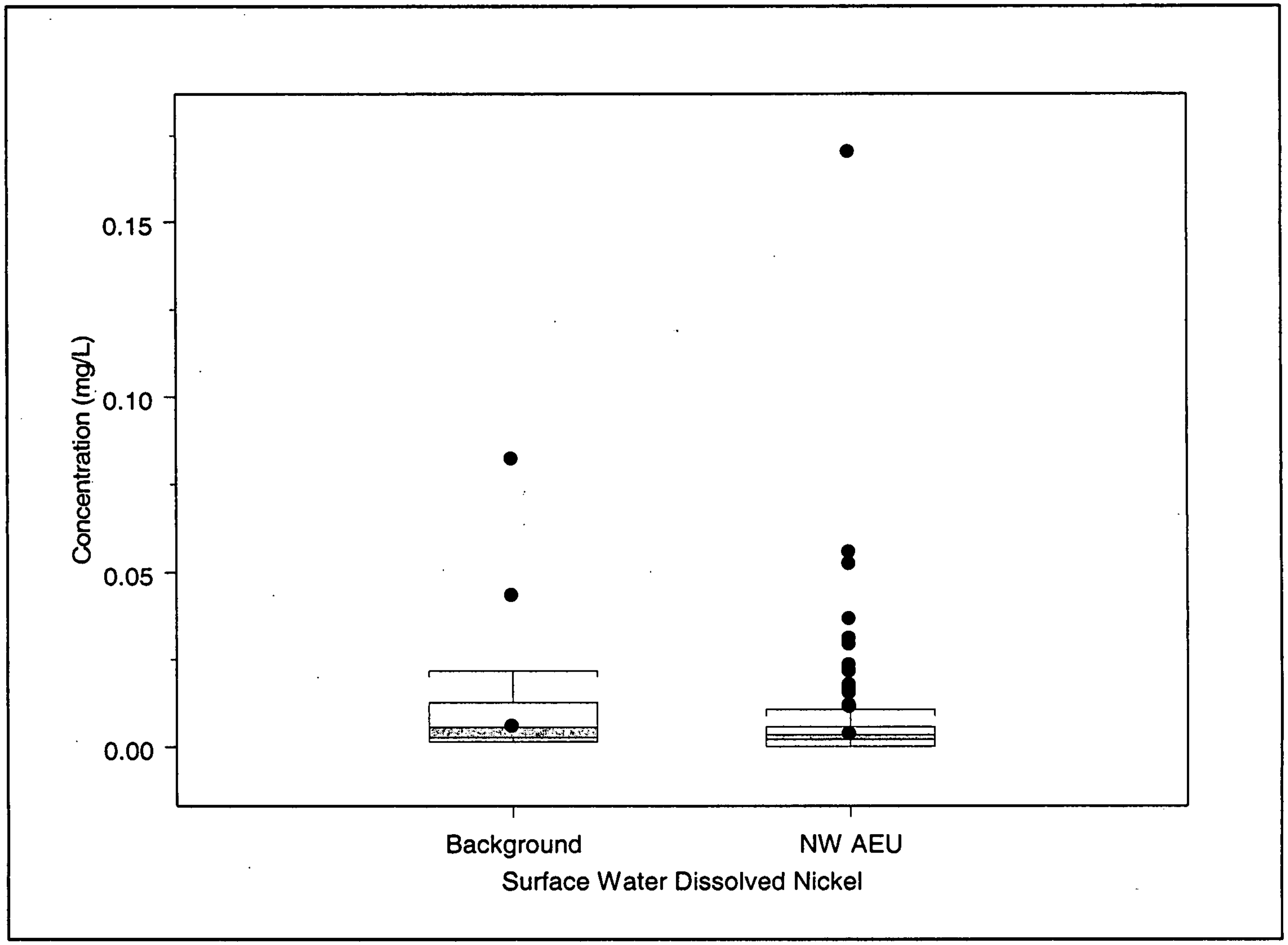
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.23
NW AEU Surface Water Dissolved Box Plots for Manganese



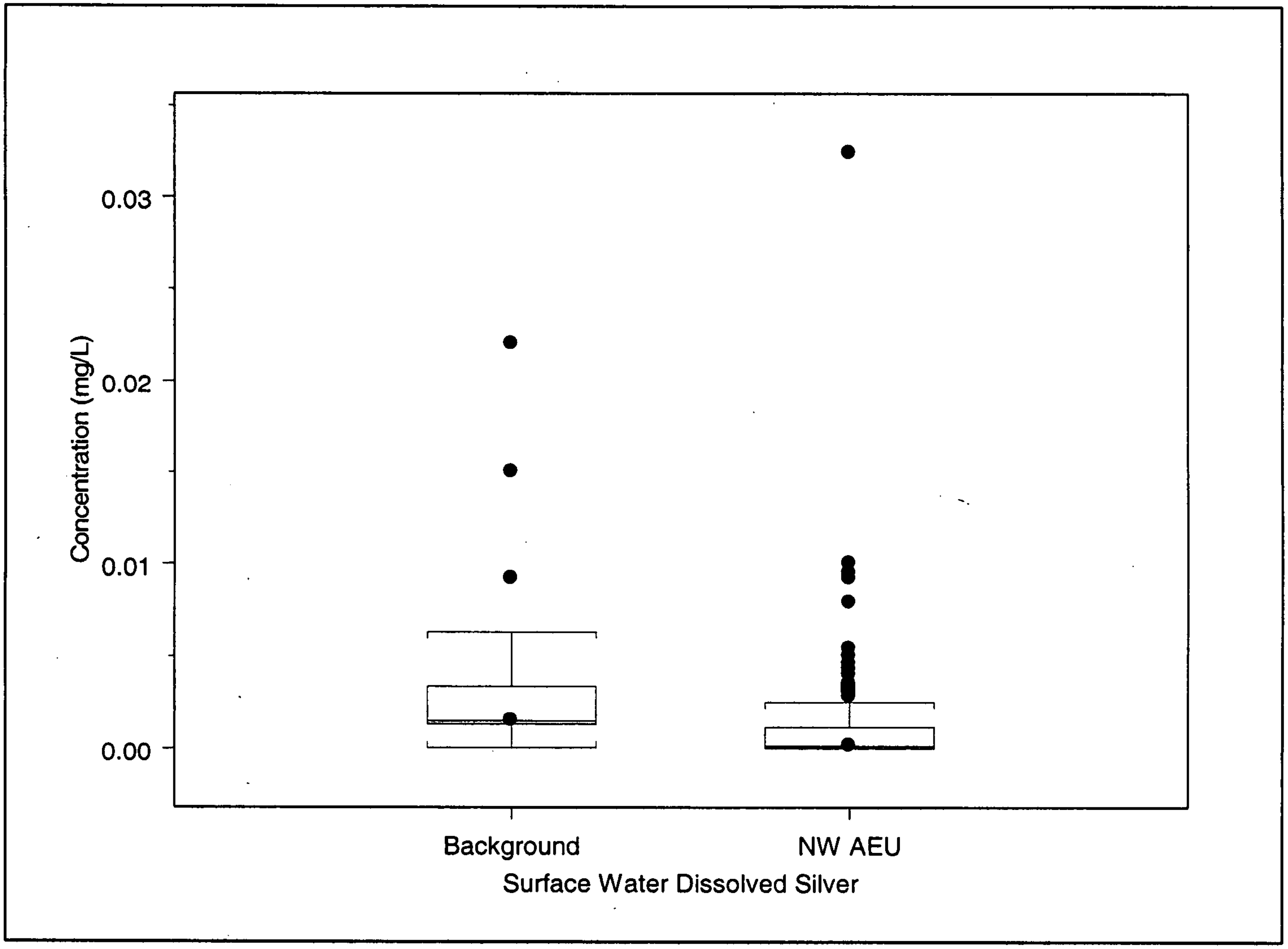
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.24
NW AEU Surface Water Dissolved Box Plots for Nickel



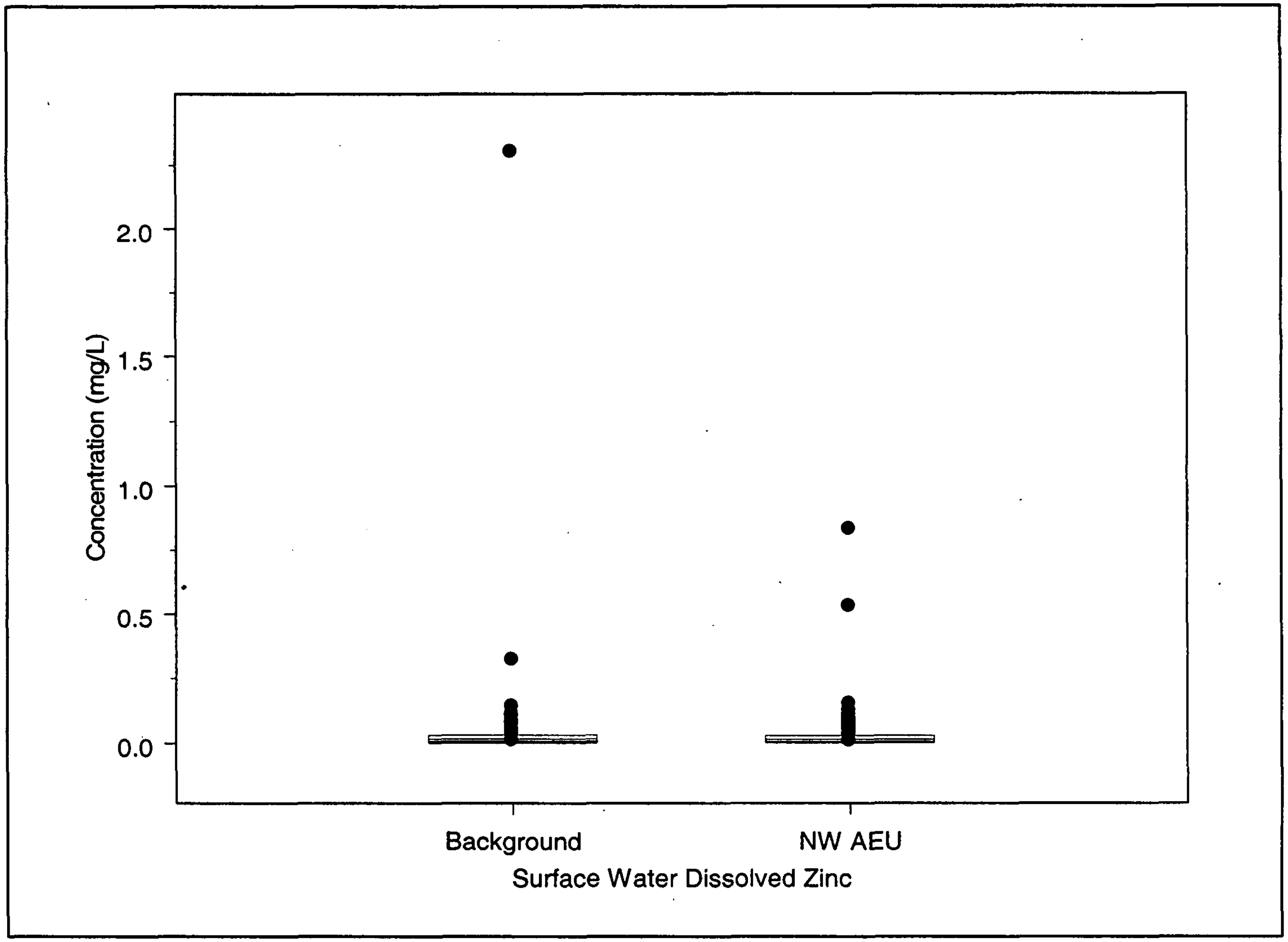
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.25
NW AEU Surface Water Dissolved Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

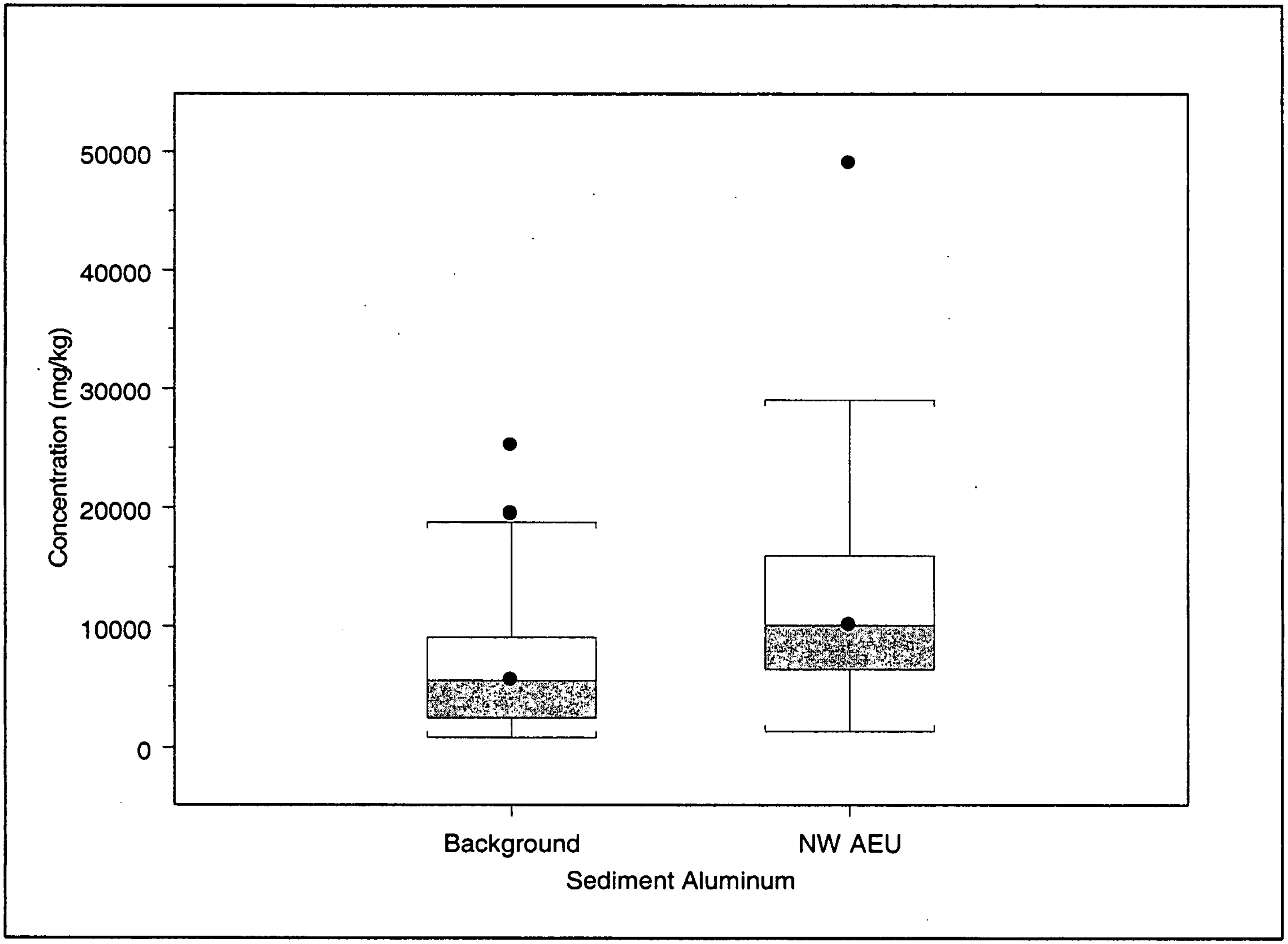
Figure A3.2.NW AEU.26
NW AEU Surface Water Dissolved Box Plots for Zinc



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

635

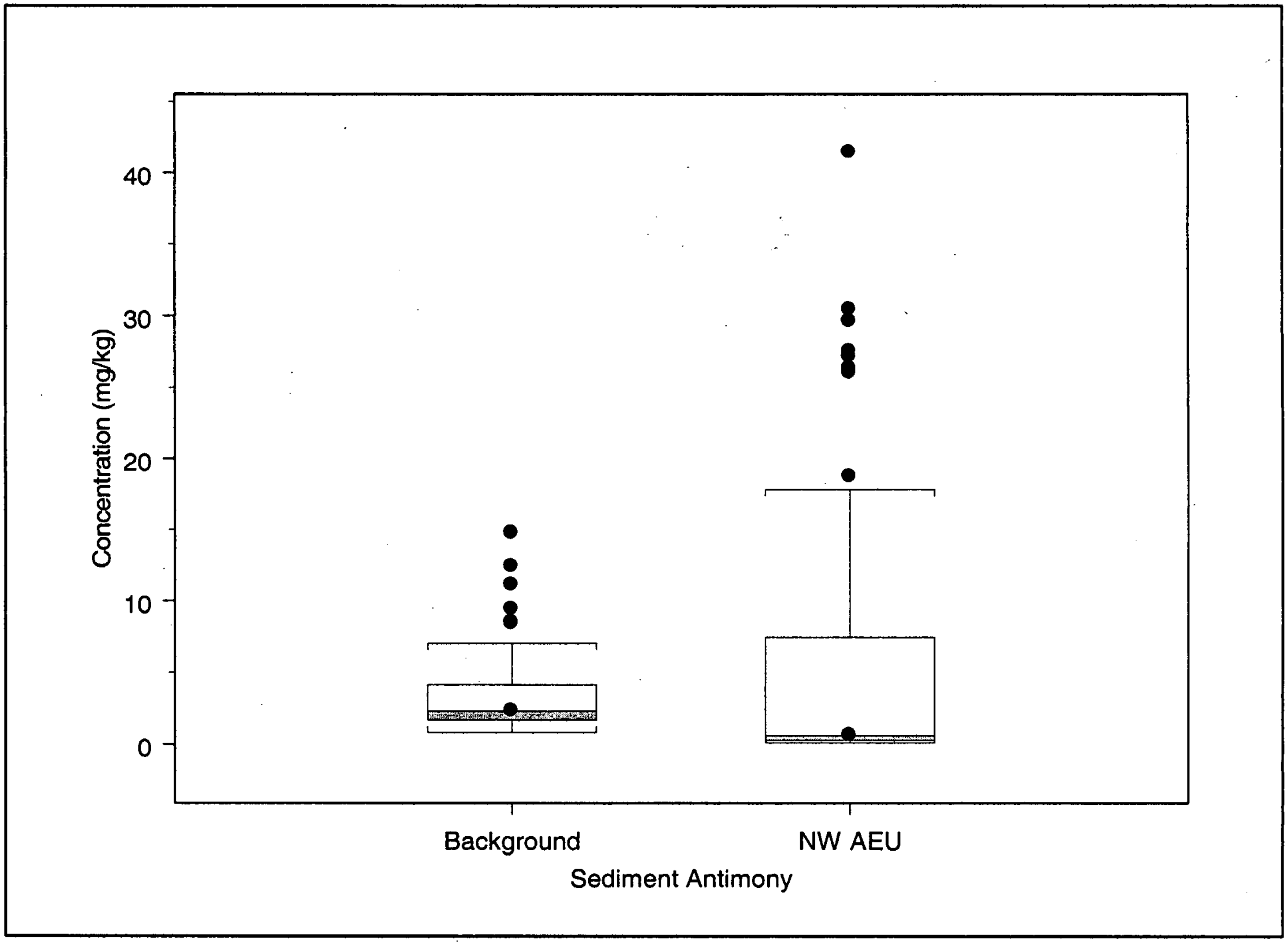
Figure A3.[illegible]W AEU.27
NW AEU Sediment Box Plots for Aluminum



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

636

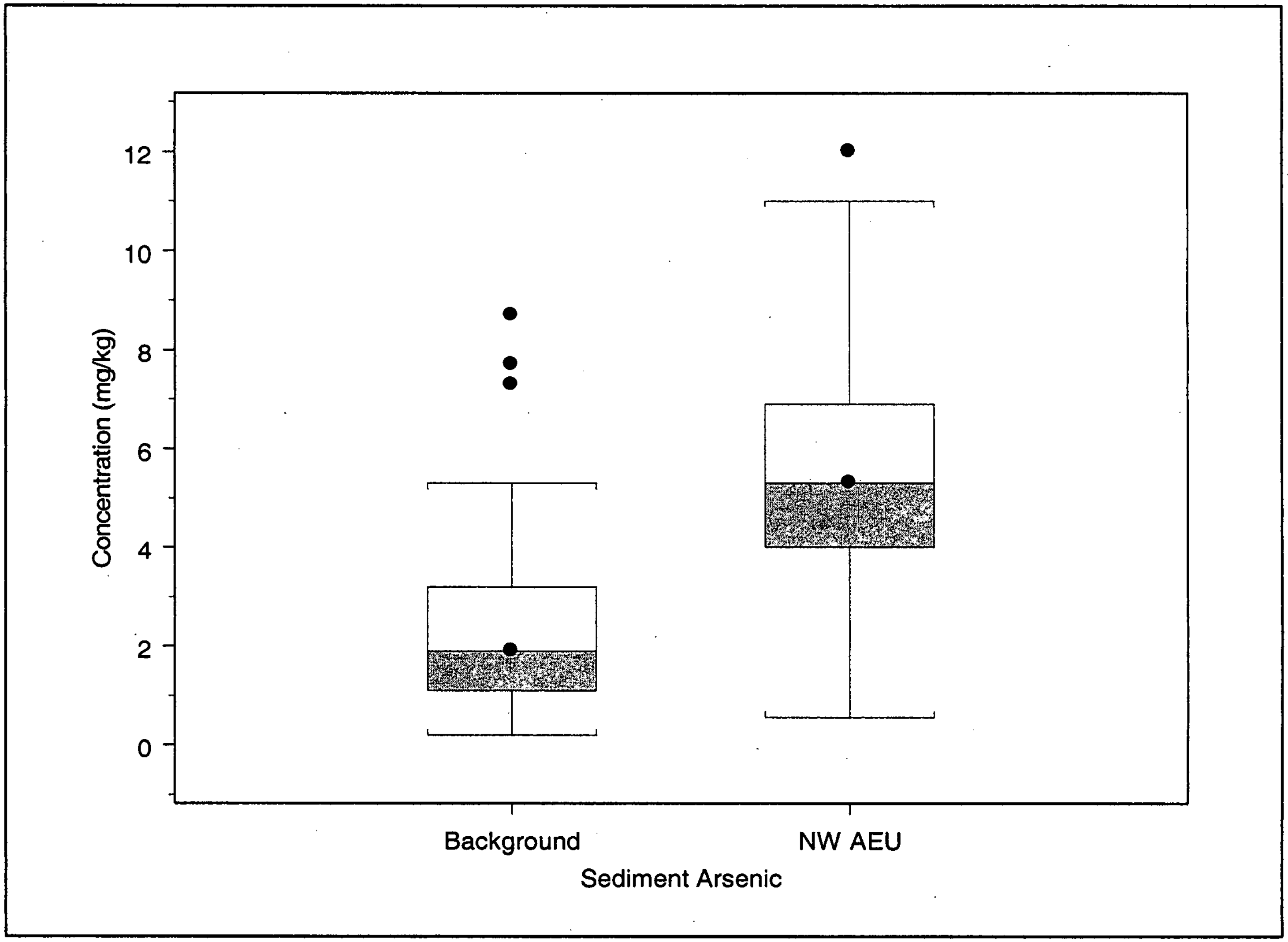
Figure A3.2.NW AEU.28
NW AEU Sediment Box Plots for Antimony



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

637

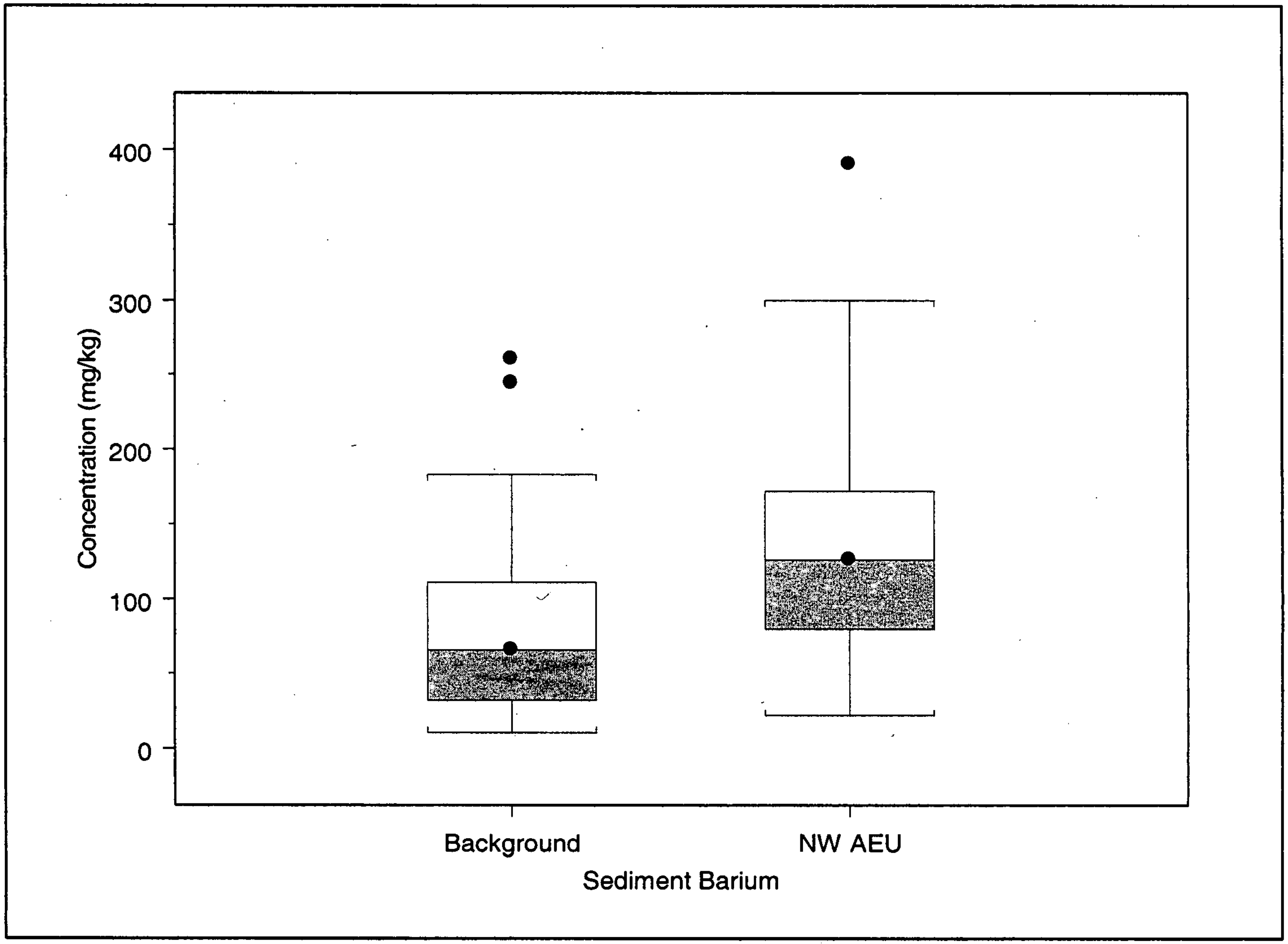
Figure A3.2.NW AEU.29
NW AEU Sediment Box Plots for Arsenic



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

638

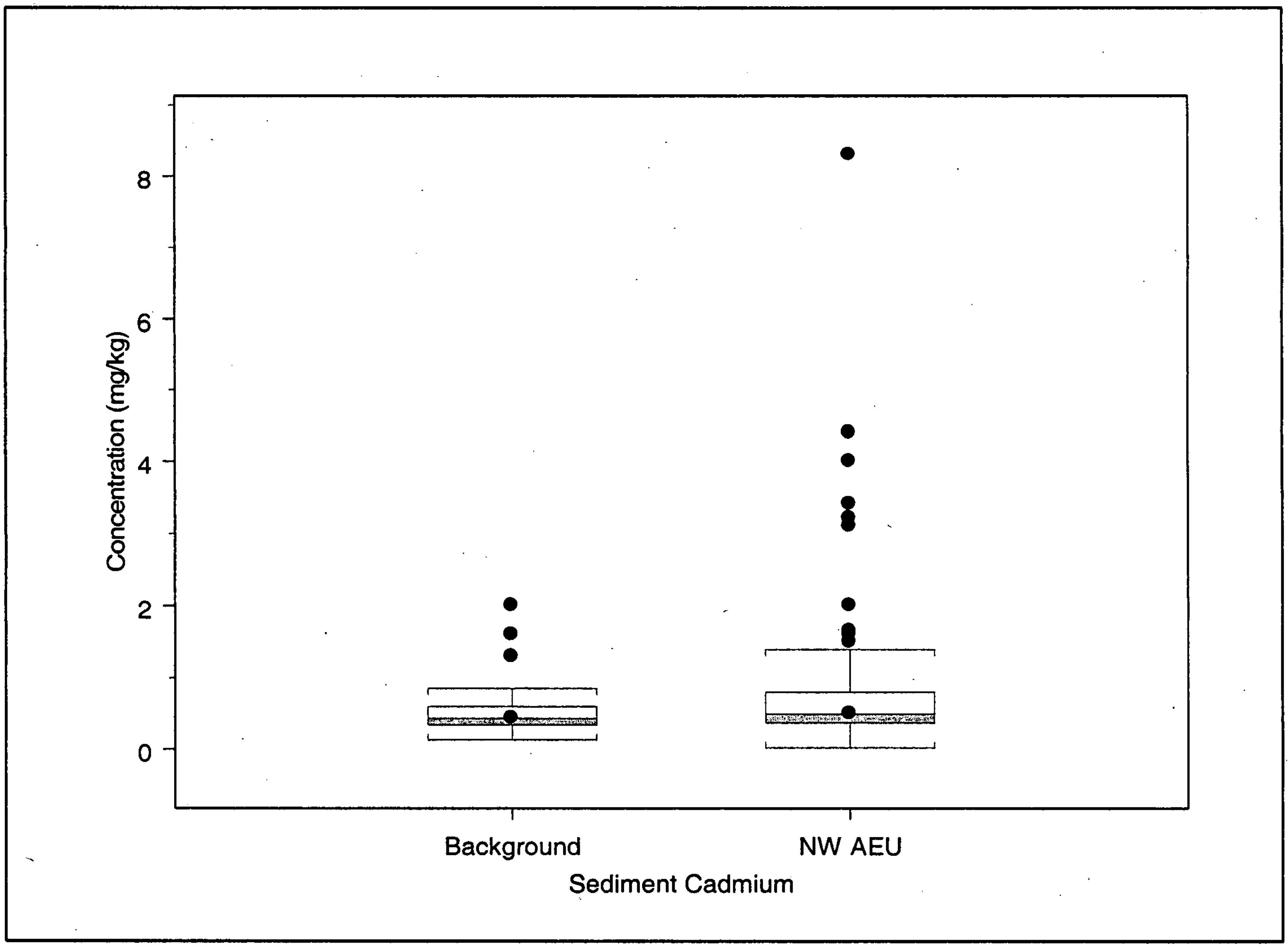
Figure A3.2.NW AEU.30
NW AEU Sediment Box Plots for Barium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

639

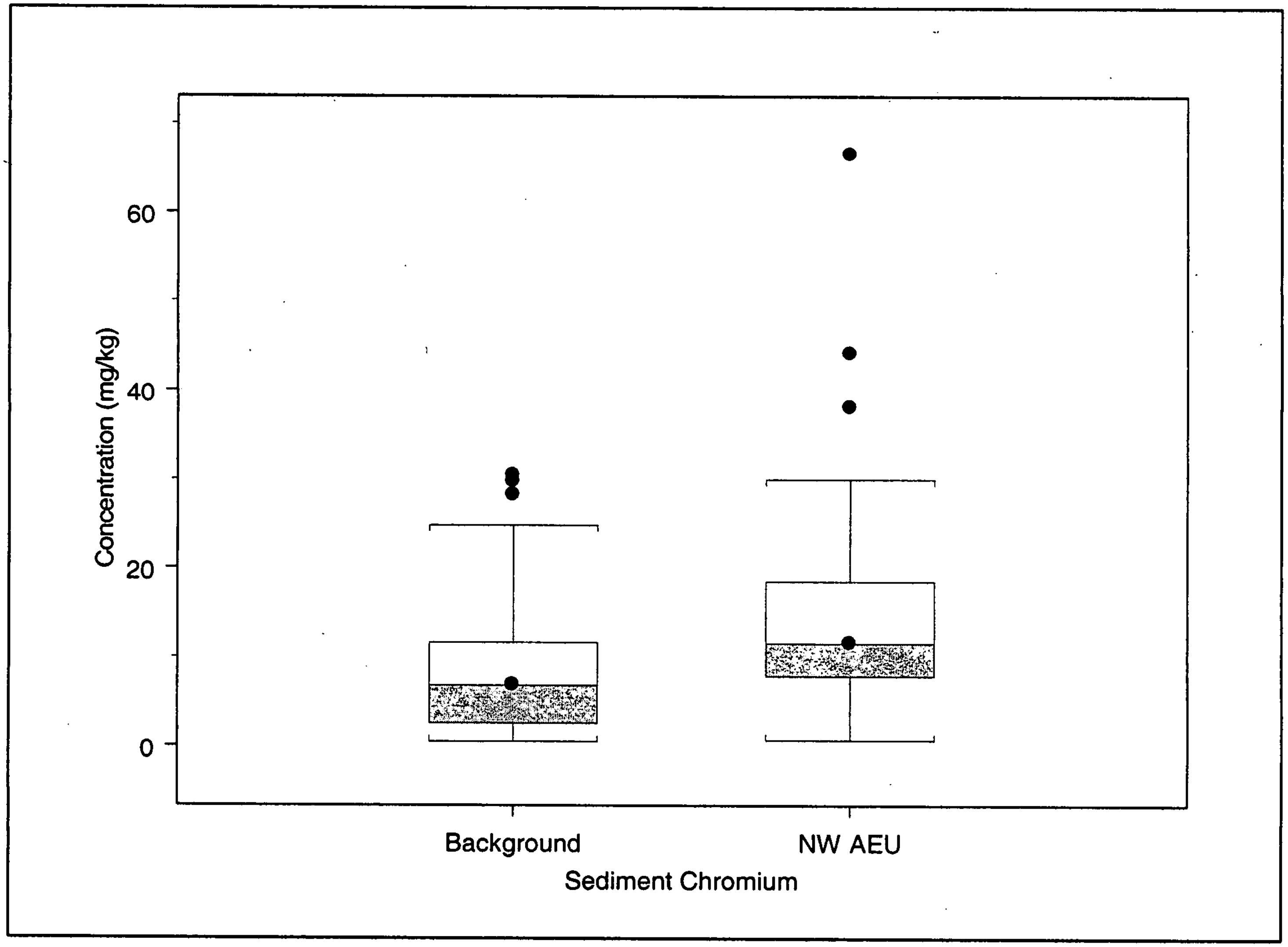
Figure A3.2.NW AEU.31
NW AEU Sediment Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

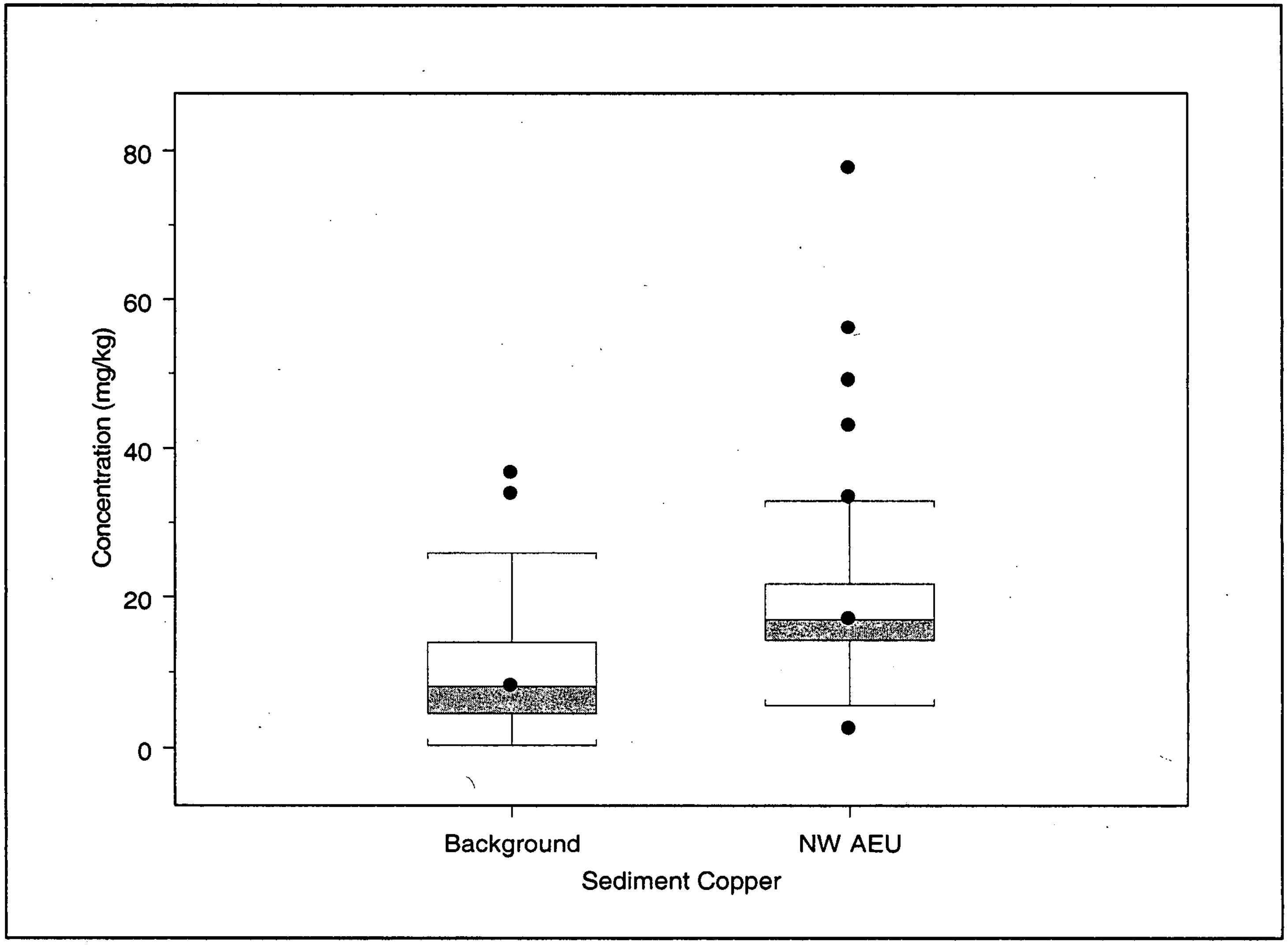
640

Figure A3.NW AEU.32
NW AEU Sediment Box Plots for Chromium



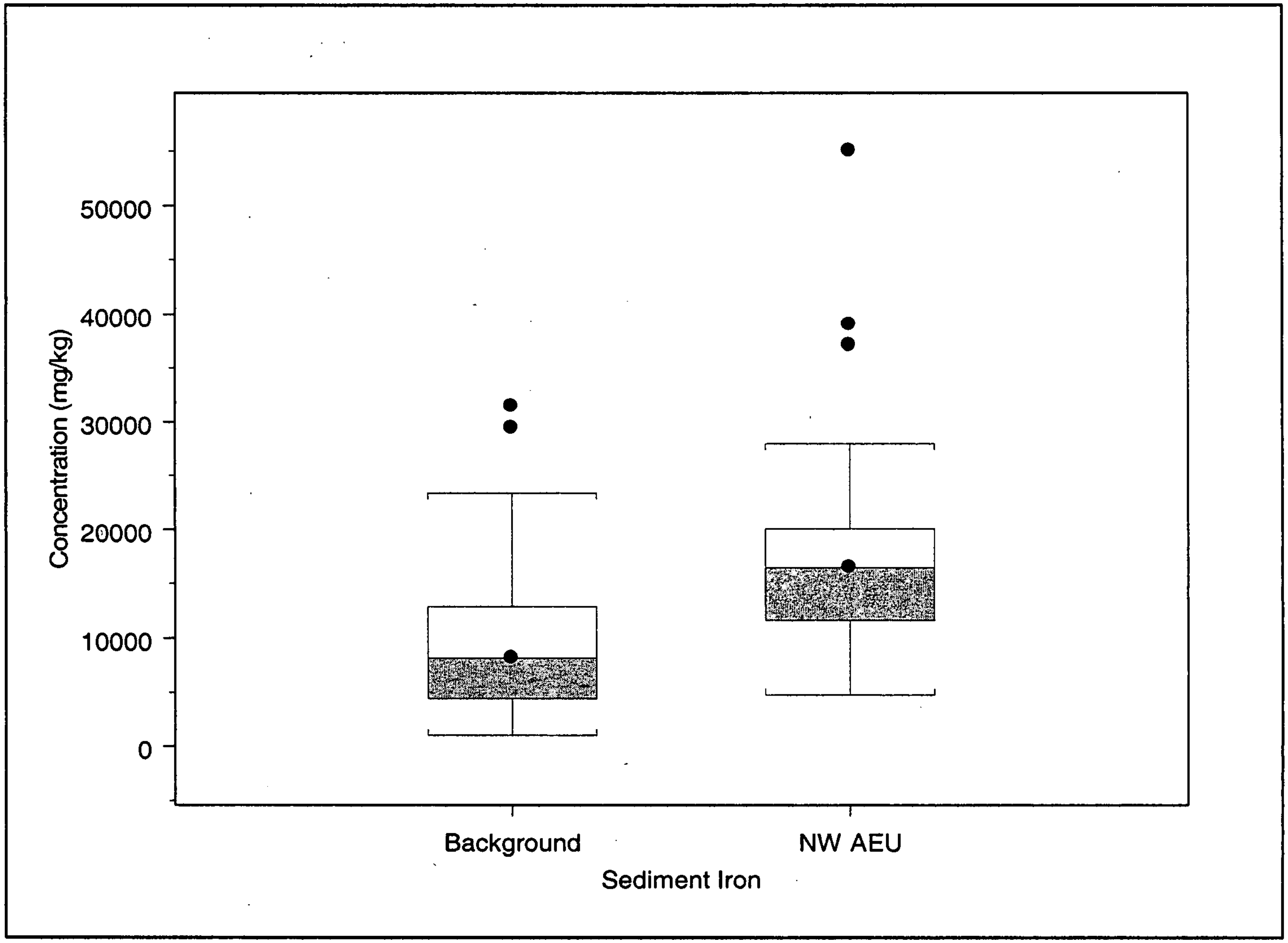
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.33
NW AEU Sediment Box Plots for Copper



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

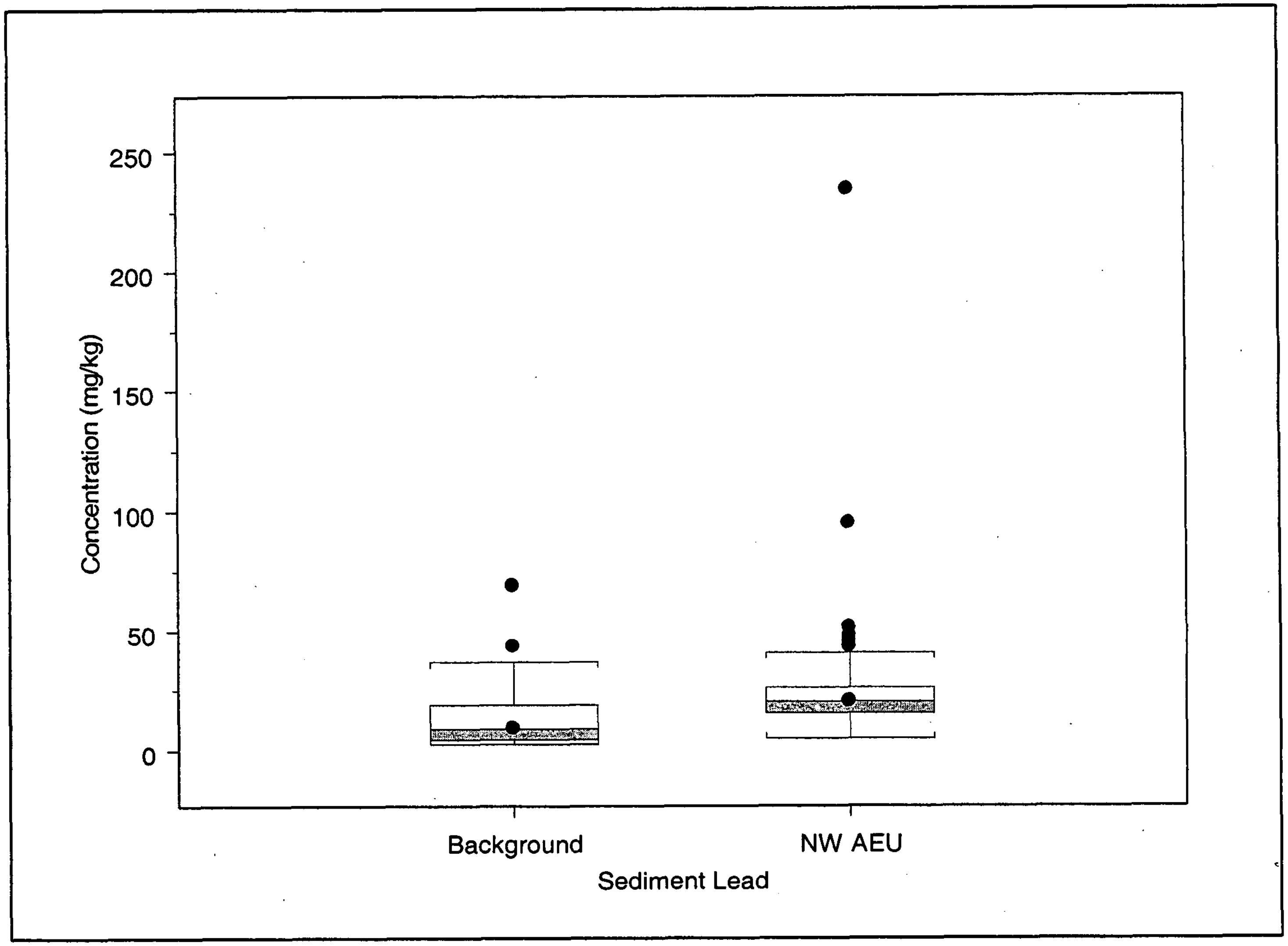
Figure A3.2.NW AEU.34
NW AEU Sediment Box Plots for Iron



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

643

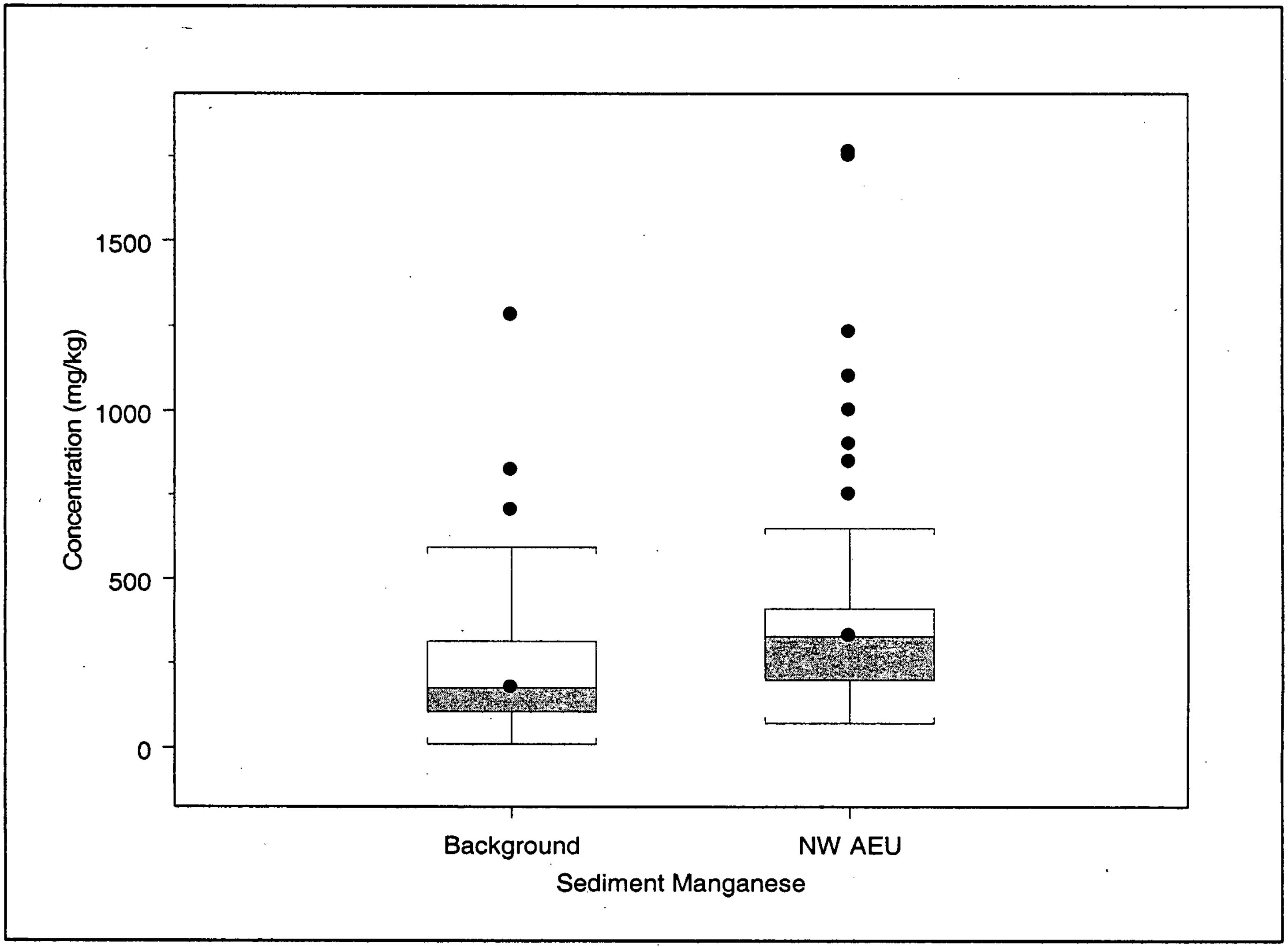
Figure A3.2.NW AEU.35
NW AEU Sediment Box Plots for Lead



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

644

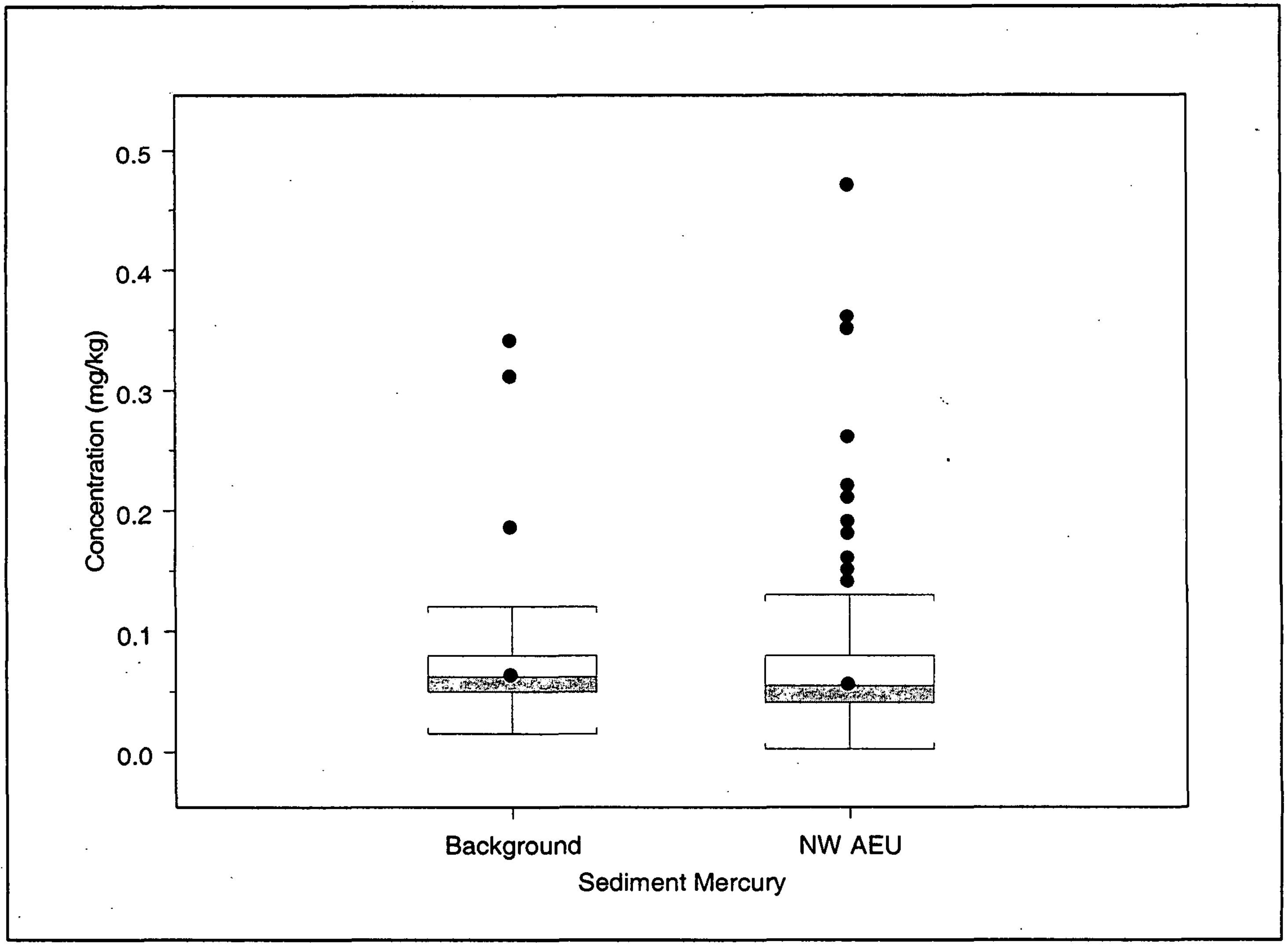
Figure A3.2.NW AEU.36
NW AEU Sediment Box Plots for Manganese



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

645

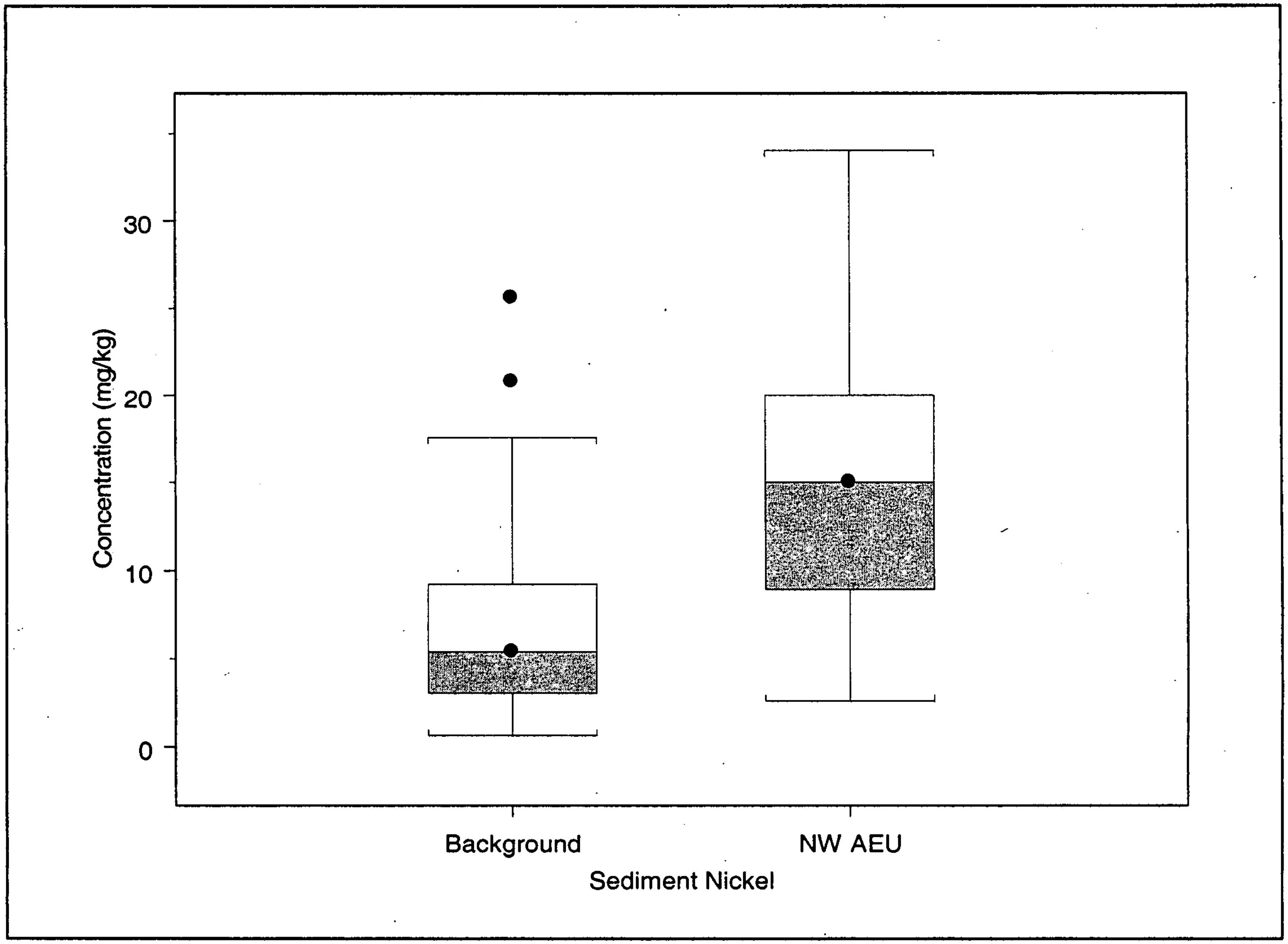
Figure A3.2.NW AEU.37
NW AEU Sediment Box Plots for Mercury



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

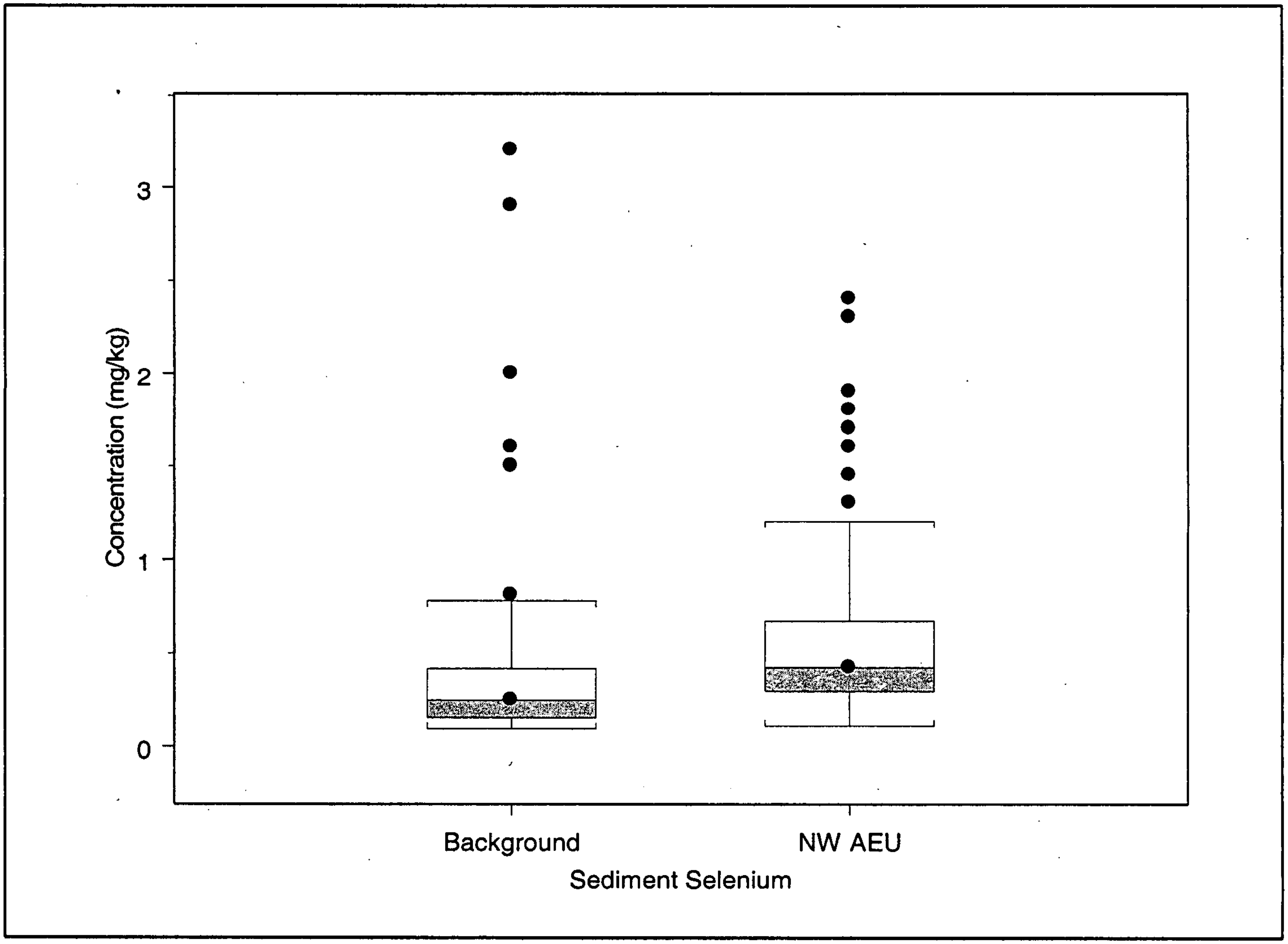
646

Figure A3.[illegible]W AEU.38
NW AEU Sediment Box Plots for Nickel



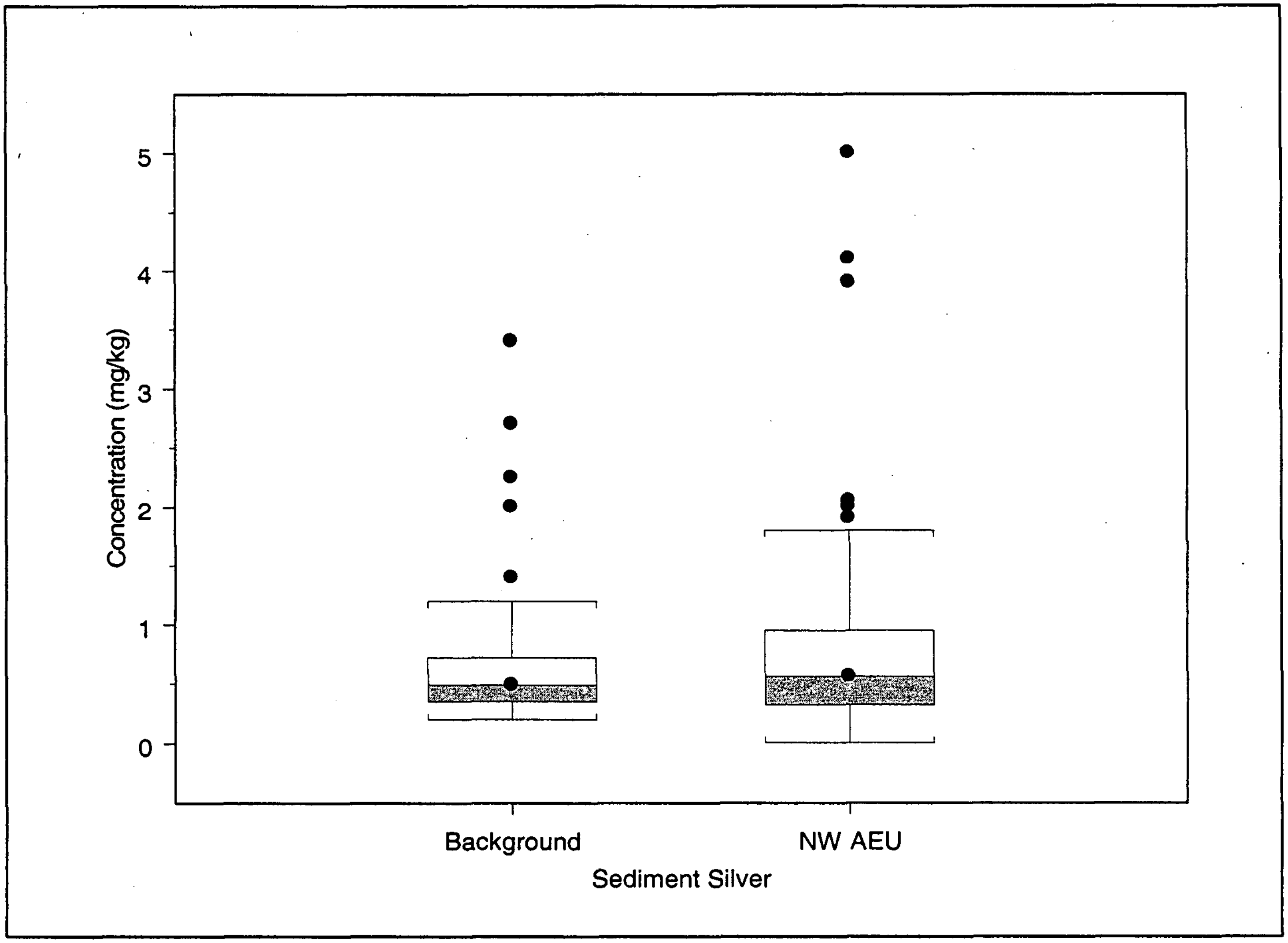
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.39
NW AEU Sediment Box Plots for Selenium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

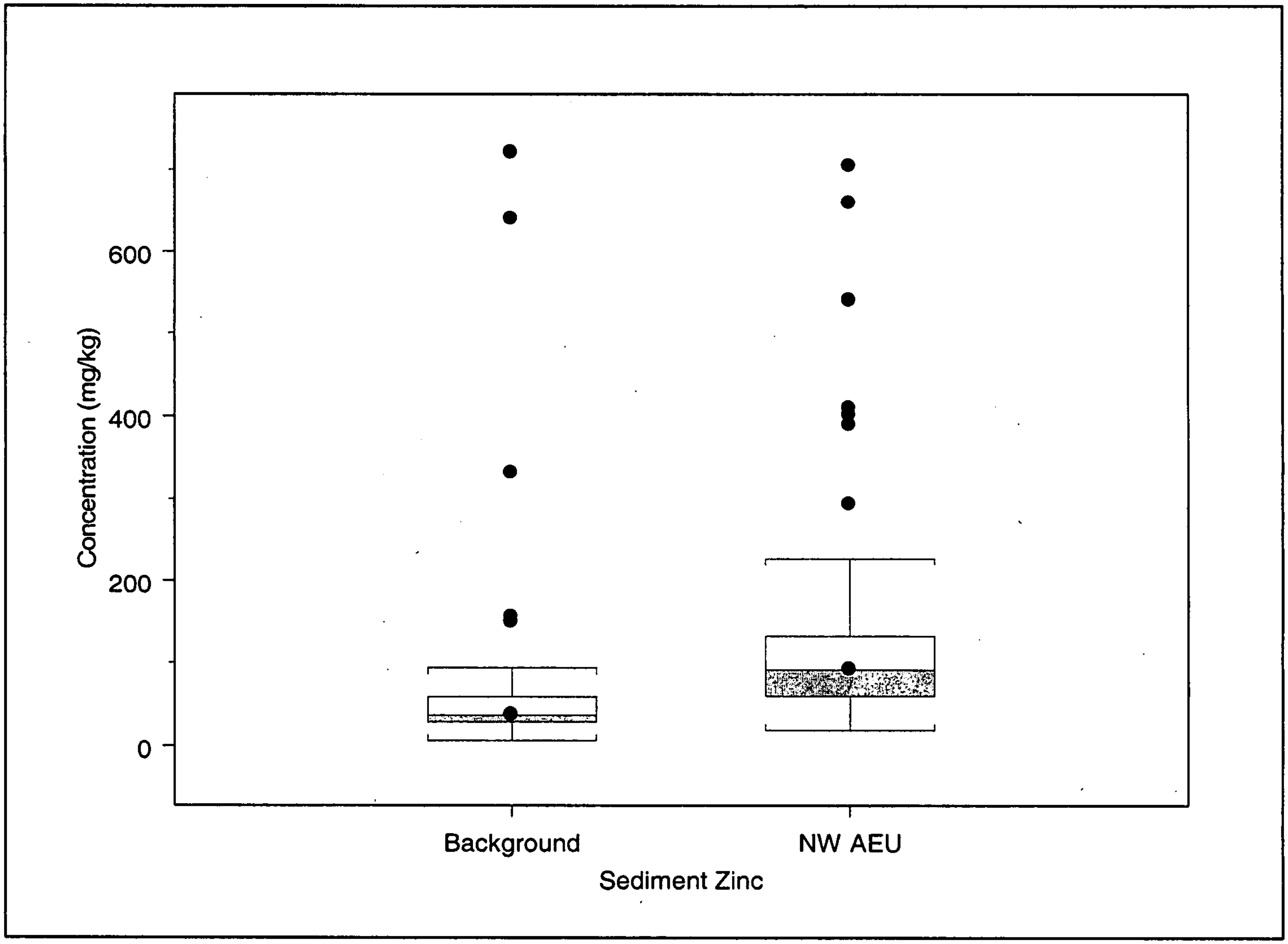
Figure A3.2.NW AEU.40
NW AEU Sediment Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

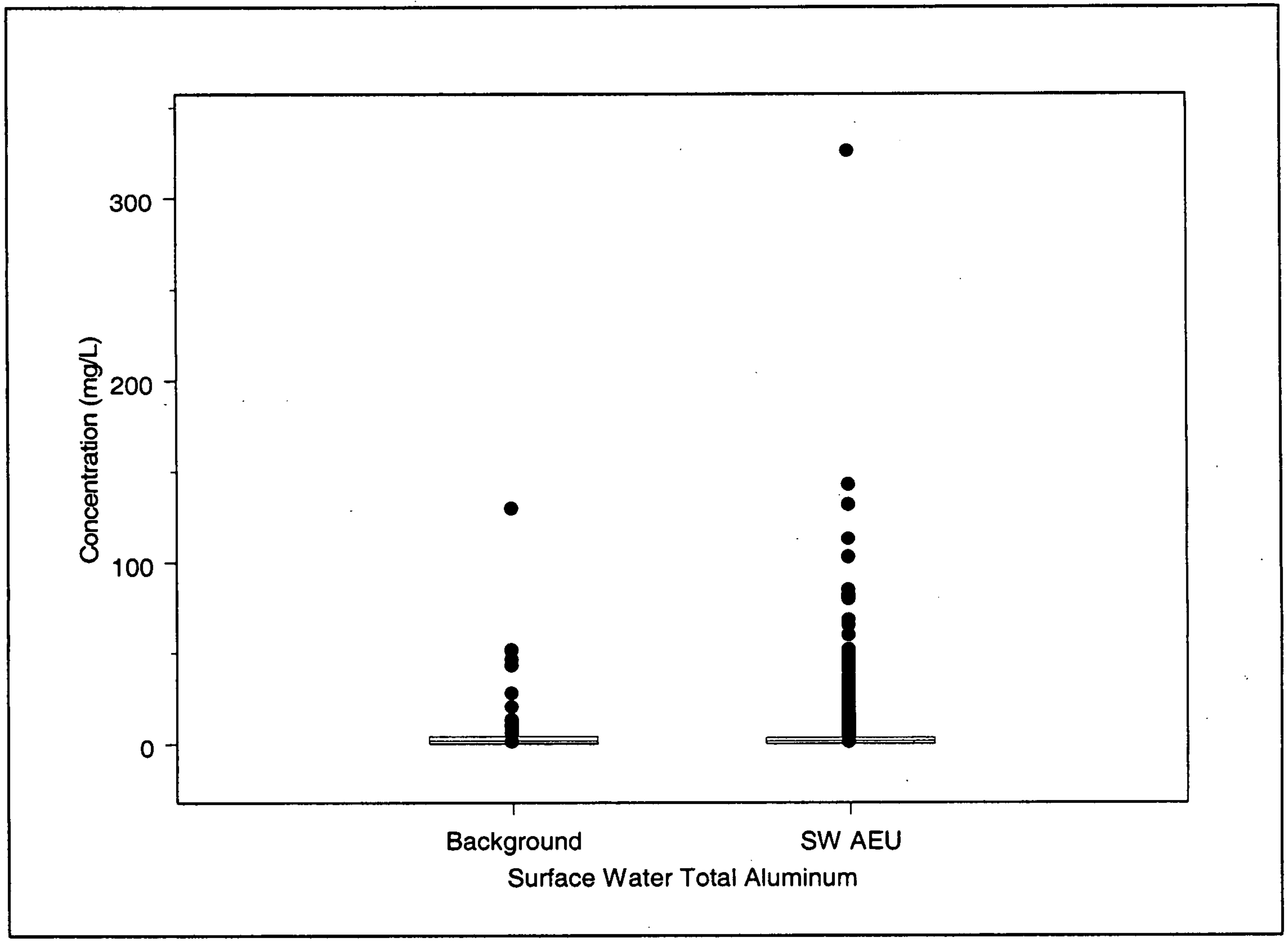
649

Figure A3.2.NW AEU.41
NW AEU Sediment Box Plots for Zinc



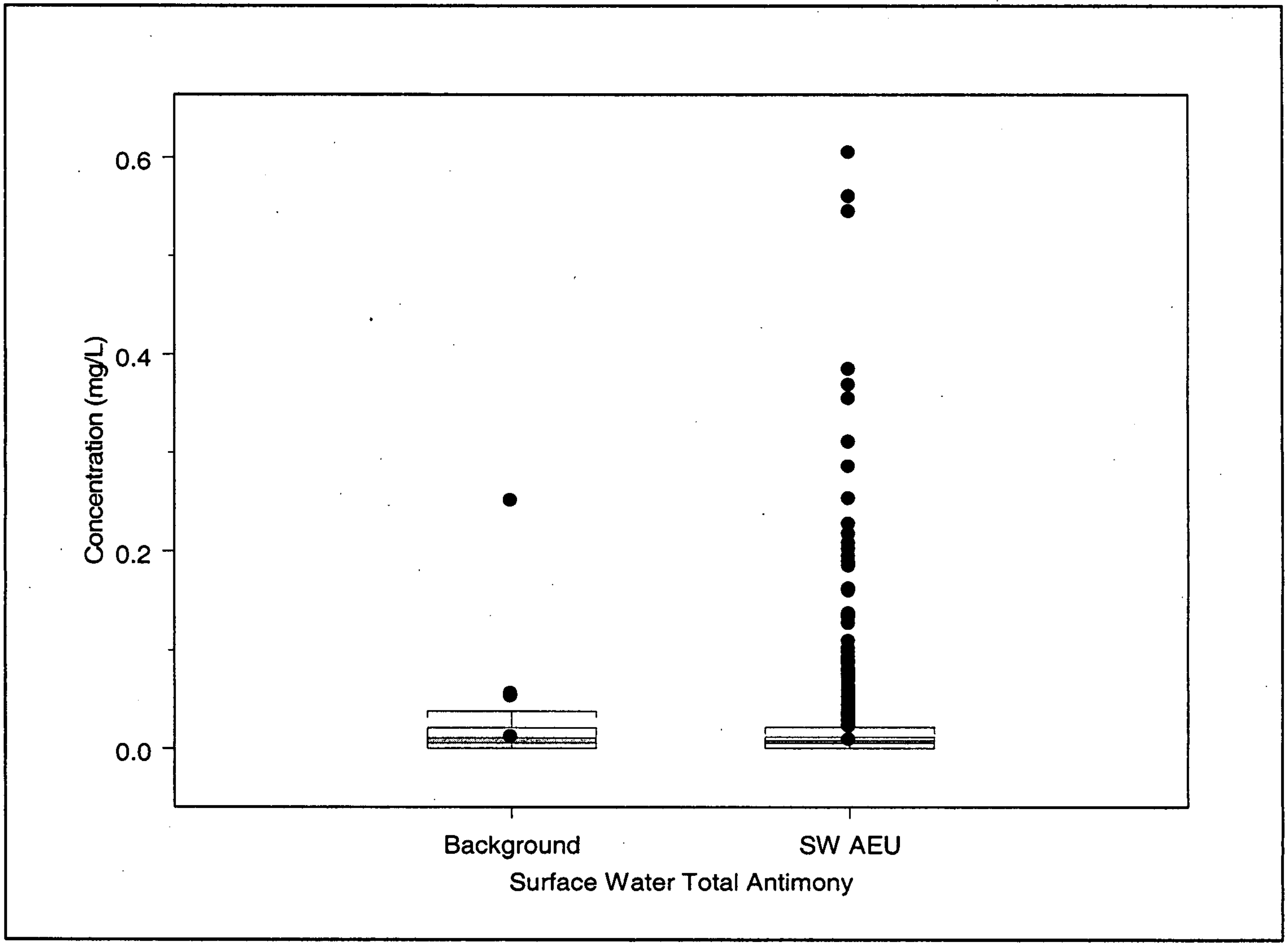
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3[illegible]SW AEU.1
SW AEU Surface Water Total Box Plots for Aluminum



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

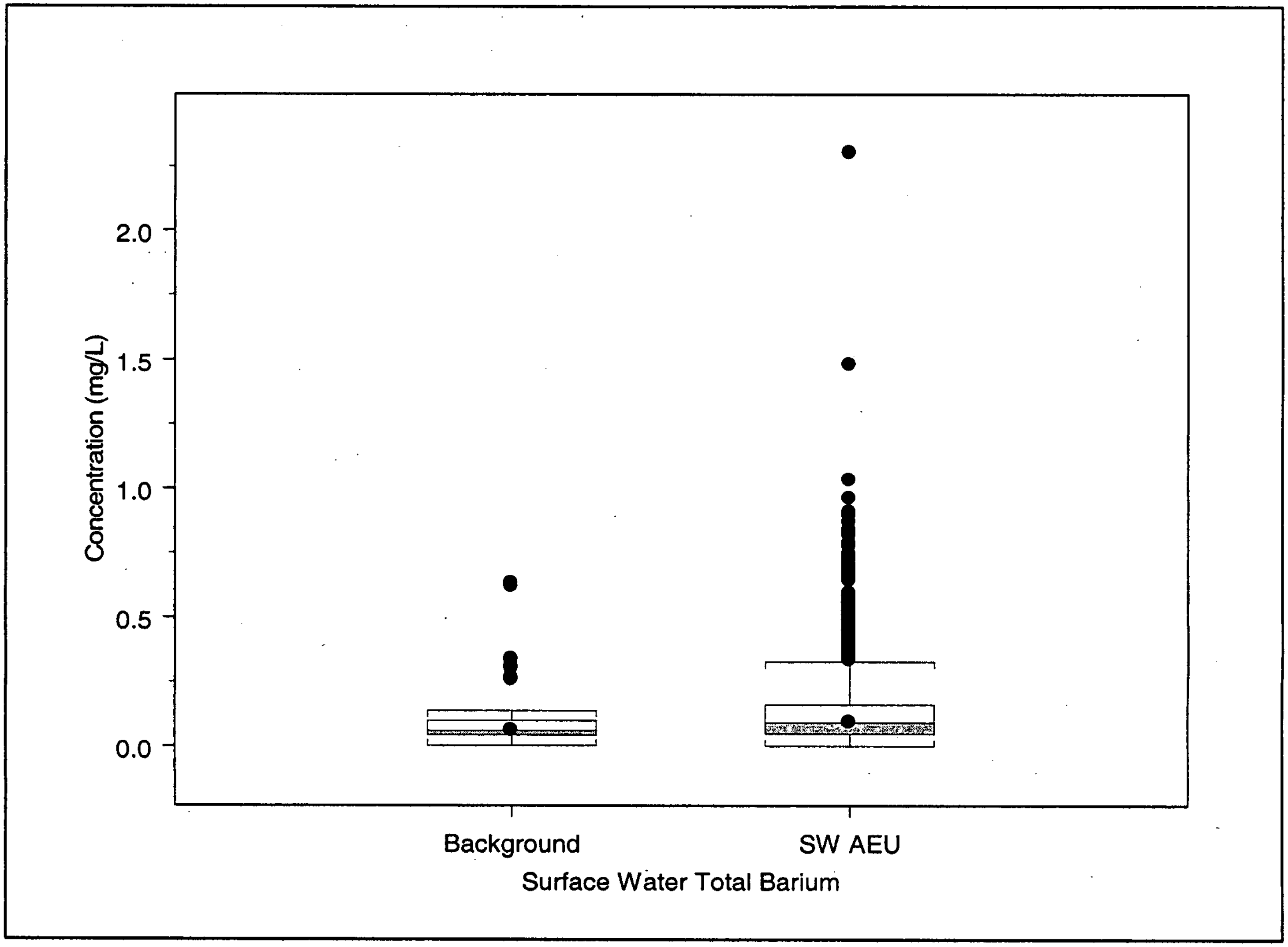
Figure A3[illegible]W AEU.2
SW AEU Surface Water Total Box Plots for Antimony



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

652

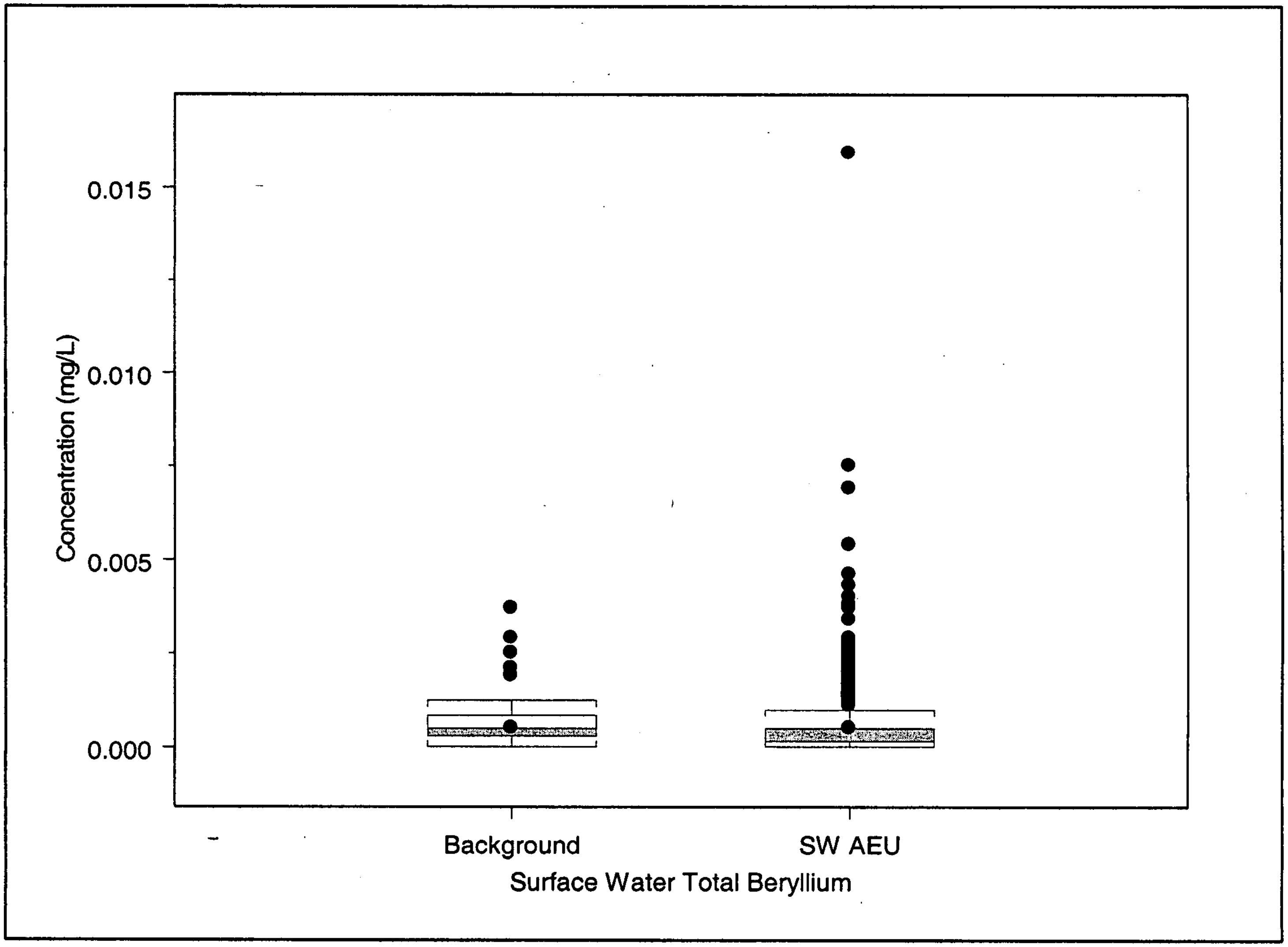
Figure A3.2.SW AEU.3
SW AEU Surface Water Total Box Plots for Barium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

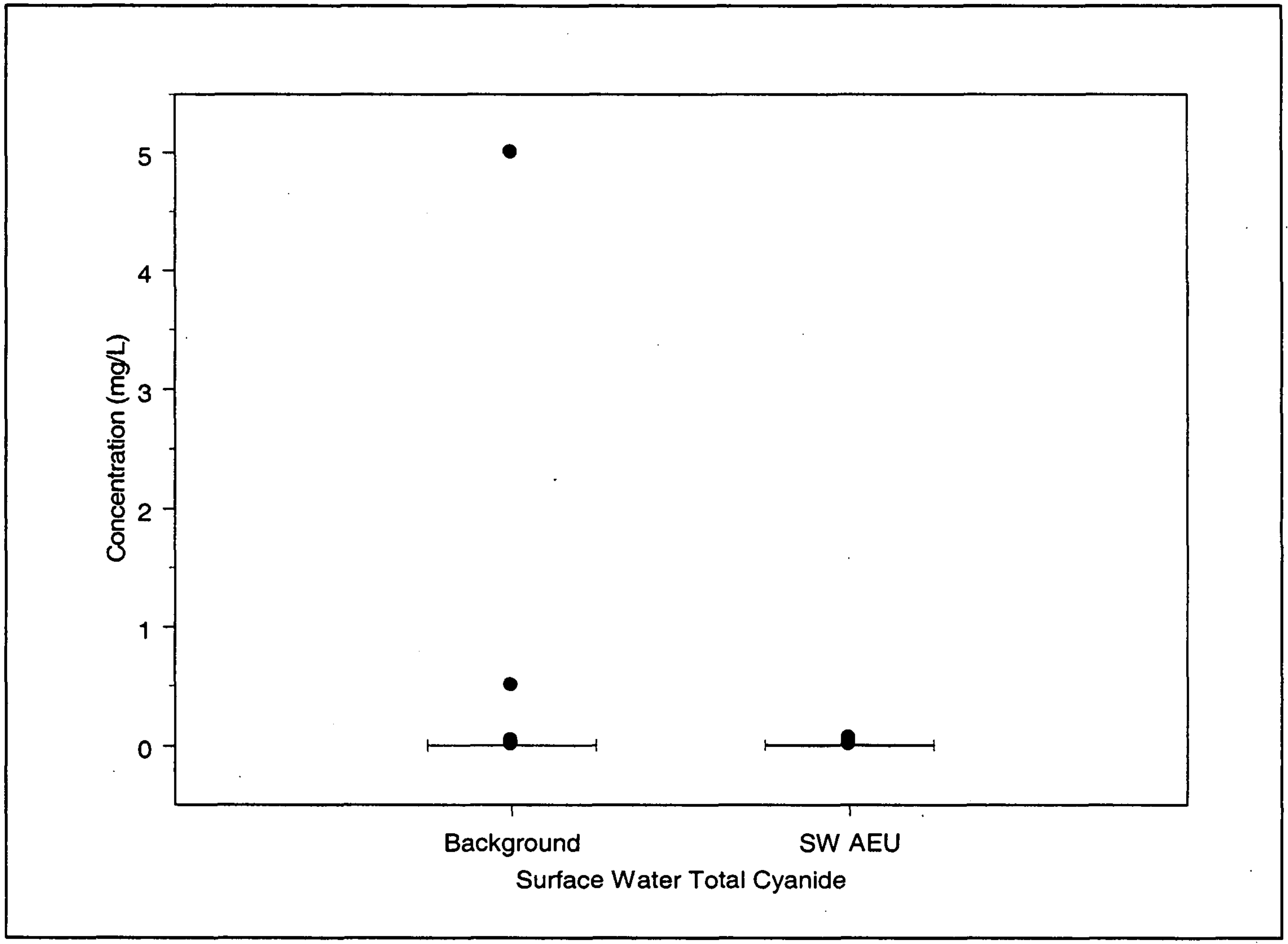
653

Figure A3.2.SW AEU.4
SW AEU Surface Water Total Box Plots for Beryllium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

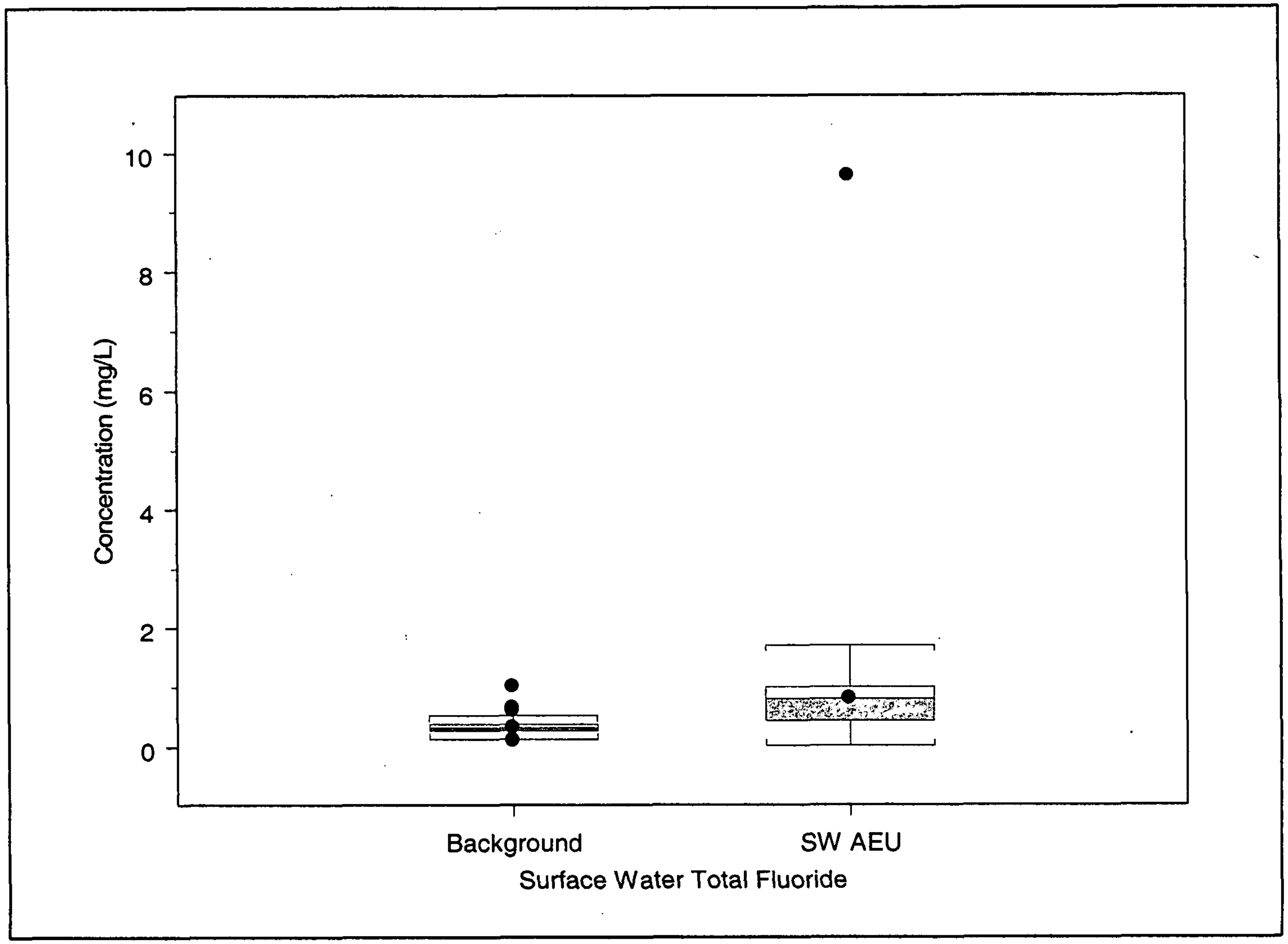
Figure A3.2.SW AEU.5
SW AEU Surface Water Total Box Plots for Cyanide



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

655

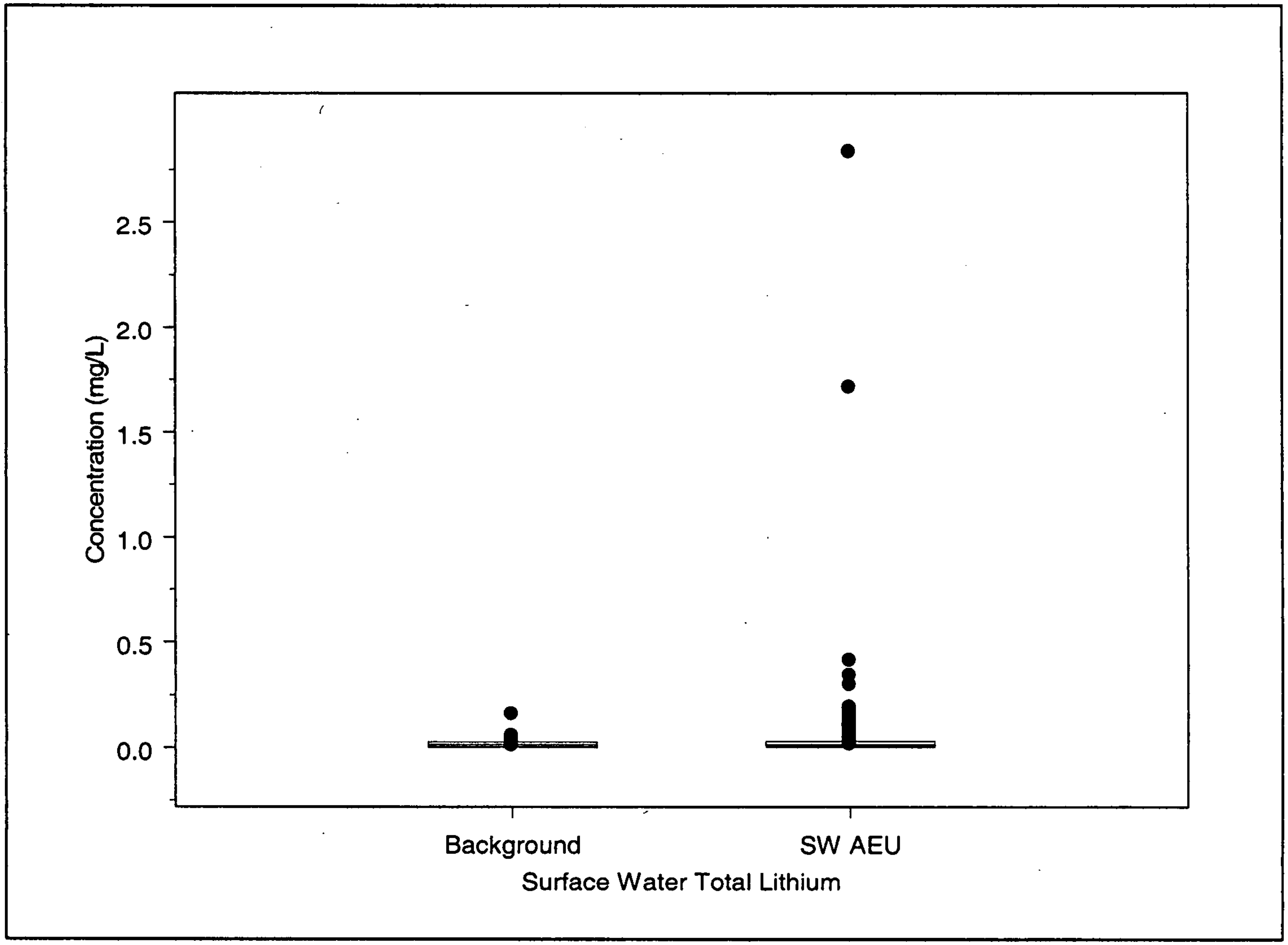
Figure A3.2.SW AEU.6
SW AEU Surface Water Total Box Plots for Fluoride



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

656

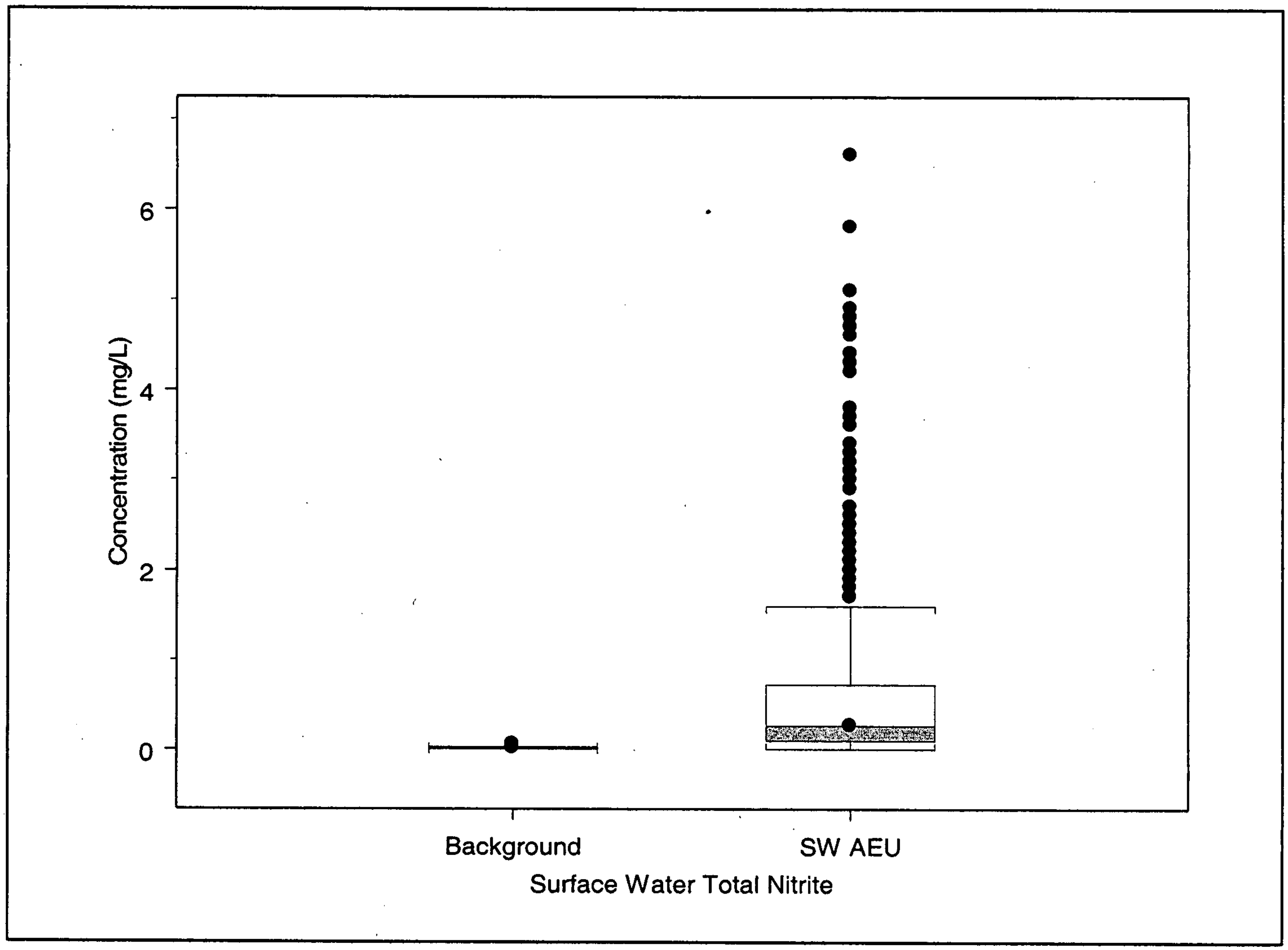
Figure A3.[illegible]W AEU.7
SW AEU Surface Water Total Box Plots for Lithium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

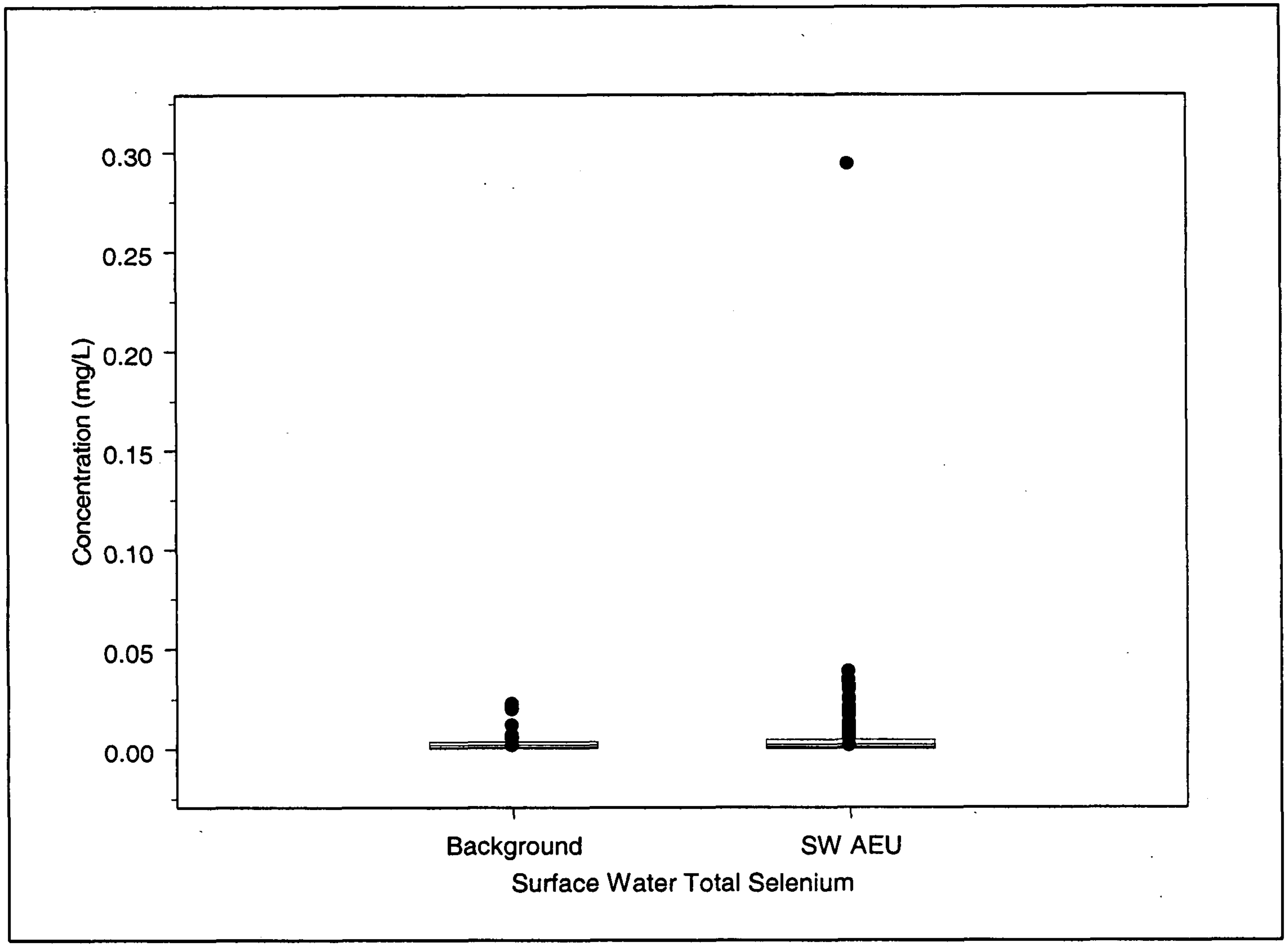
657

Figure A3.[illegible]SW AEU.8
SW AEU Surface Water Total Box Plots for Nitrite



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

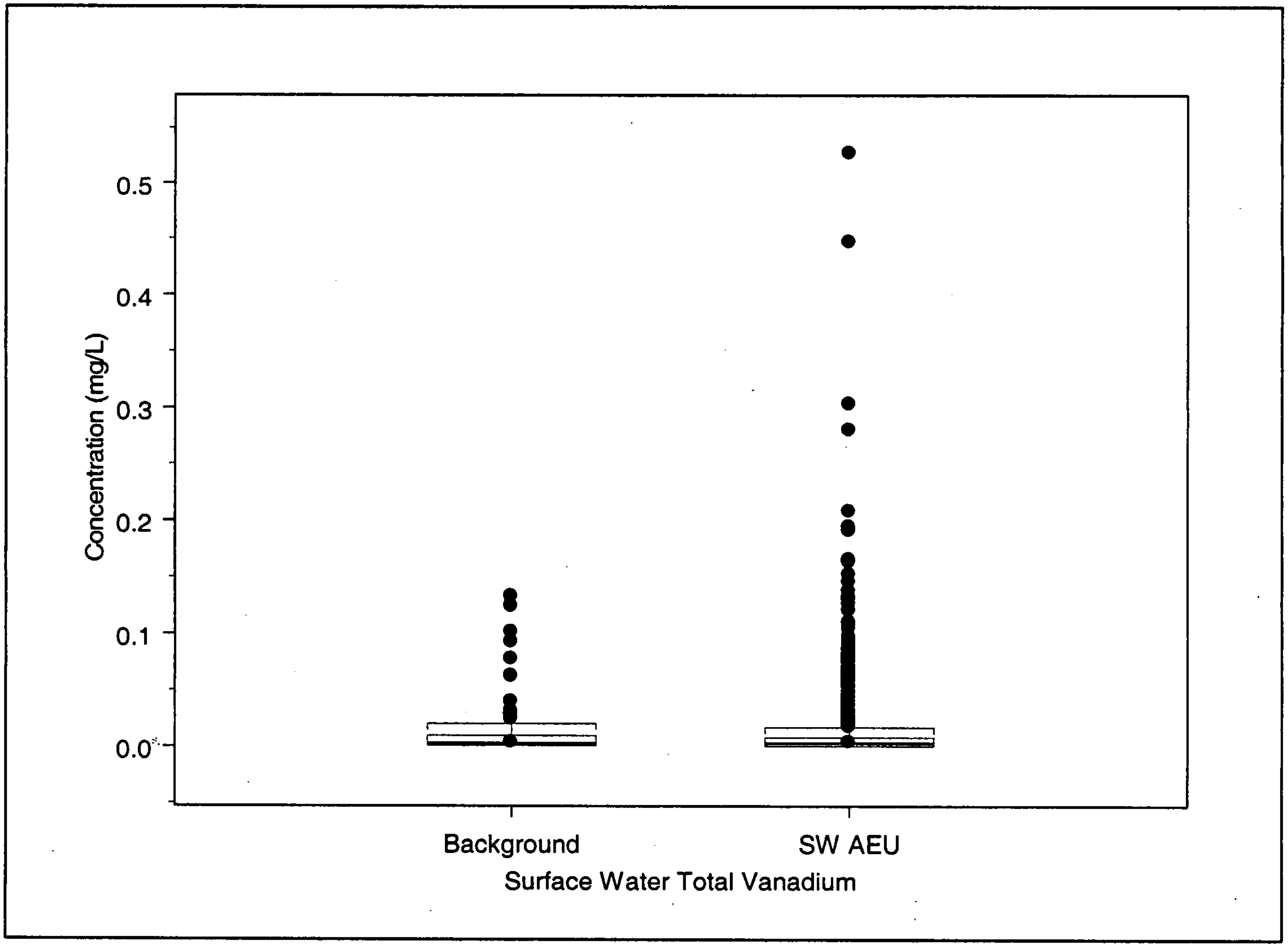
Figure A3.[illegible]SW AEU.9
SW AEU Surface Water Total Box Plots for Selenium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

659

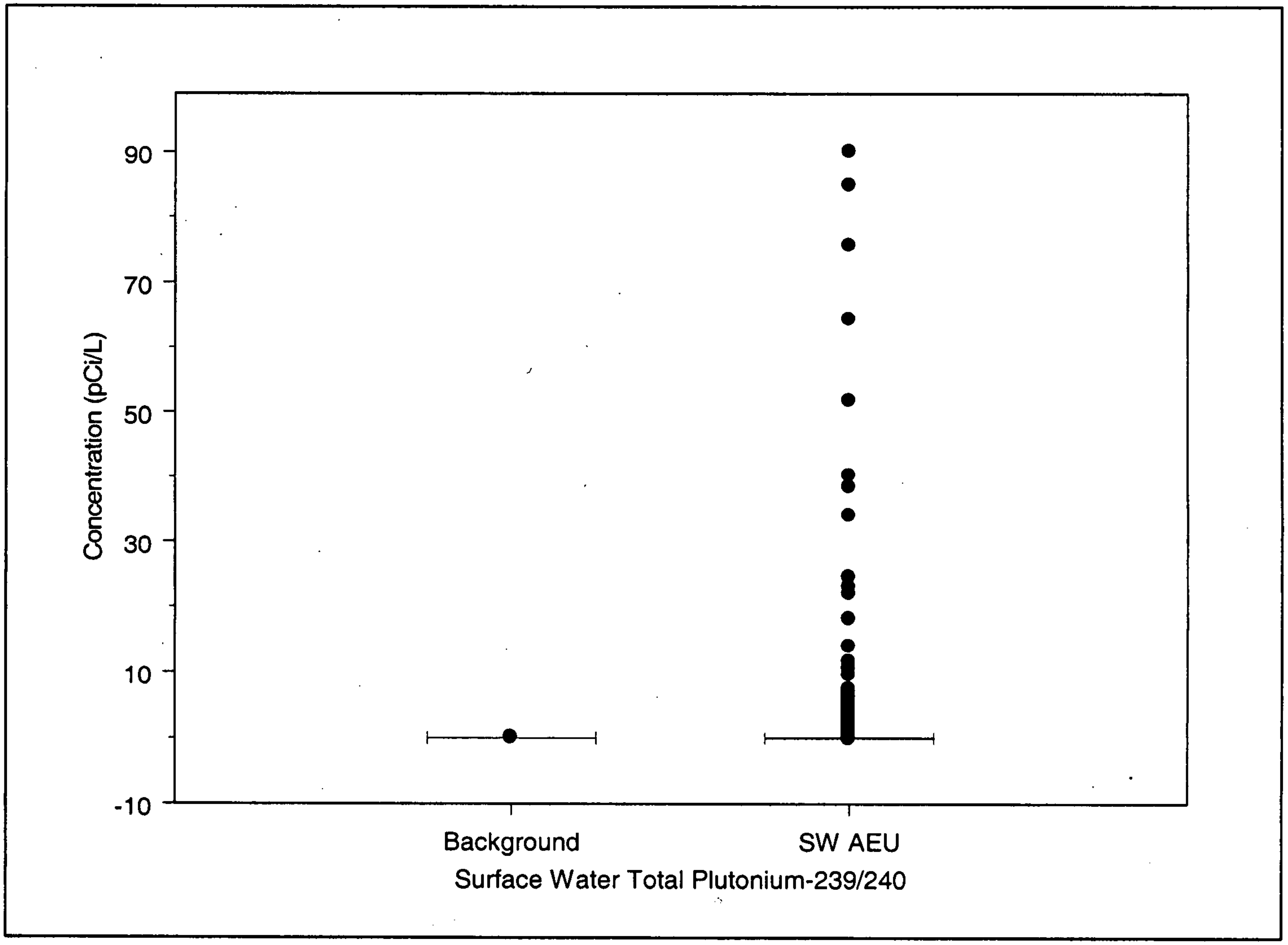
Figure A3.2.SW AEU.10
SW AEU Surface Water Total Box Plots for Vanadium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

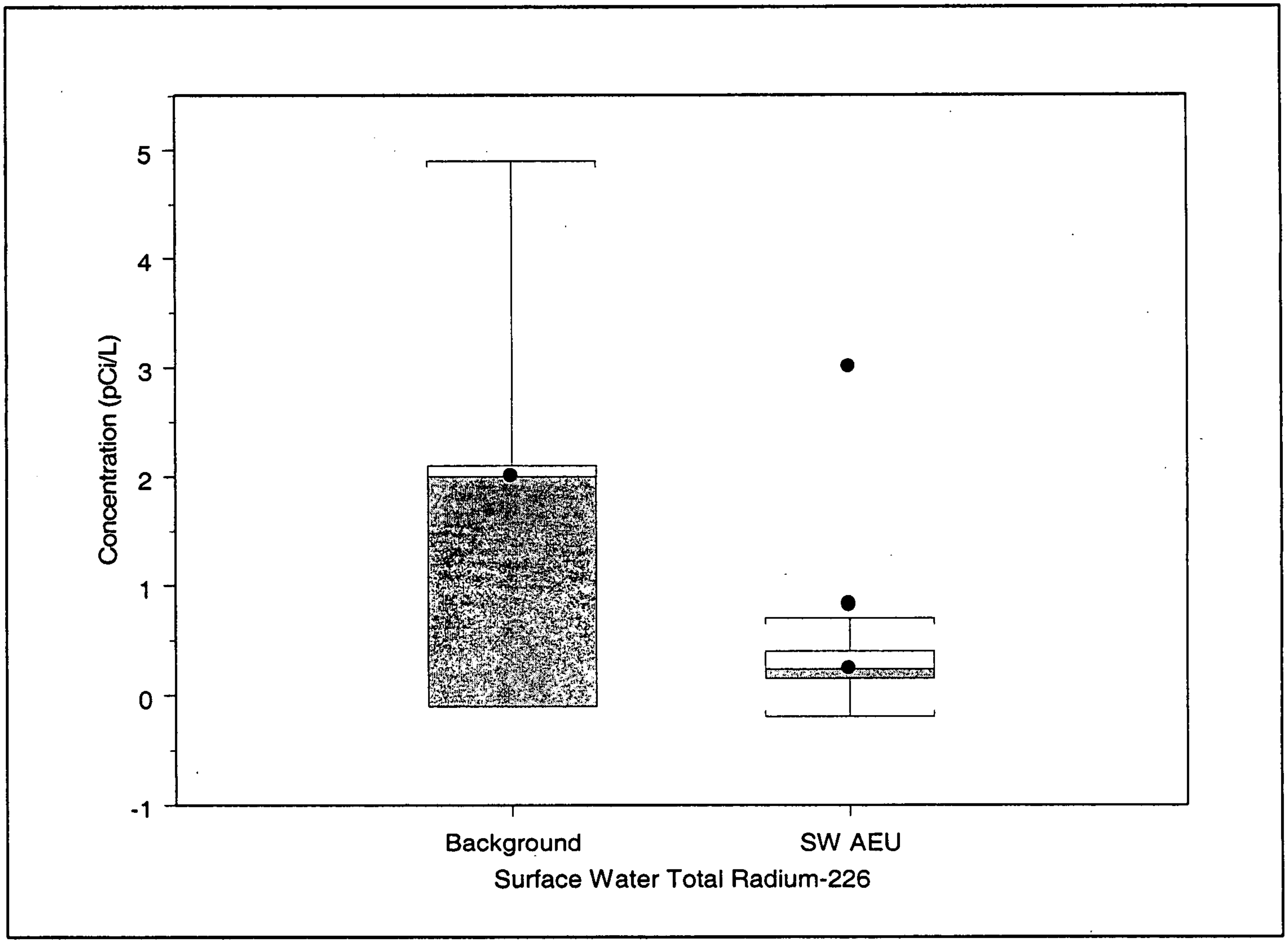
660

Figure A3.2.SW AEU.11
SW AEU Surface Water Total Box Plots for Plutonium-239/240



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

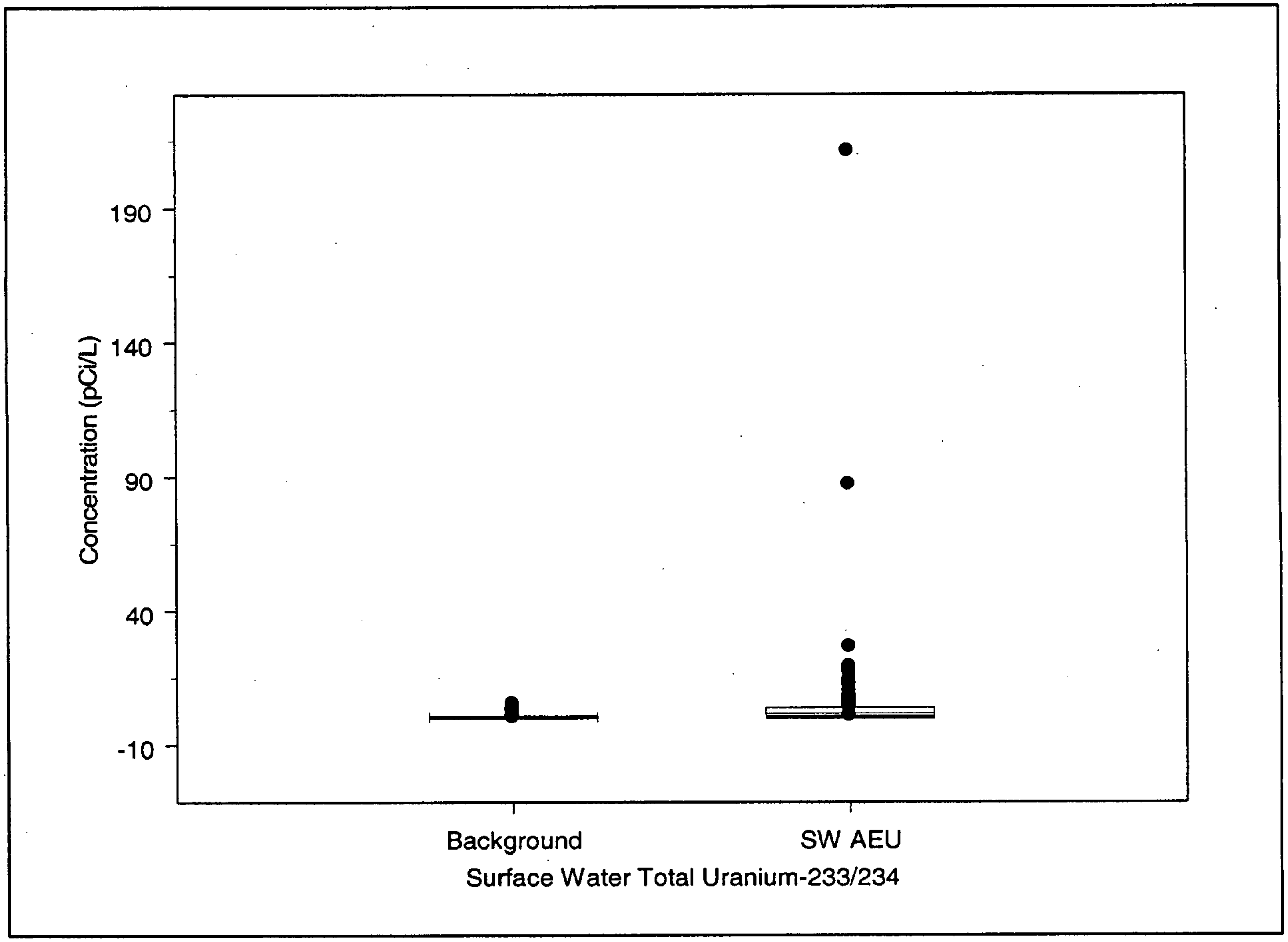
Figure A3[illegible]W AEU.12
SW AEU Surface Water Total Box Plots for Radium-226



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

662

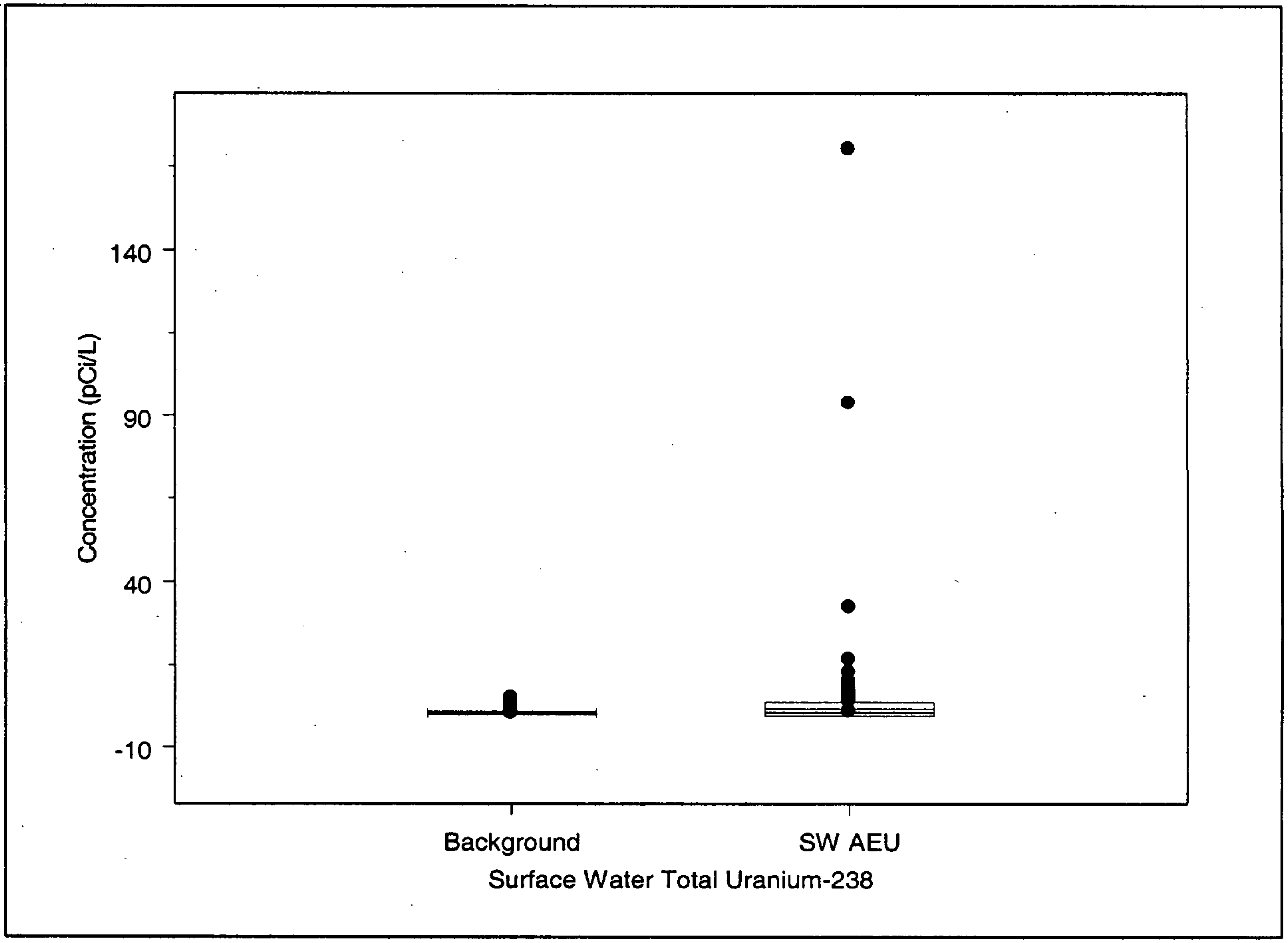
Figure A3.2.SW AEU.13
SW AEU Surface Water Total Box Plots for Uranium-233/234



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

663

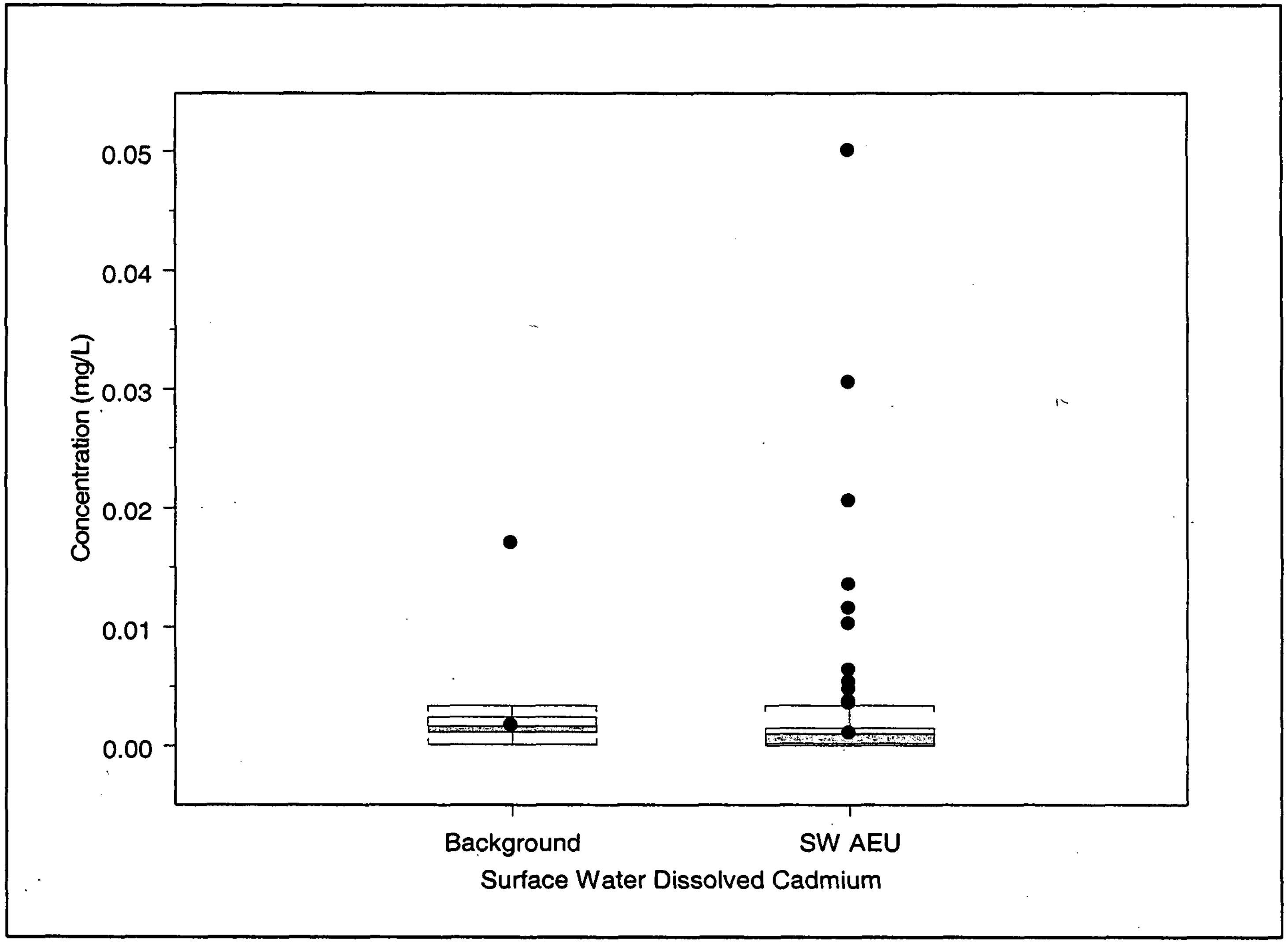
Figure A3.[illegible]W AEU.14
SW AEU Surface Water Total Box Plots for Uranium-238



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

664

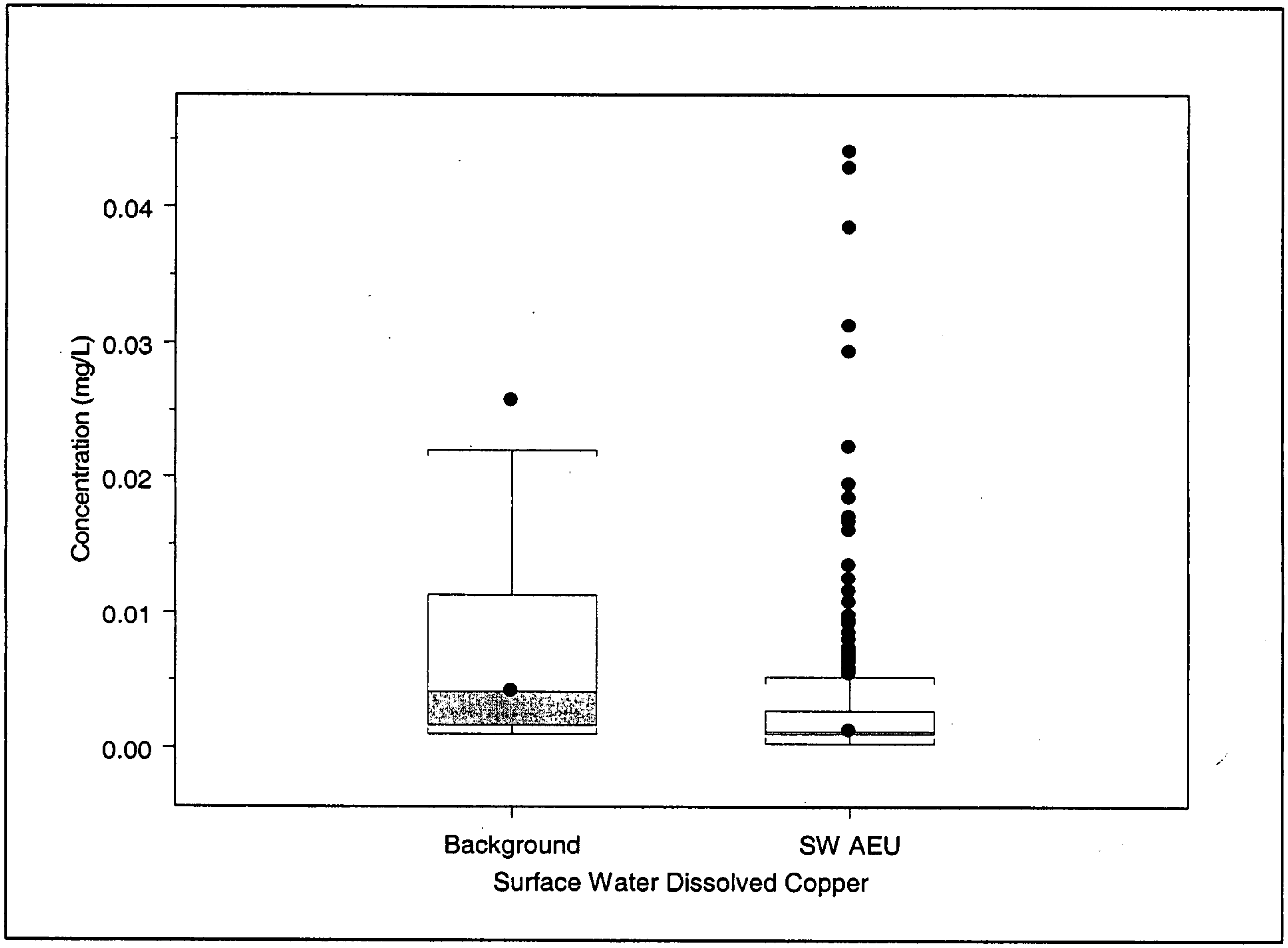
Figure A3.2.SW AEU.15
SW AEU Surface Water Dissolved Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

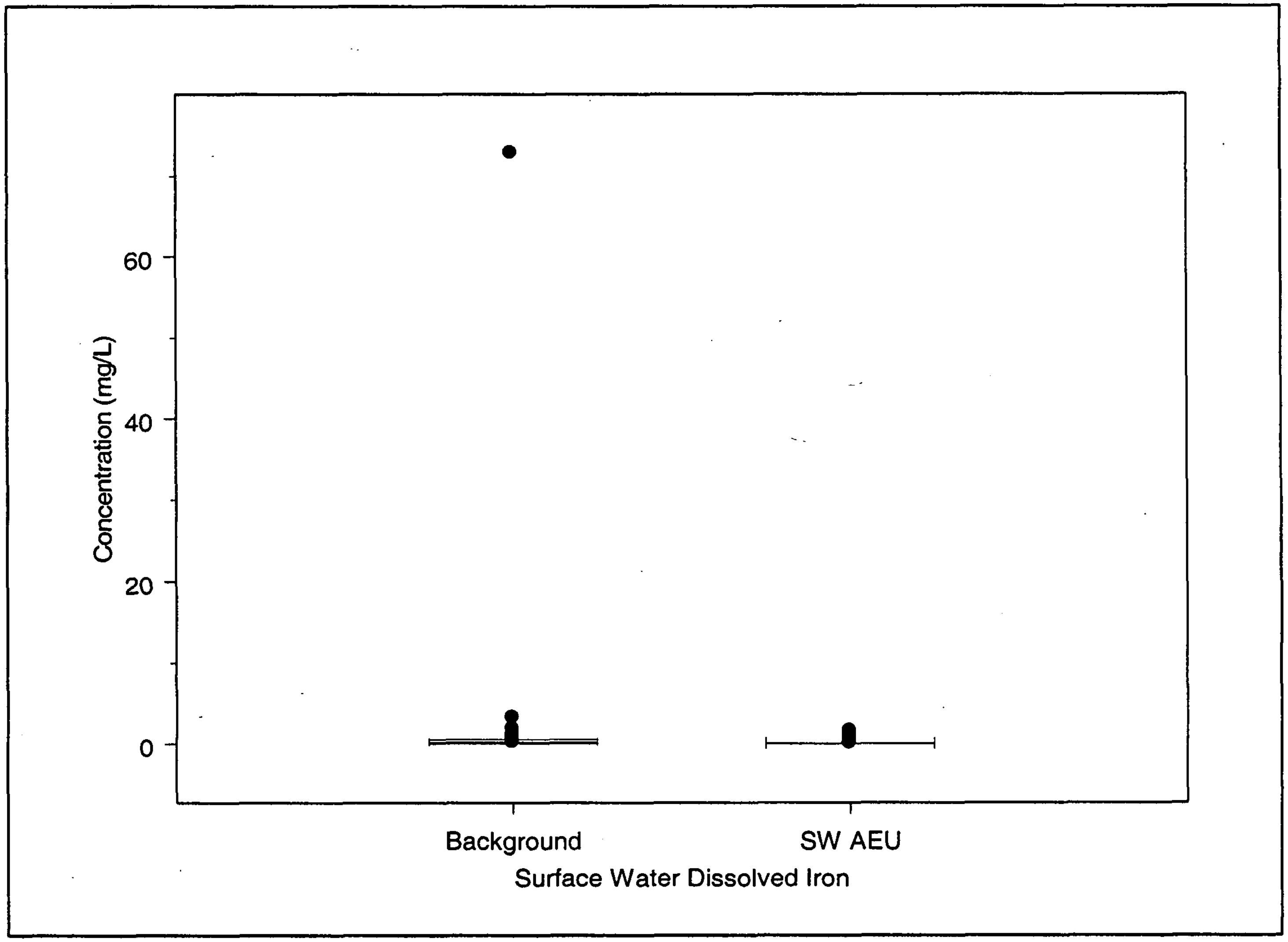
665

Figure A3.2.SW AEU.16
SW AEU Surface Water Dissolved Box Plots for Copper



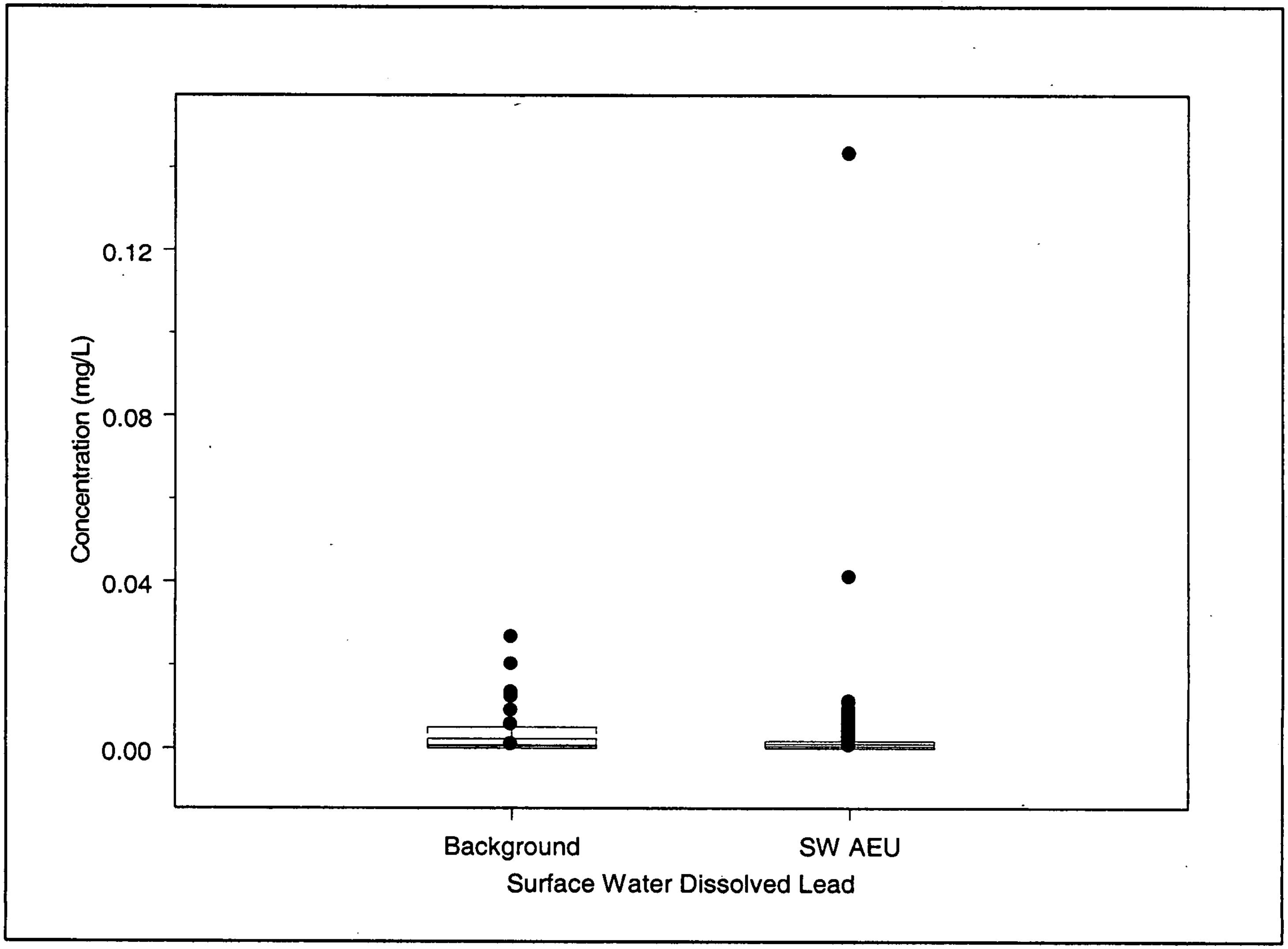
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]SW AEU.17
SW AEU Surface Water Dissolved Box Plots for Iron



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

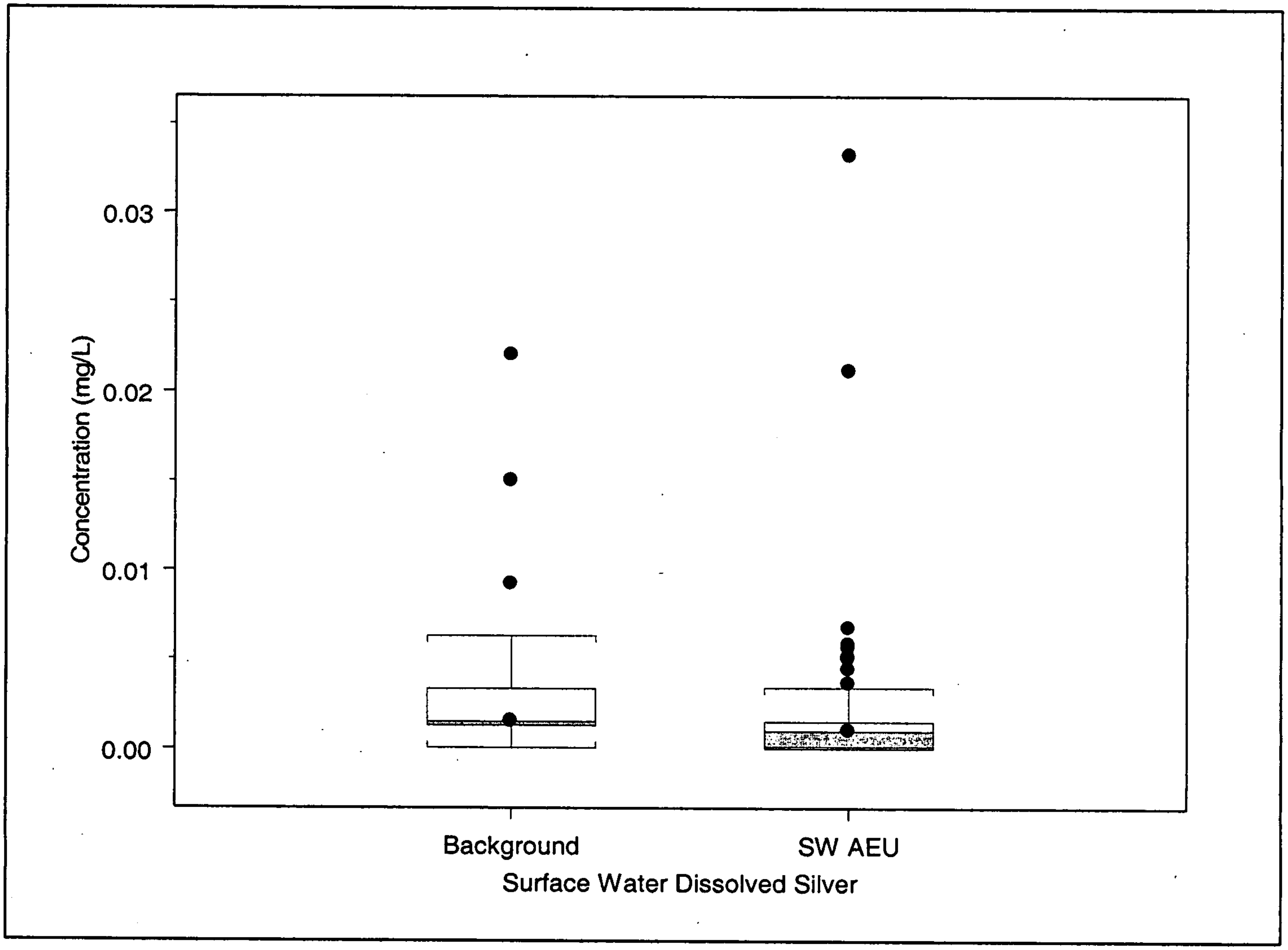
Figure A3.2.SW AEU.18
SW AEU Surface Water Dissolved Box Plots for Lead



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

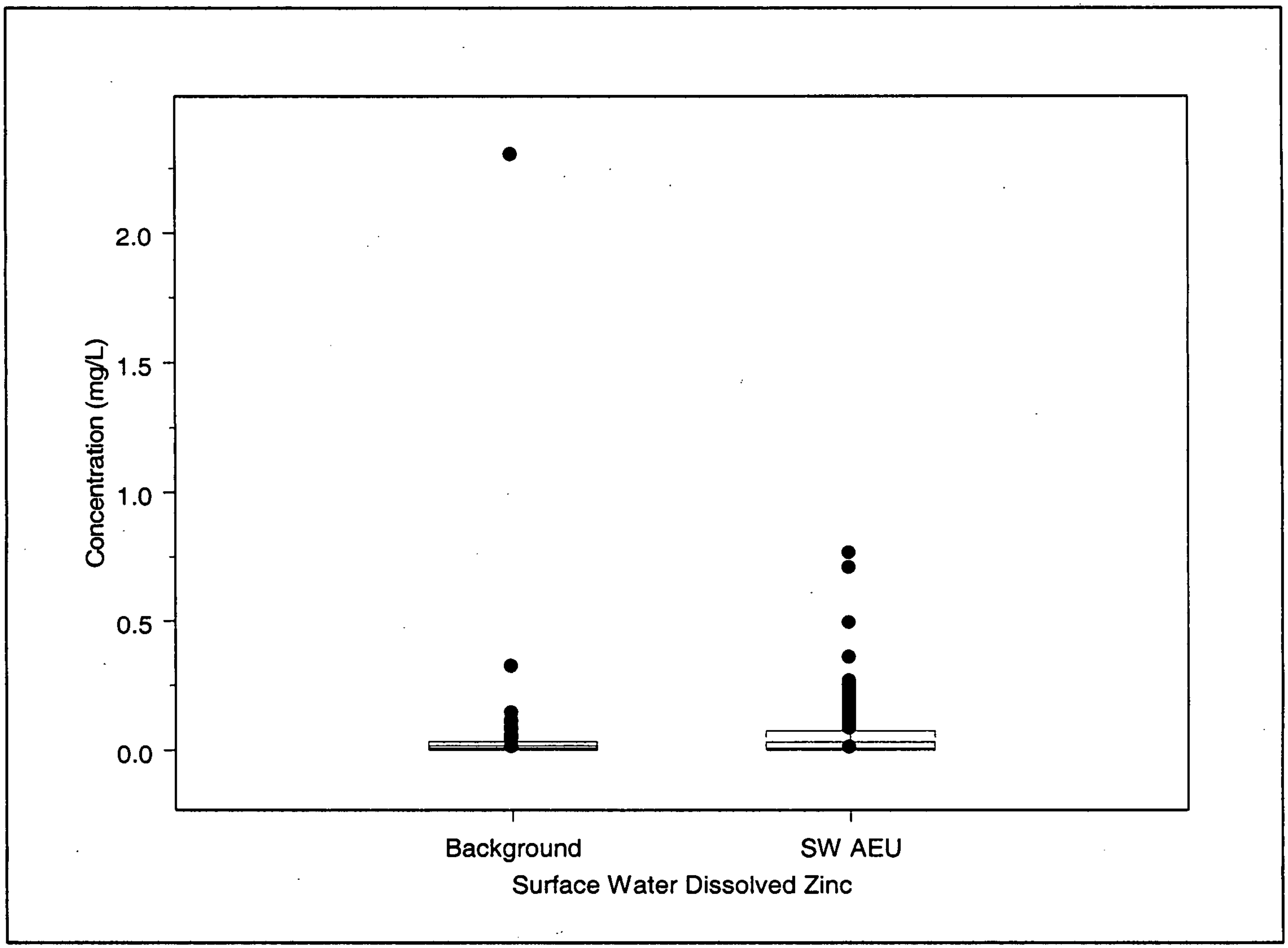
668

Figure A3.2.SW AEU.19
SW AEU Surface Water Dissolved Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

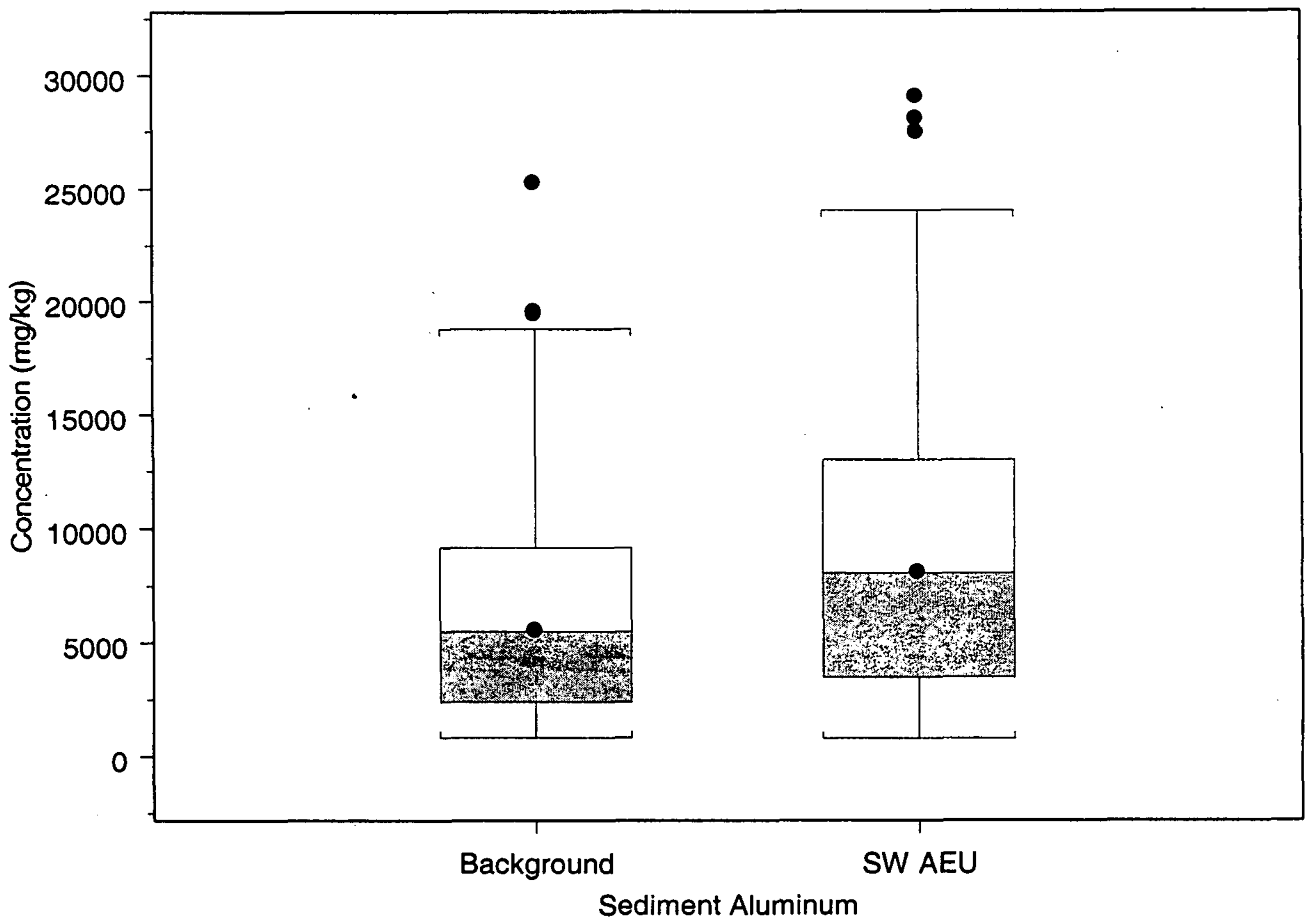
Figure A3.2.SW AEU.20
SW AEU Surface Water Dissolved Box Plots for Zinc



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

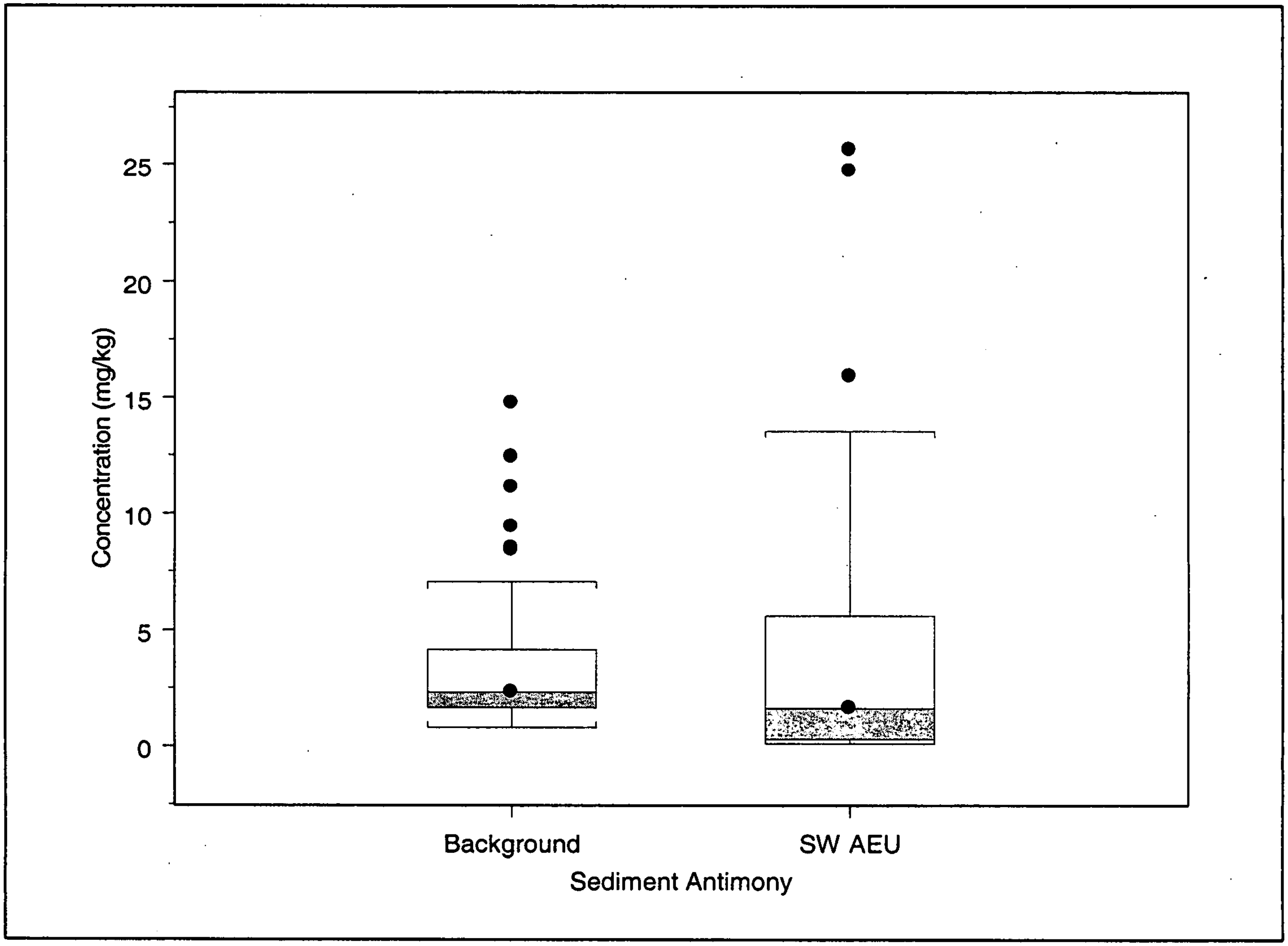
670

Figure A3.[illegible]W AEU.21
SW AEU Sediment Box Plots for Aluminum



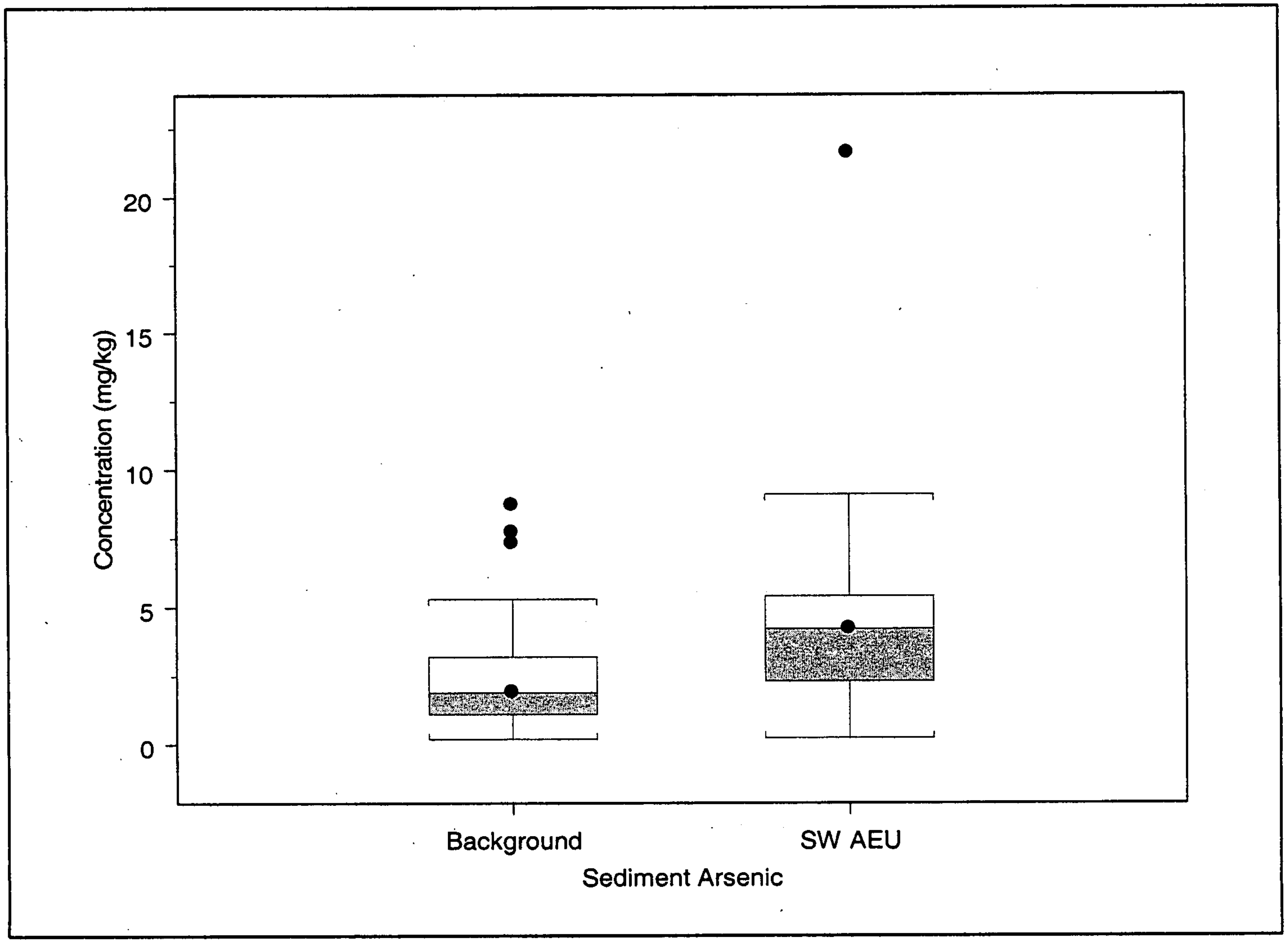
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.22
SW AEU Sediment Box Plots for Antimony



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

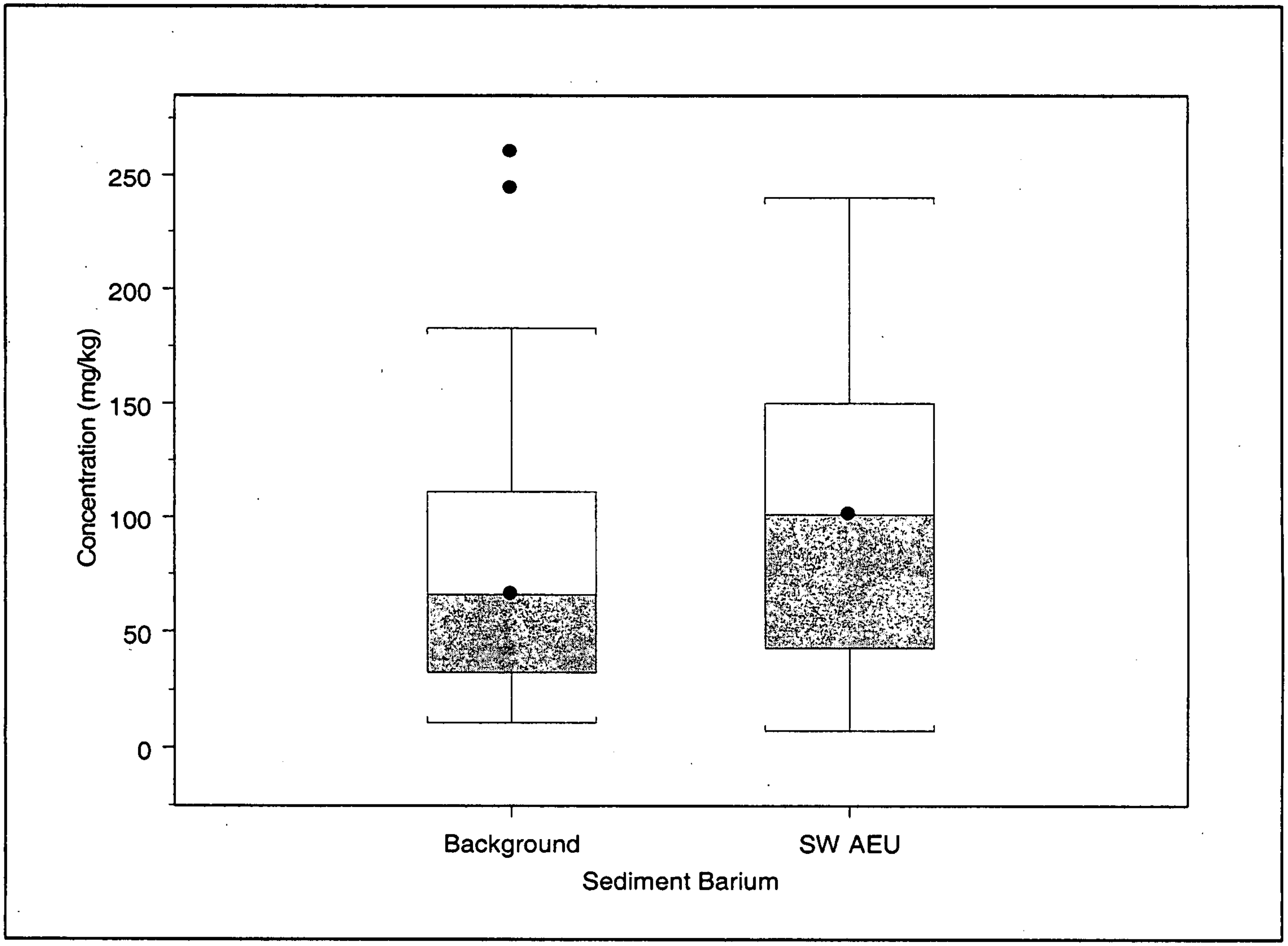
Figure A3.2.SW AEU.23
SW AEU Sediment Box Plots for Arsenic



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

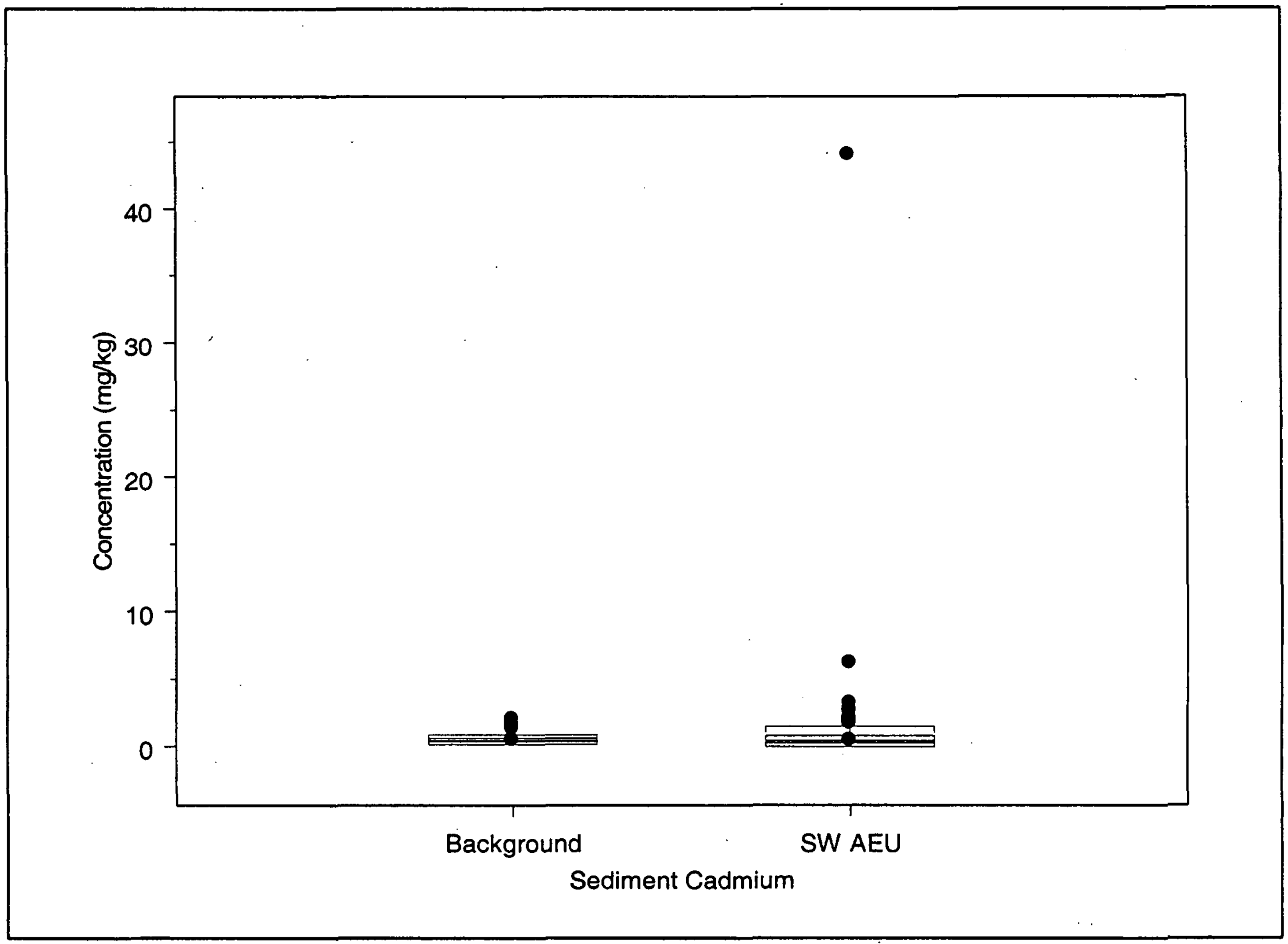
673

Figure A3.2.SW AEU.24
SW AEU Sediment Box Plots for Barium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

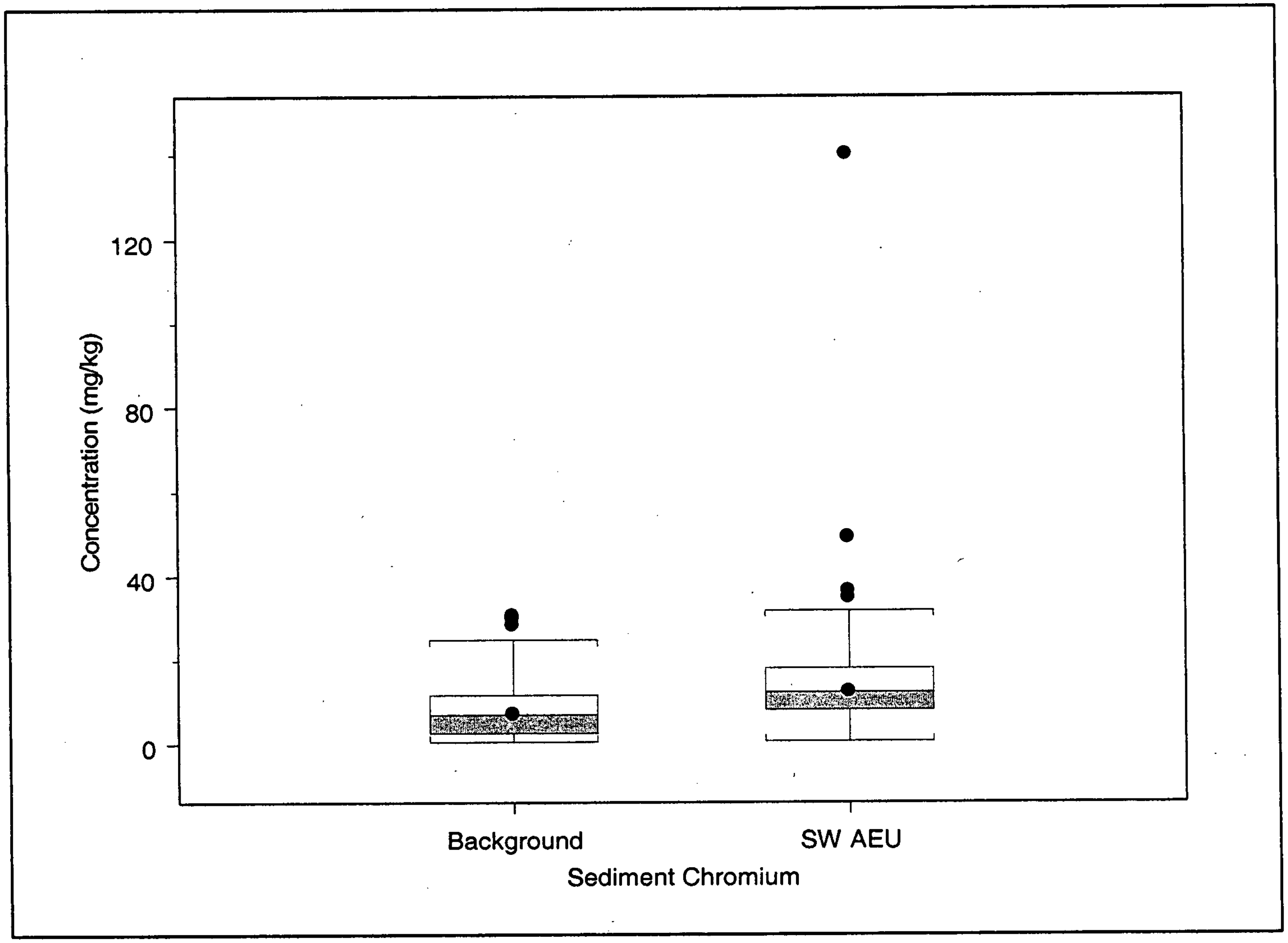
Figure A3.2.SW AEU.25
SW AEU Sediment Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

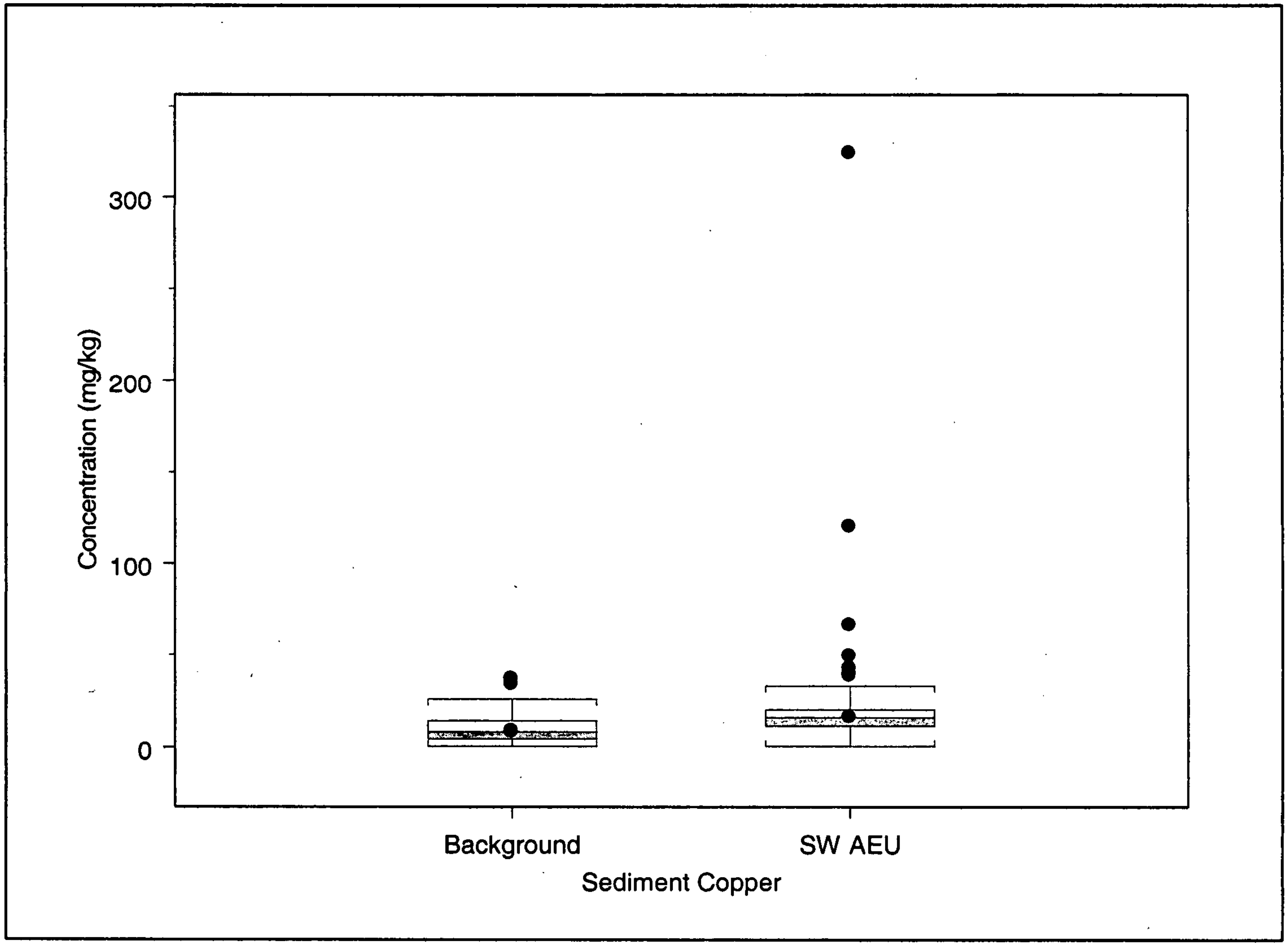
675

Figure A3.2.SW AEU.26
SW AEU Sediment Box Plots for Chromium



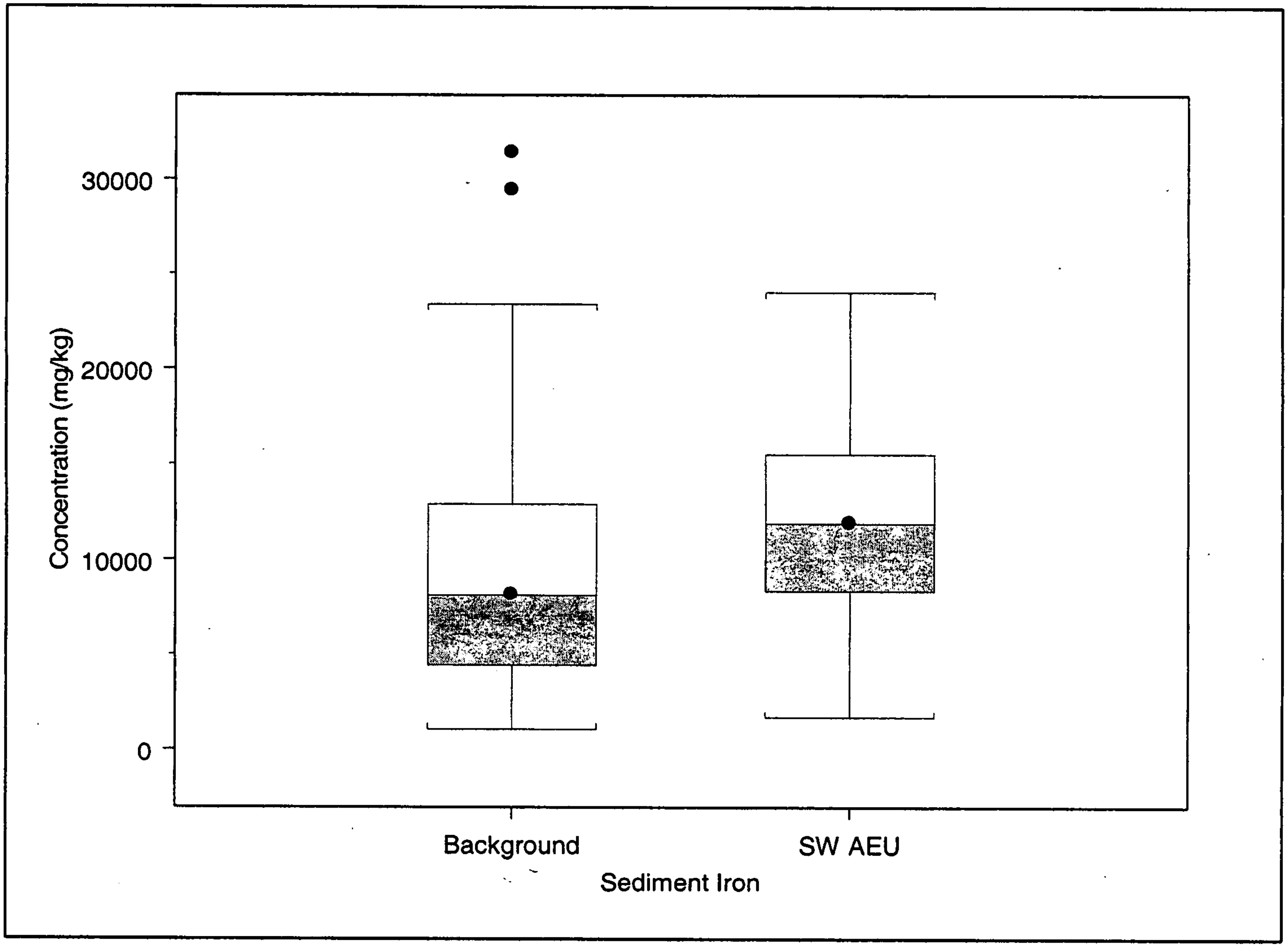
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.27
SW AEU Sediment Box Plots for Copper



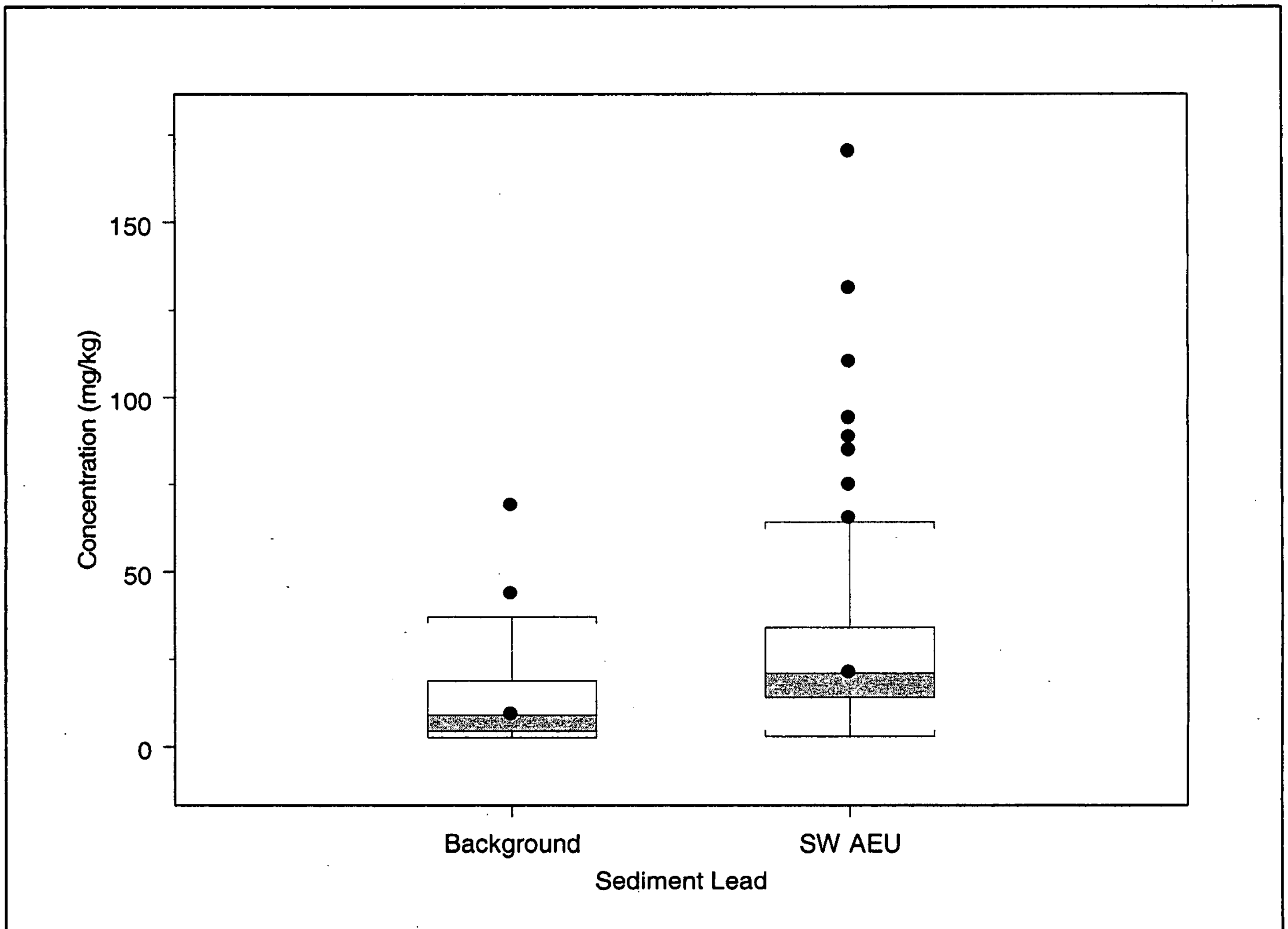
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.28
SW AEU Sediment Box Plots for Iron



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

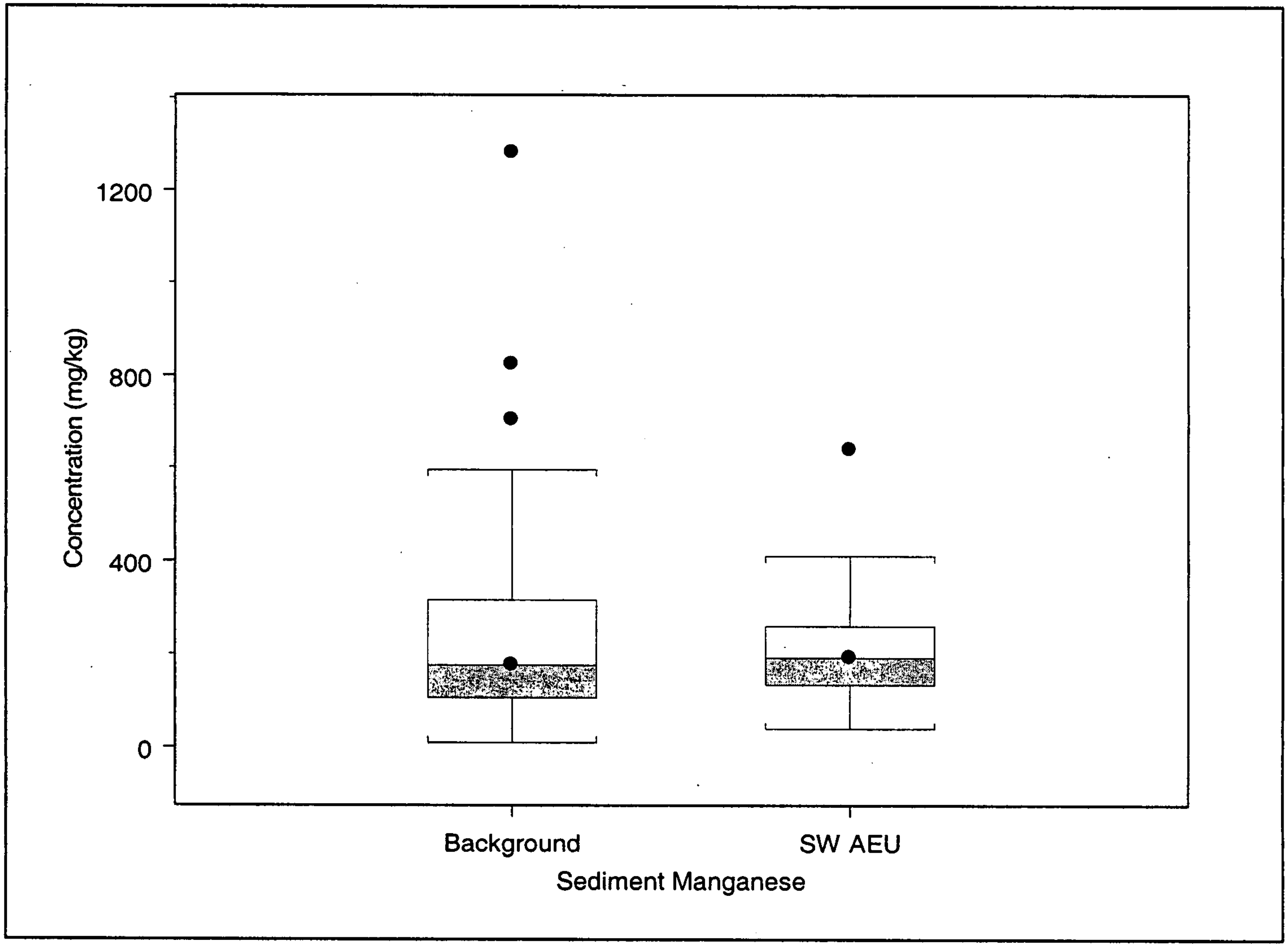
Figure A3.2.SW AEU.29
SW AEU Sediment Box Plots for Lead



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

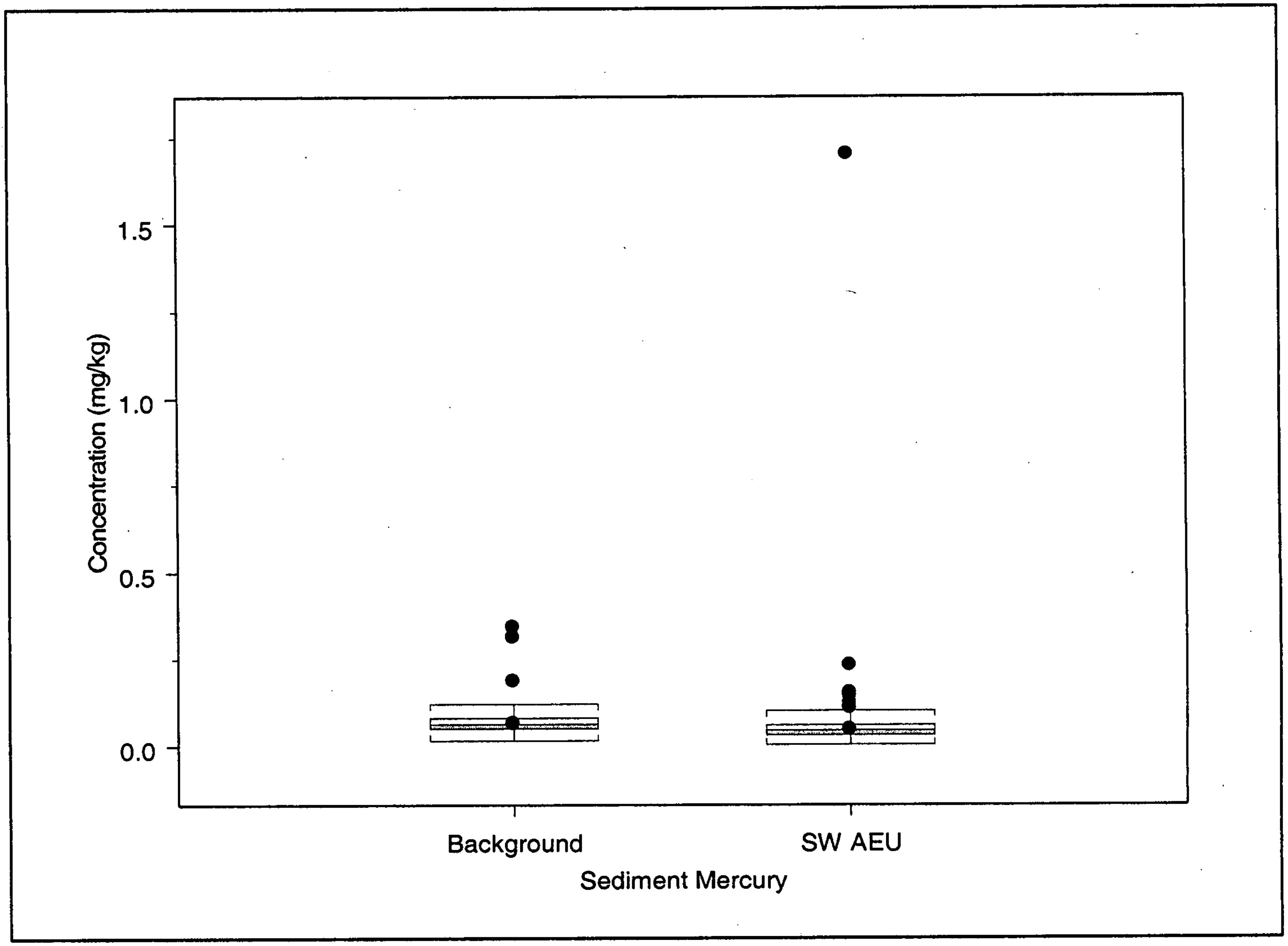
679

Figure A3.2.SW AEU.30
SW AEU Sediment Box Plots for Manganese



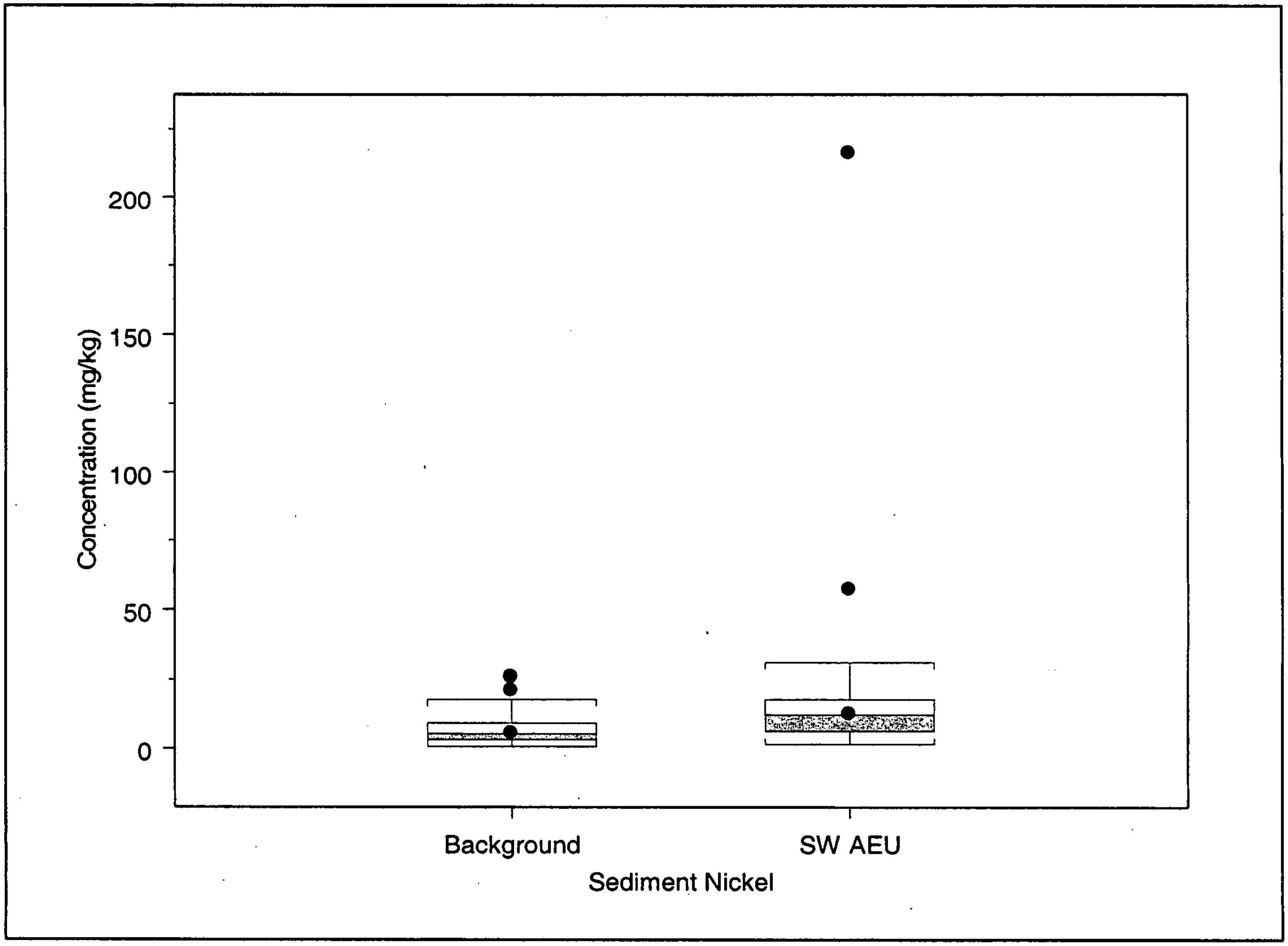
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]W AEU.31
SW AEU Sediment Box Plots for Mercury



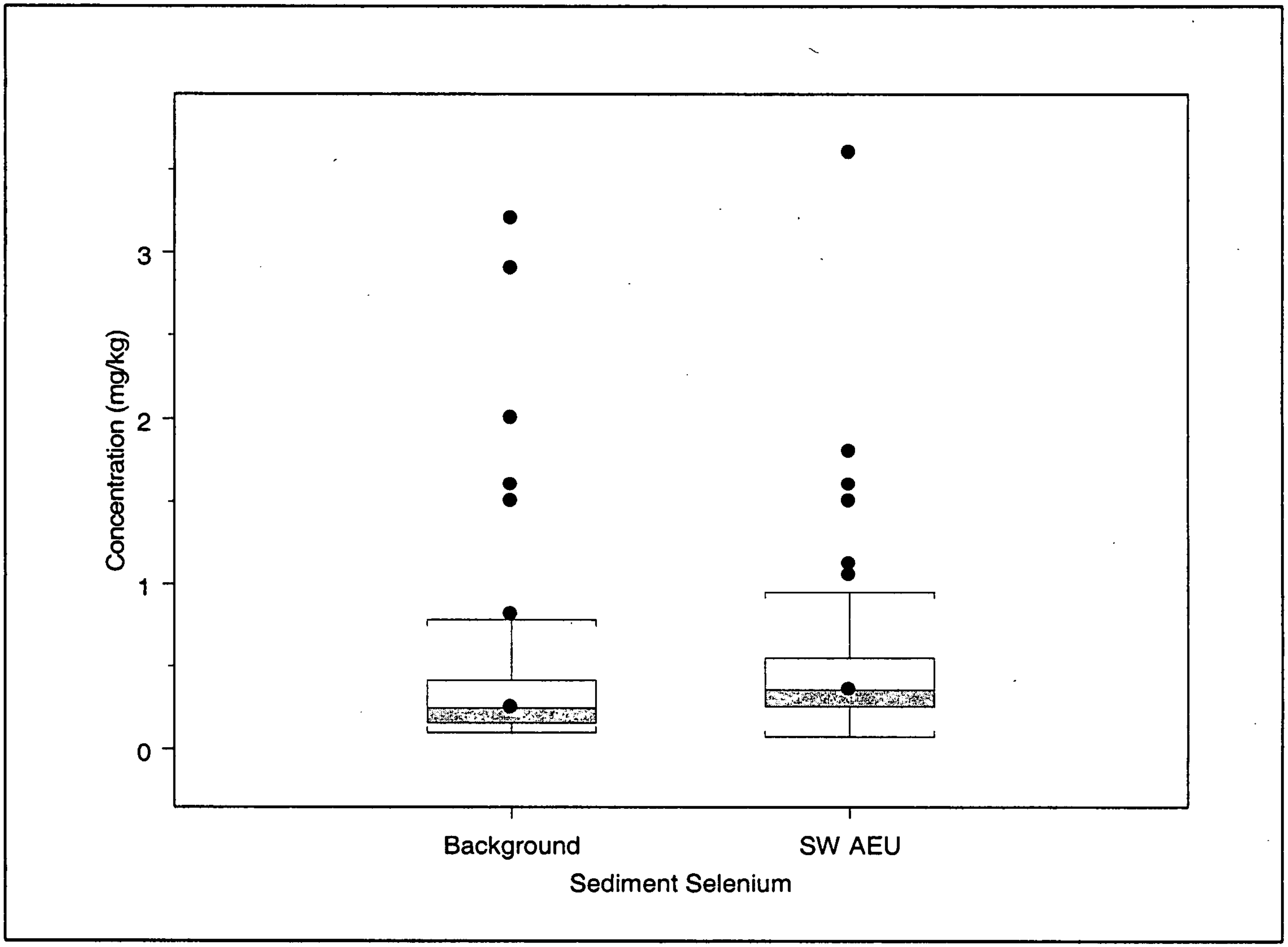
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3[illegible]W AEU.32
SW AEU Sediment Box Plots for Nickel



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

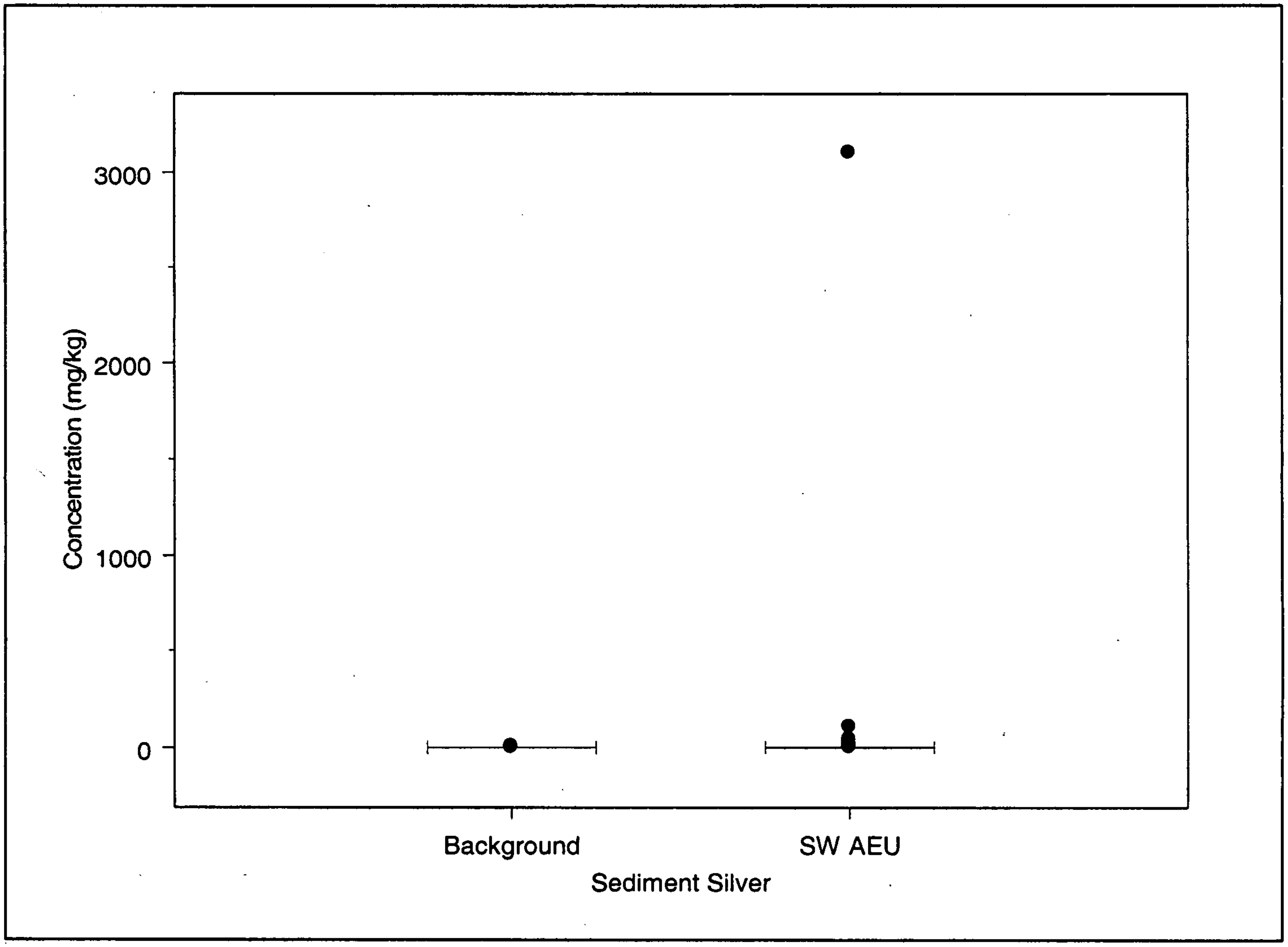
Figure A3.2.SW AEU.33
SW AEU Sediment Box Plots for Selenium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

683

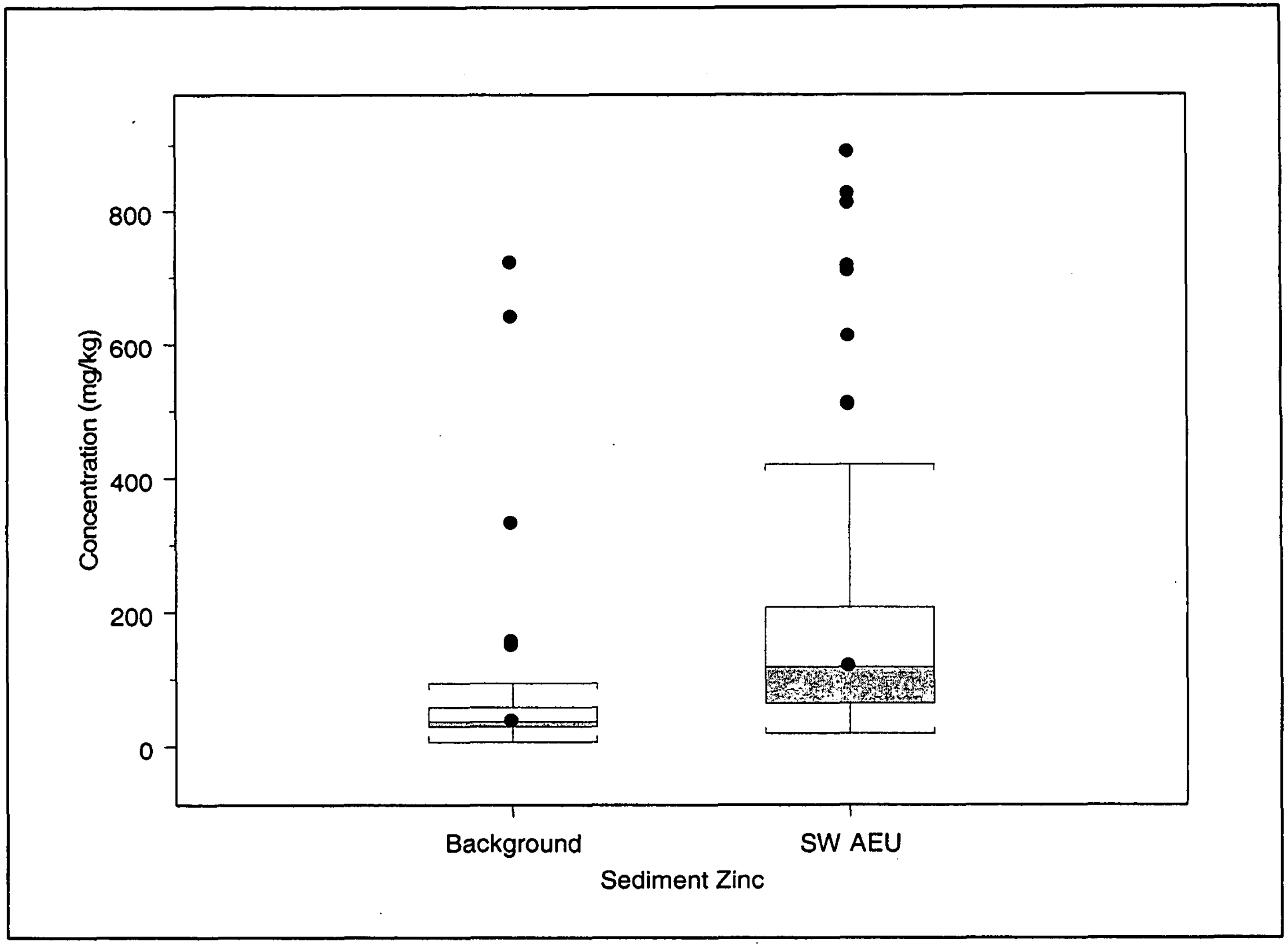
Figure A3.2.SW AEU.34
SW AEU Sediment Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

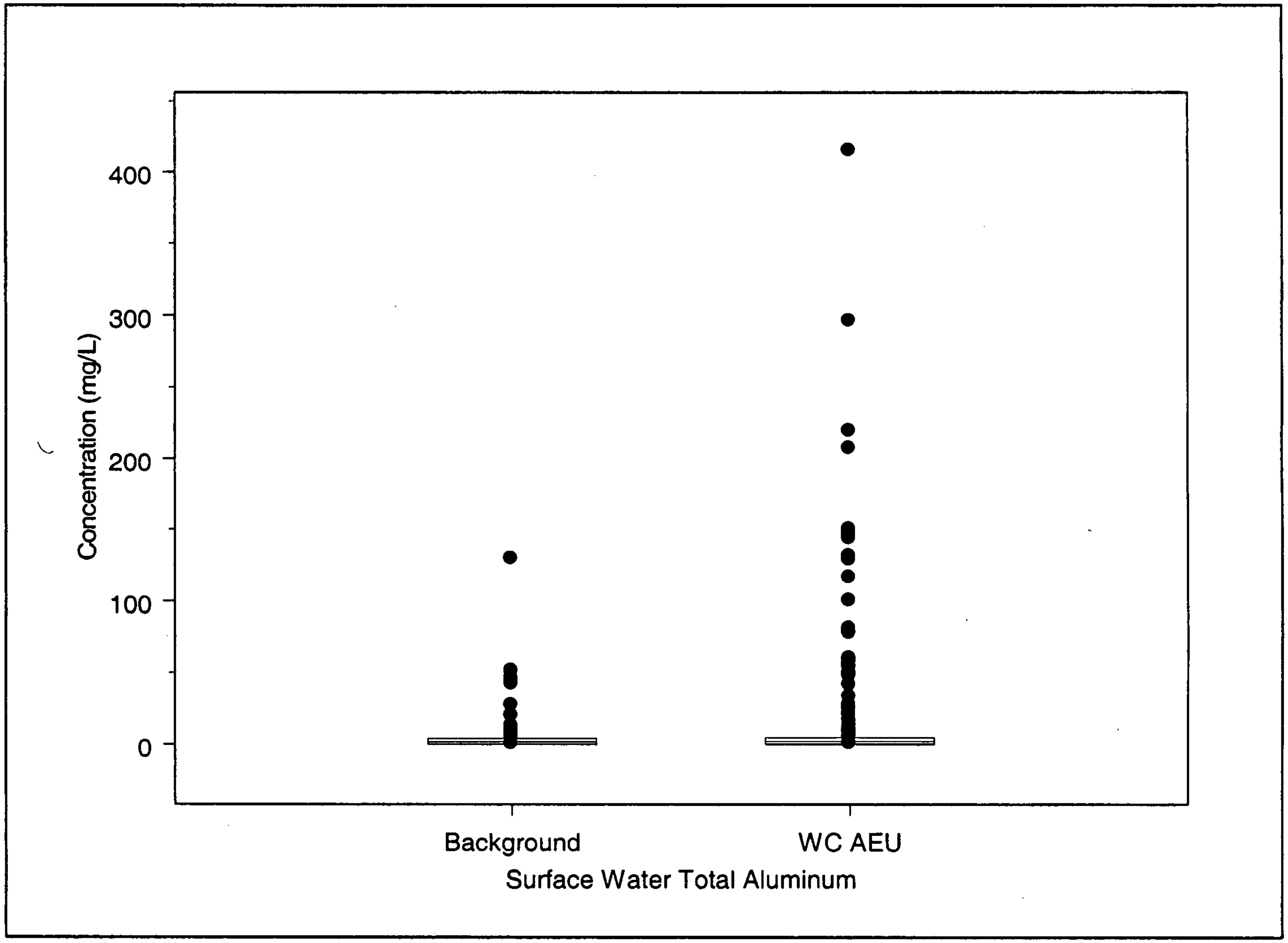
684

Figure A3.2.SW AEU.35
SW AEU Sediment Box Plots for Zinc



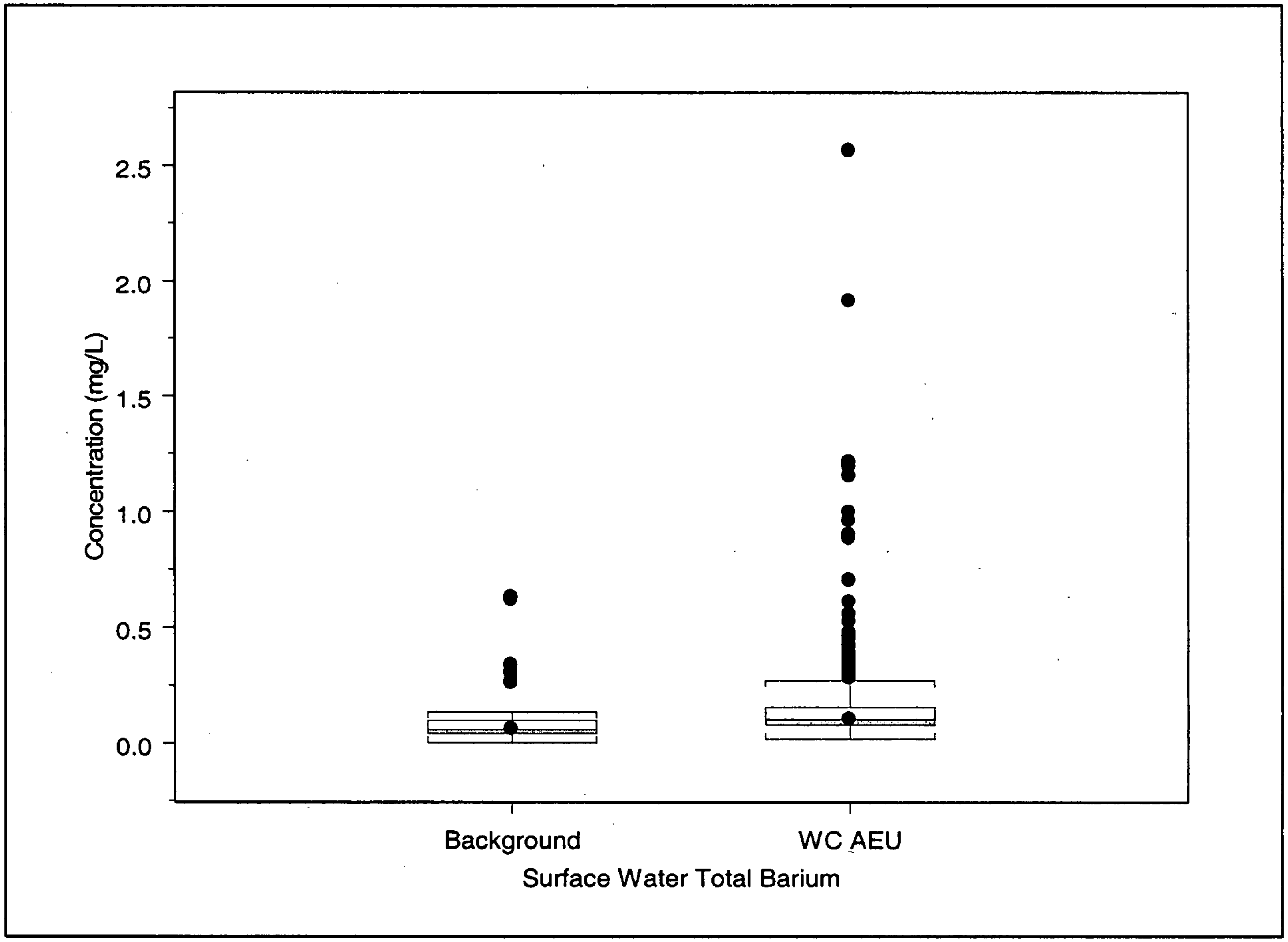
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.1
WC AEU Surface Water Total Box Plots for Aluminum



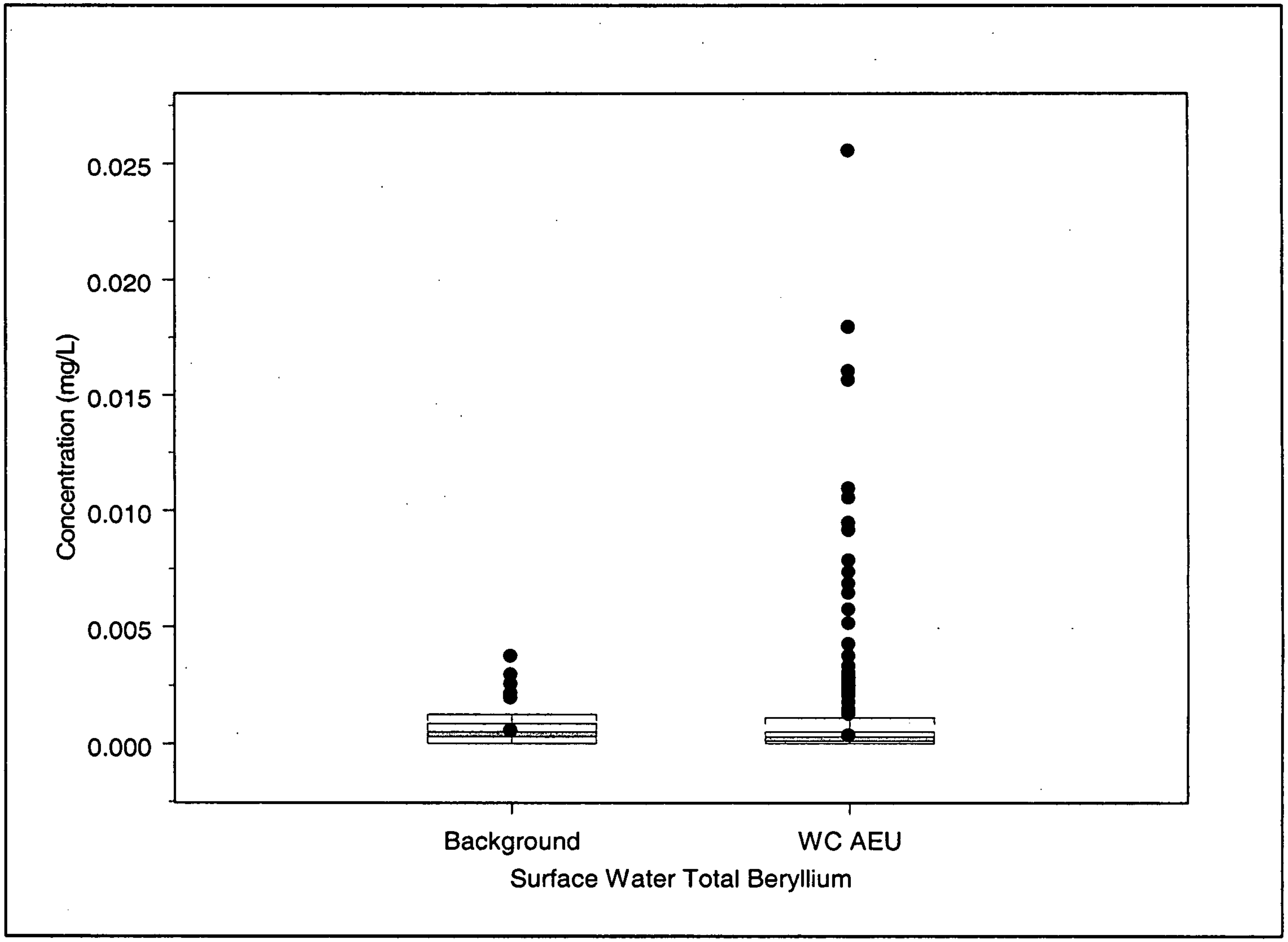
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.2
WC AEU Surface Water Total Box Plots for Barium



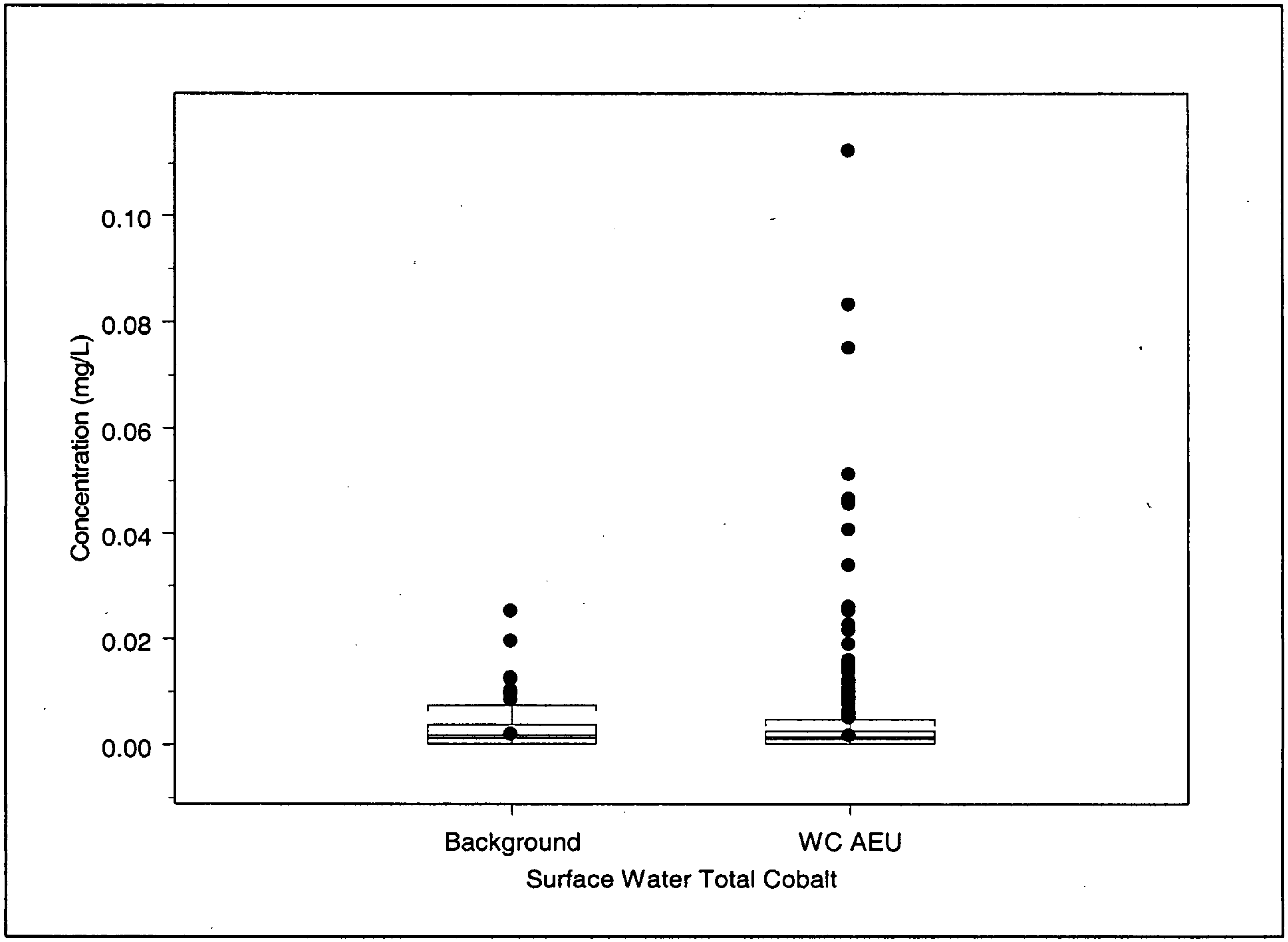
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.3
WC AEU Surface Water Total Box Plots for Beryllium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

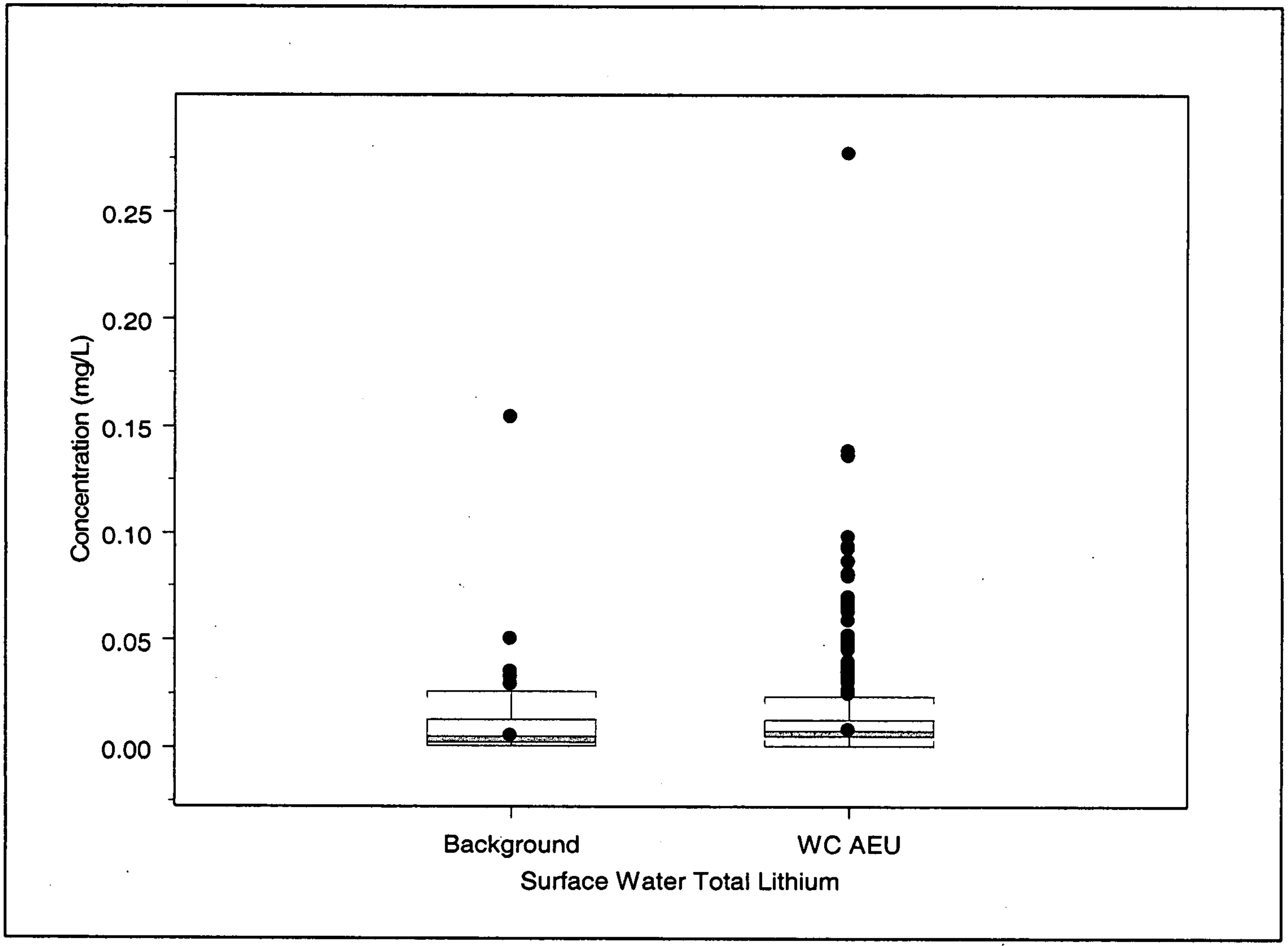
Figure A3.2.WC AEU.4
WC AEU Surface Water Total Box Plots for Cobalt



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

689

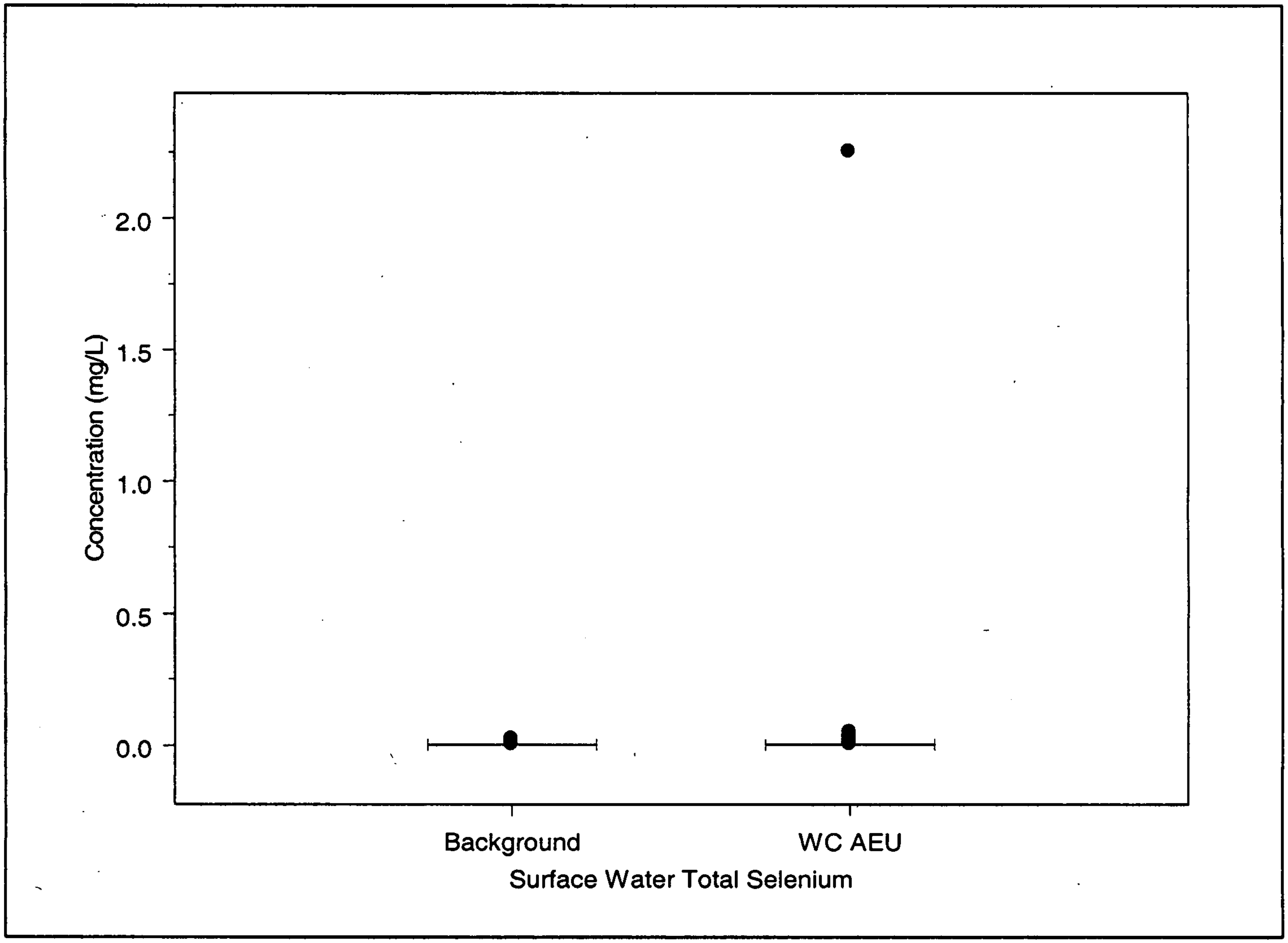
Figure A3.2.WC AEU.5
WC AEU Surface Water Total Box Plots for Lithium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

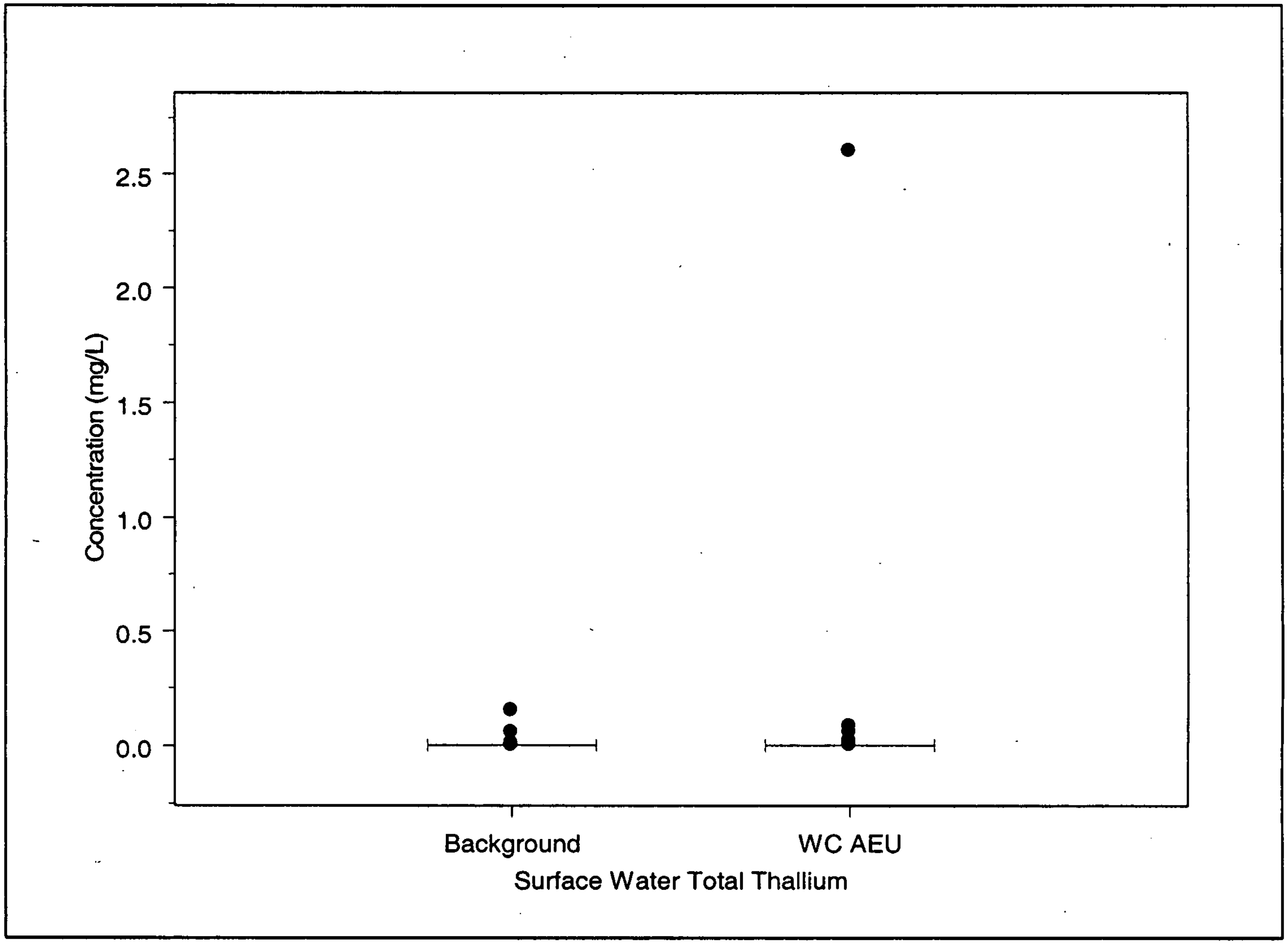
690

Figure A3.[illegible]WC AEU.6
WC AEU Surface Water Total Box Plots for Selenium



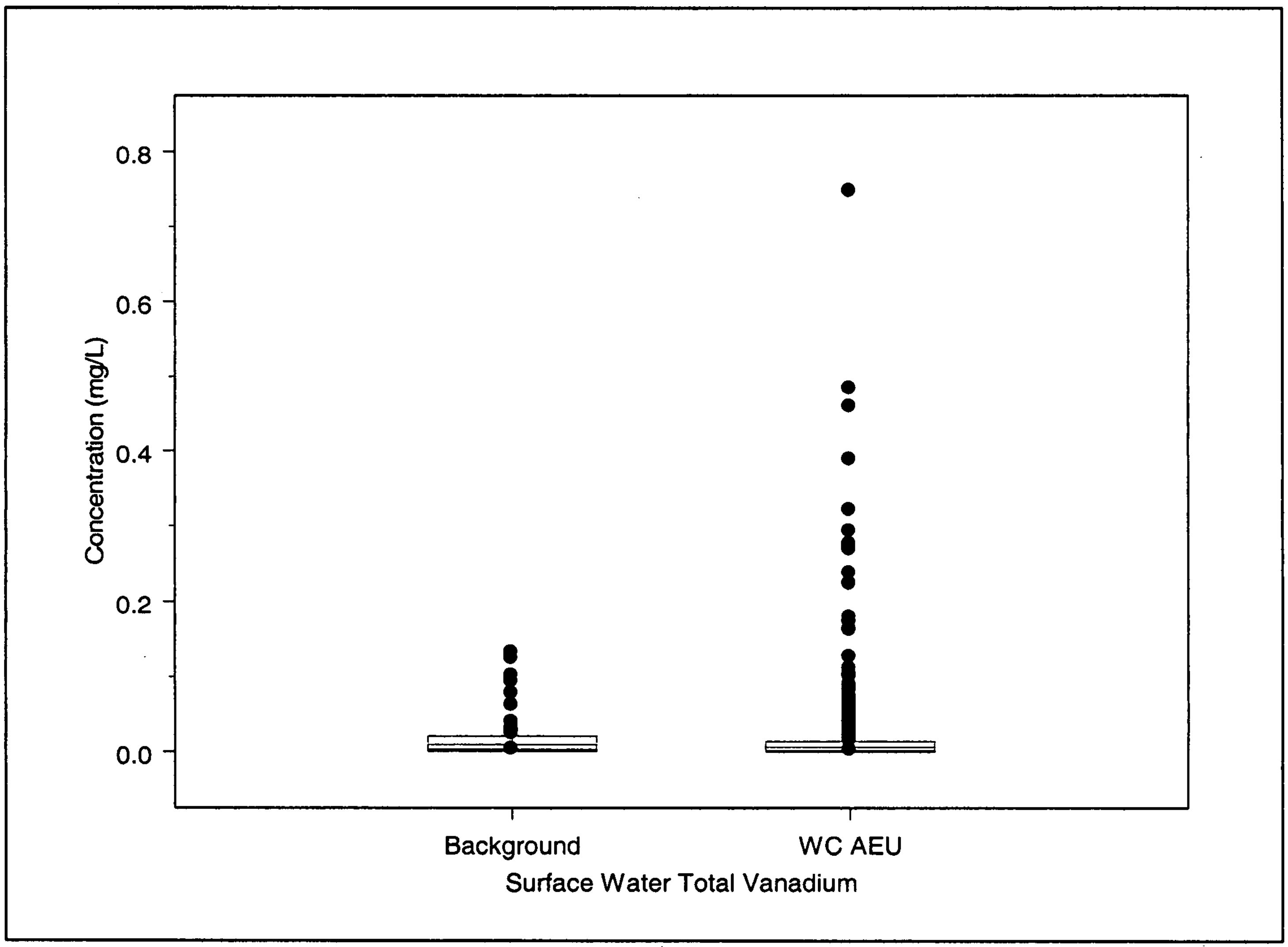
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]WC AEU.7
WC AEU Surface Water Total Box Plots for Thallium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

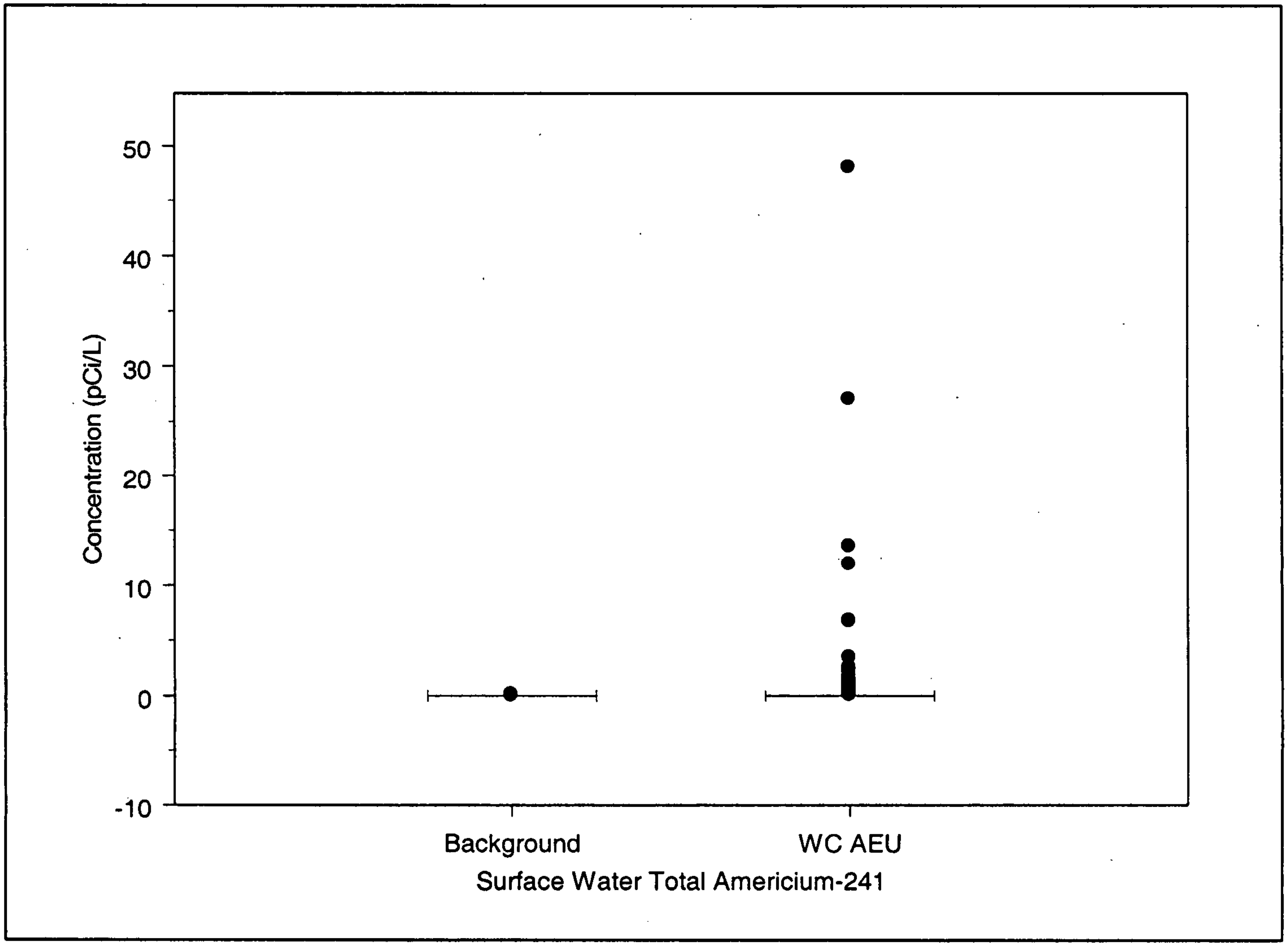
Figure A3.2.WC AEU.8
WC AEU Surface Water Total Box Plots for Vanadium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

683

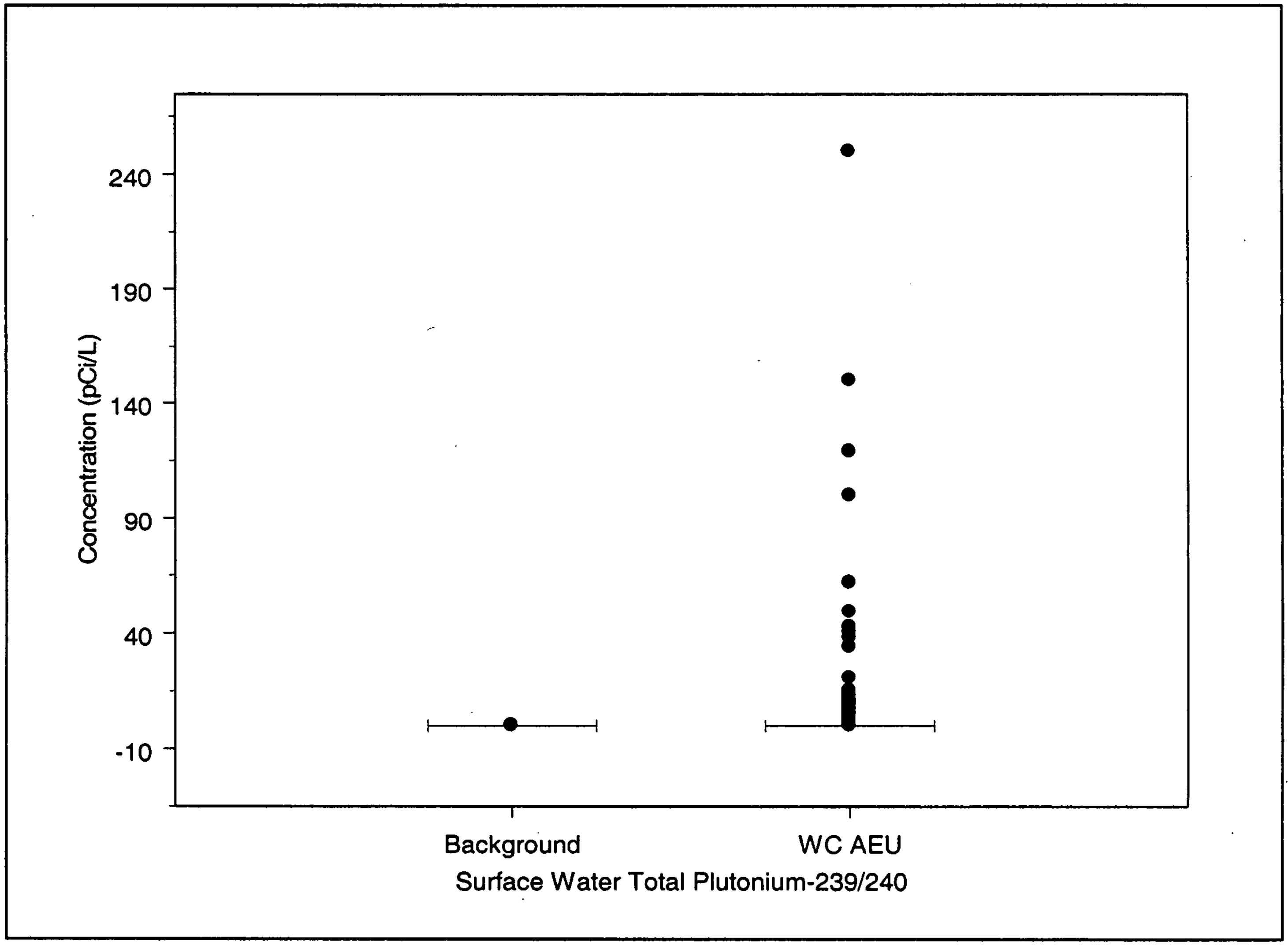
Figure A3.2.WC AEU.9
WC AEU Surface Water Total Box Plots for Americium-241



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

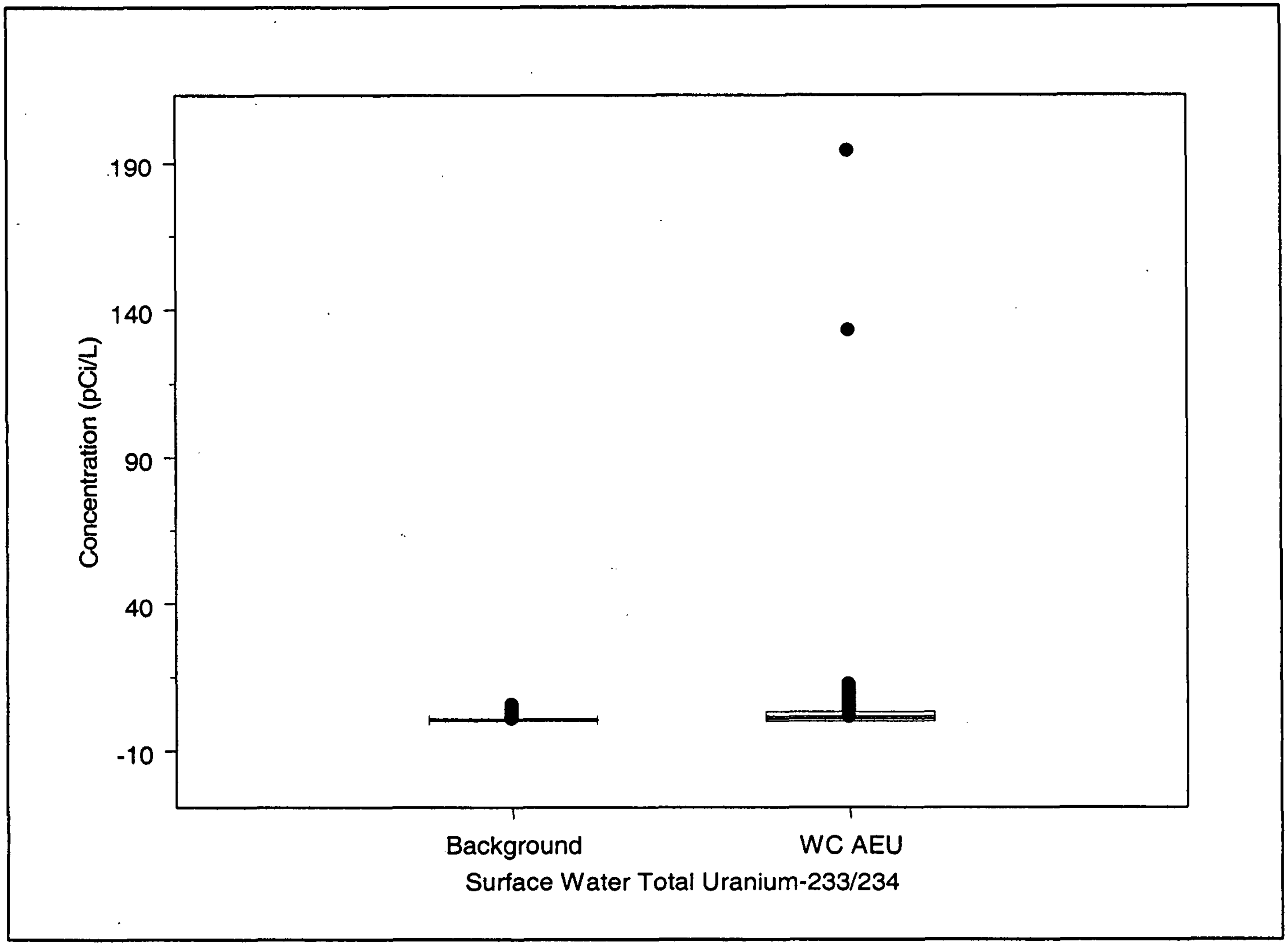
694

Figure A3.2.WC AEU.10
WC AEU Surface Water Total Box Plots for Plutonium-239/240



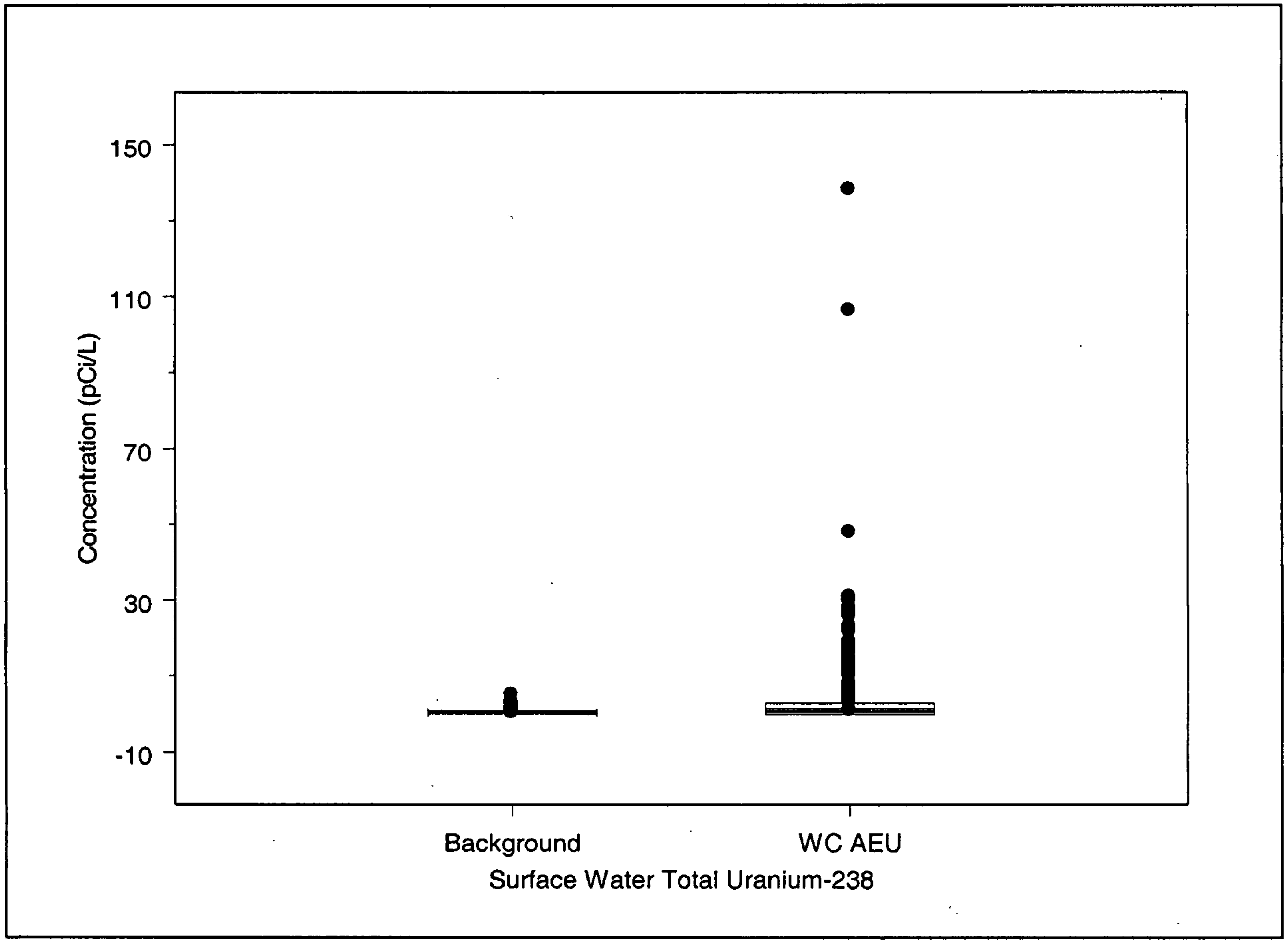
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.11
WC AEU Surface Water Total Box Plots for Uranium-233/234



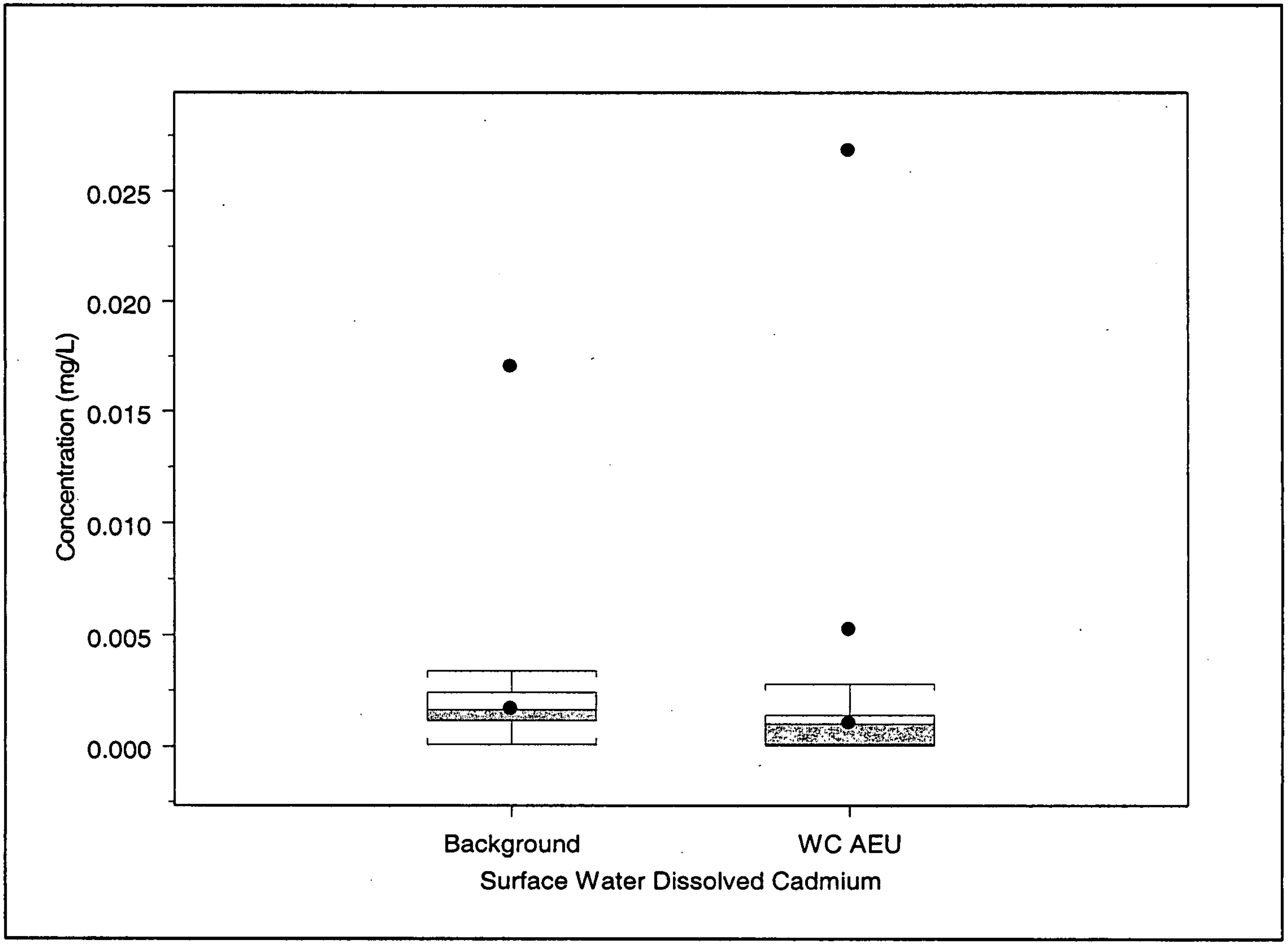
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]WC AEU.12
WC AEU Surface Water Total Box Plots for Uranium-238



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

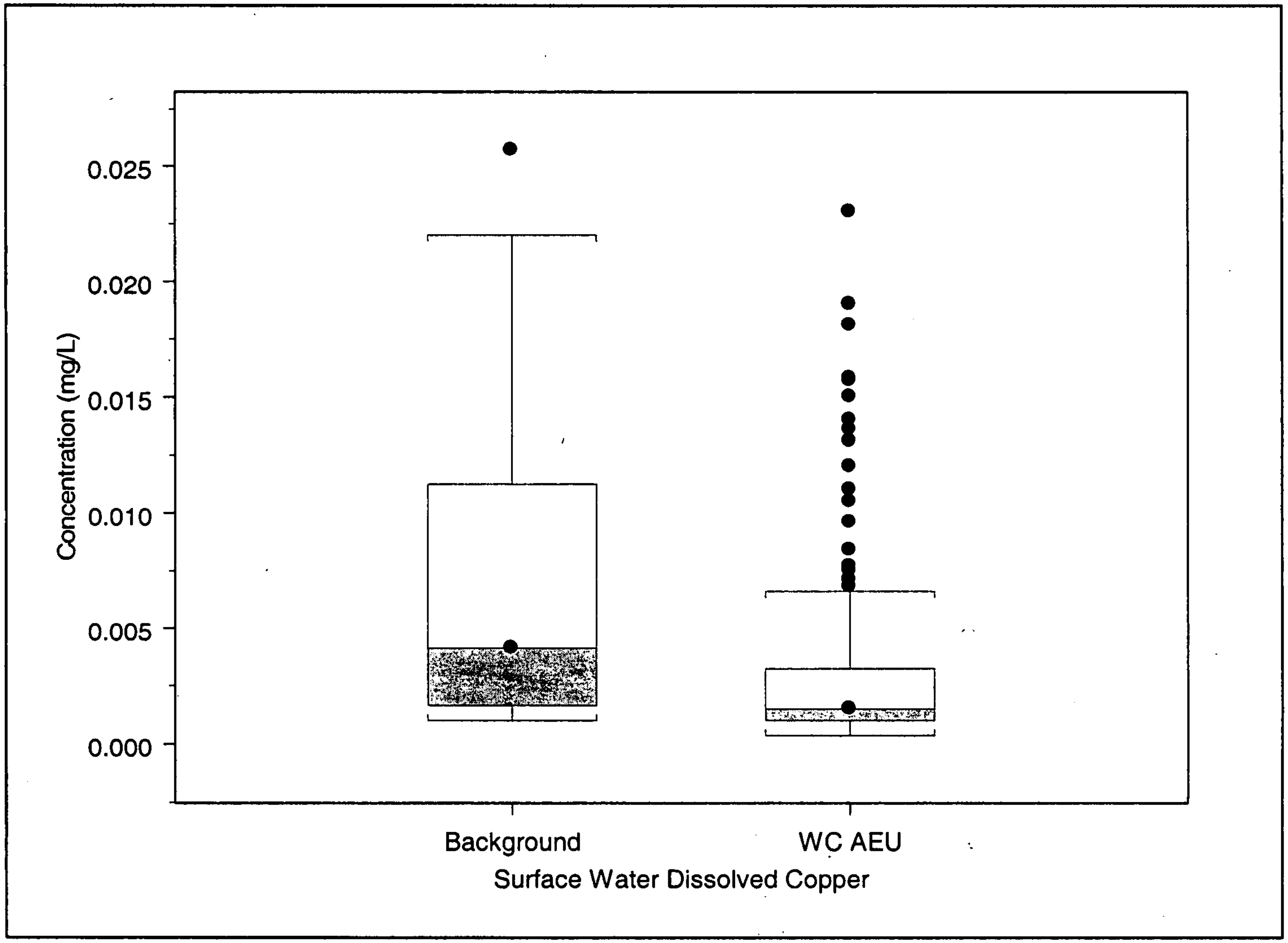
Figure A3.2.WC AEU.13
WC AEU Surface Water Dissolved Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

698

Figure A3.2.WC AEU.14
WC AEU Surface Water Dissolved Box Plots for Copper



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.15
WC AEU Surface Water Dissolved Box Plots for Iron

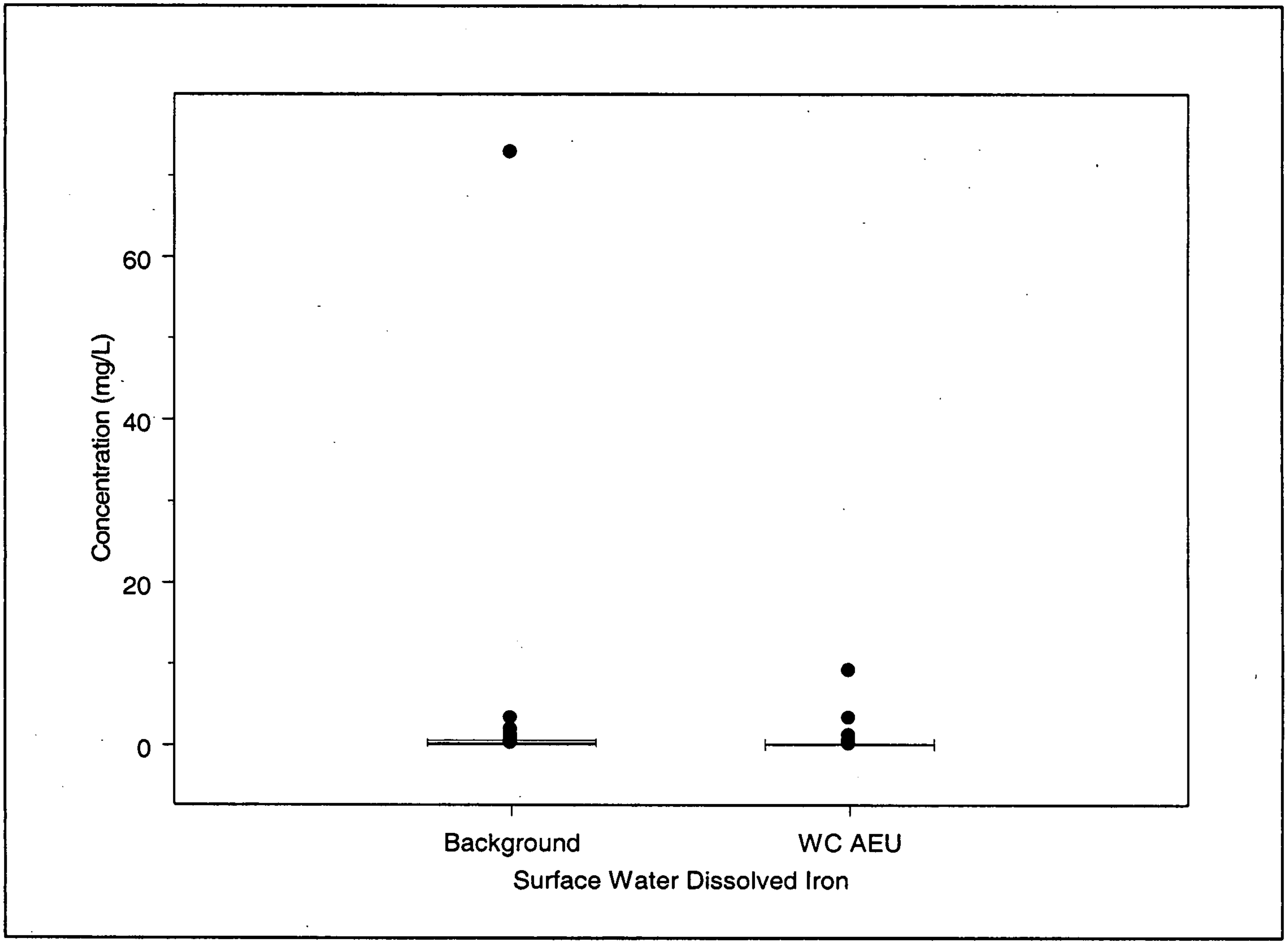


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Figure A3.[illegible]C AEU.16
WC AEU Surface Water Dissolved Box Plots for Lead

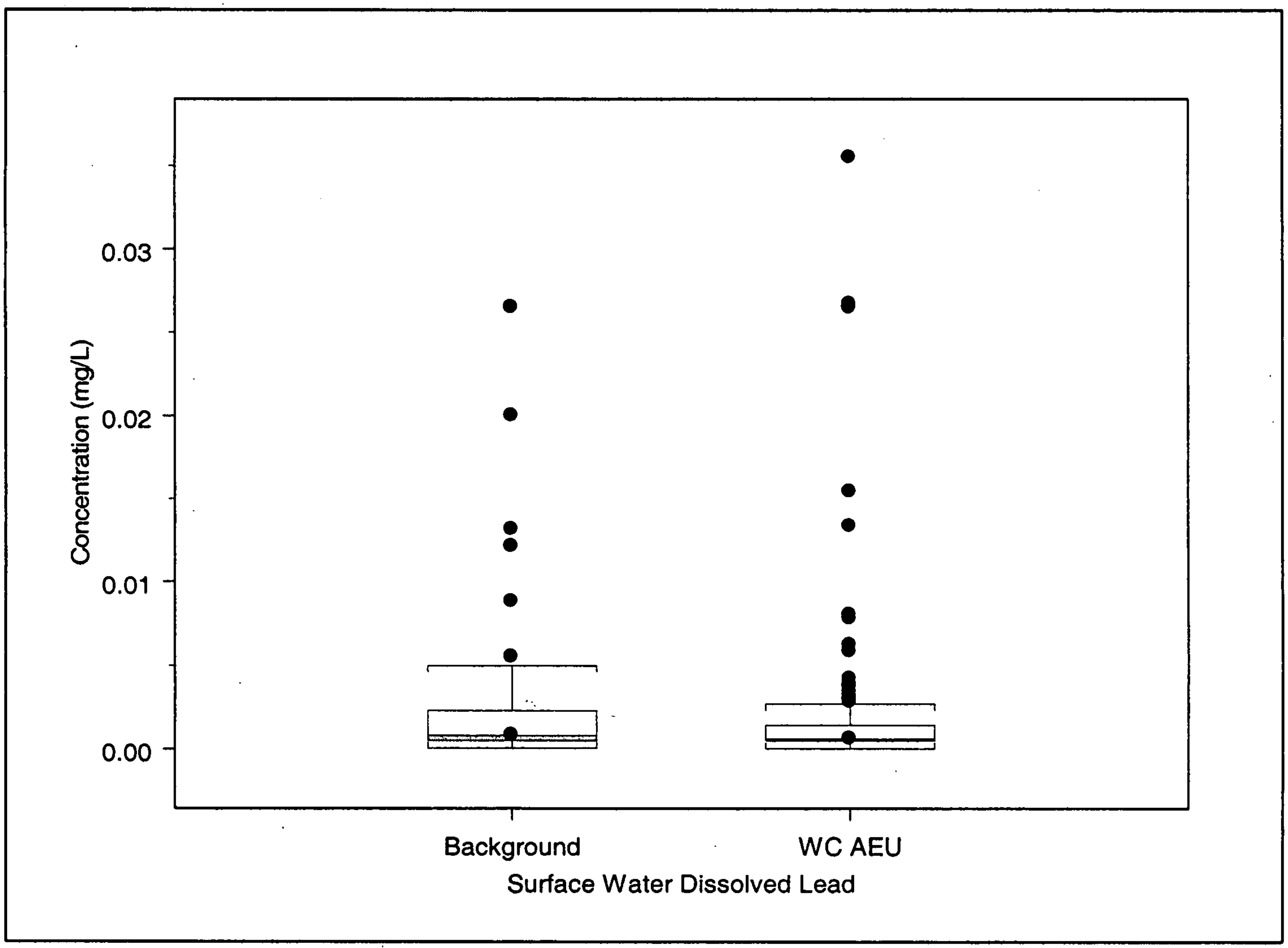

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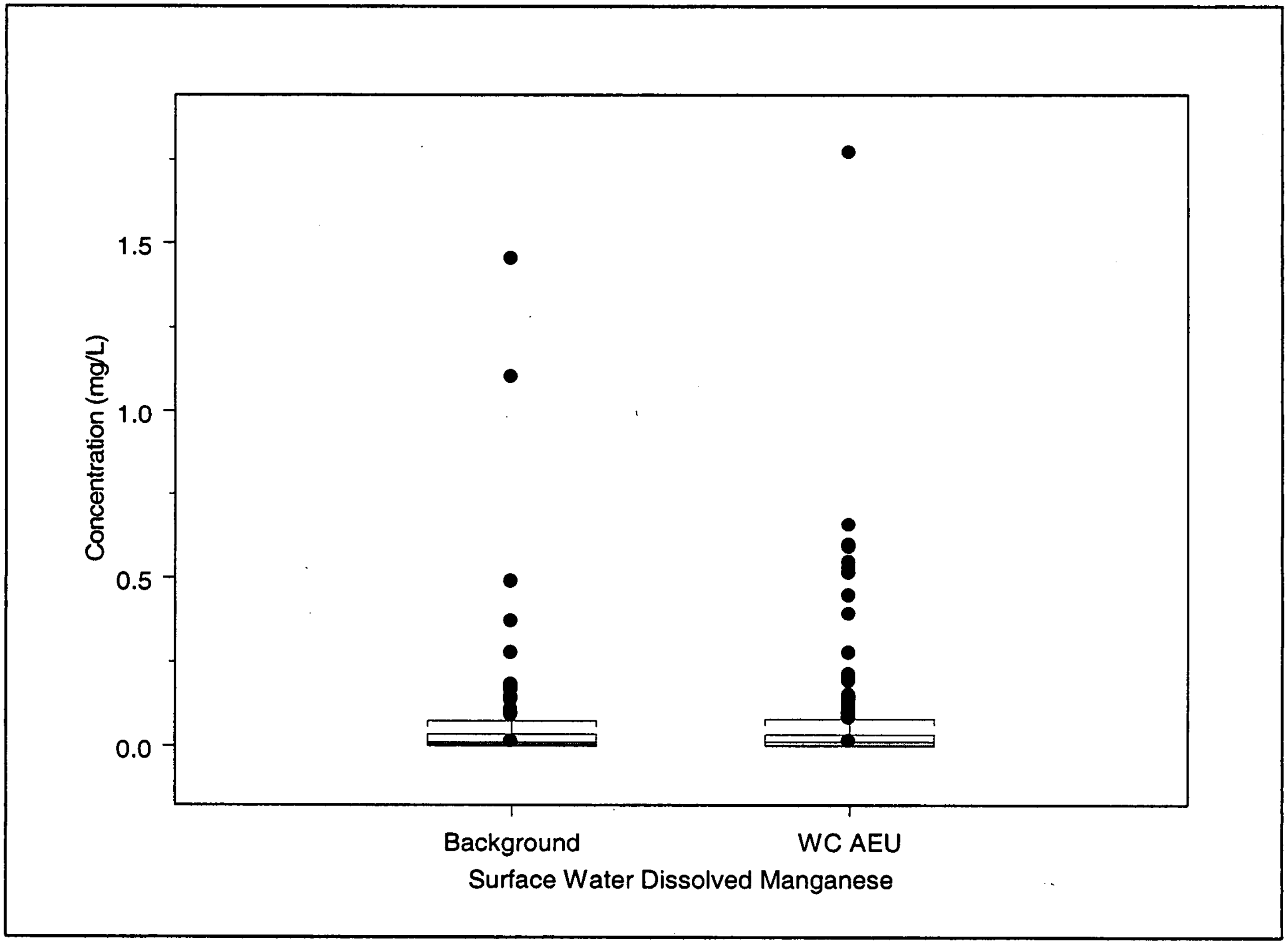
Figure A3.2.WC AEU.17
WC AEU Surface Water Dissolved Box Plots for Manganese



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.18
WC AEU Surface Water Dissolved Box Plots for Mercury

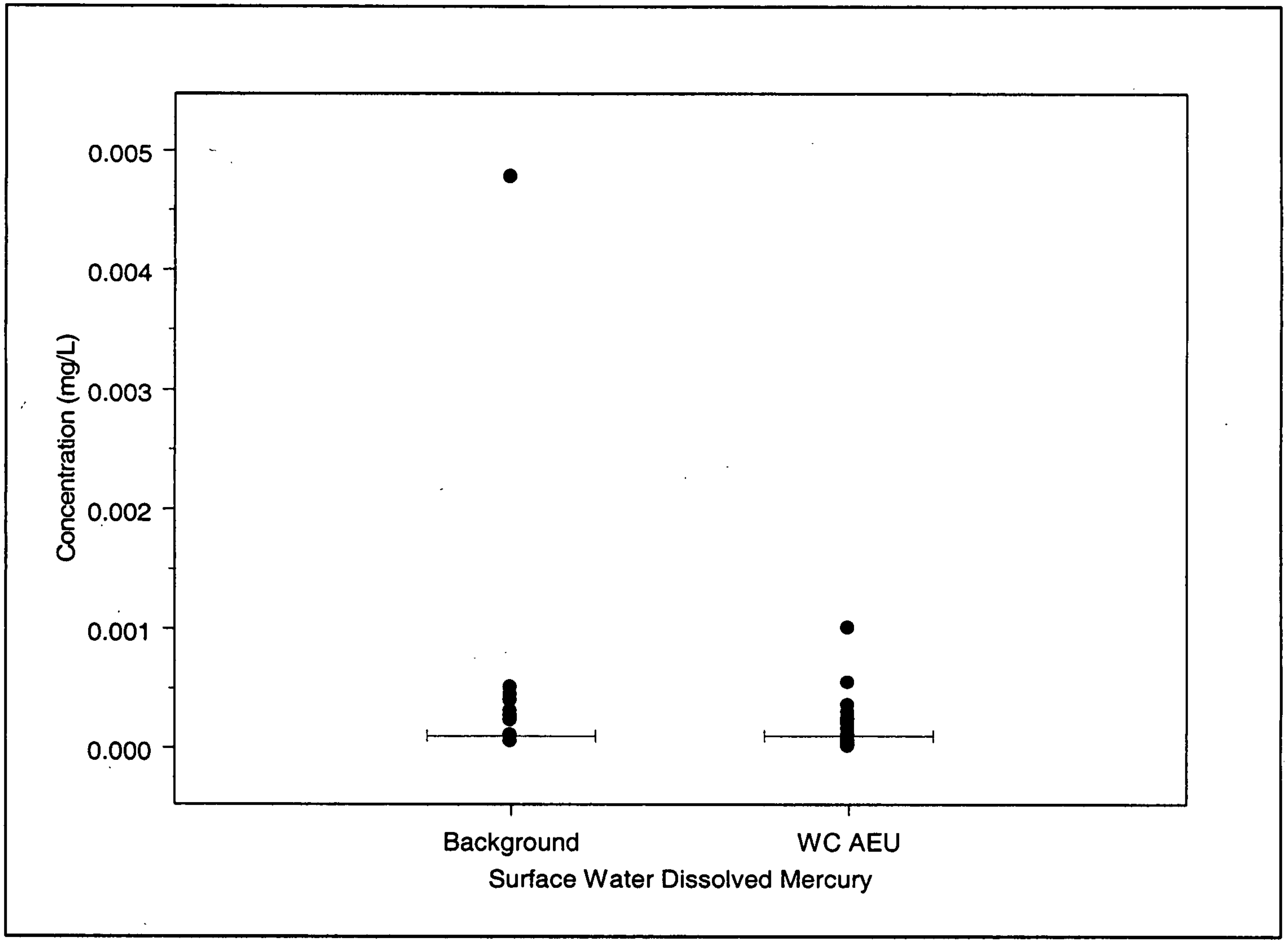


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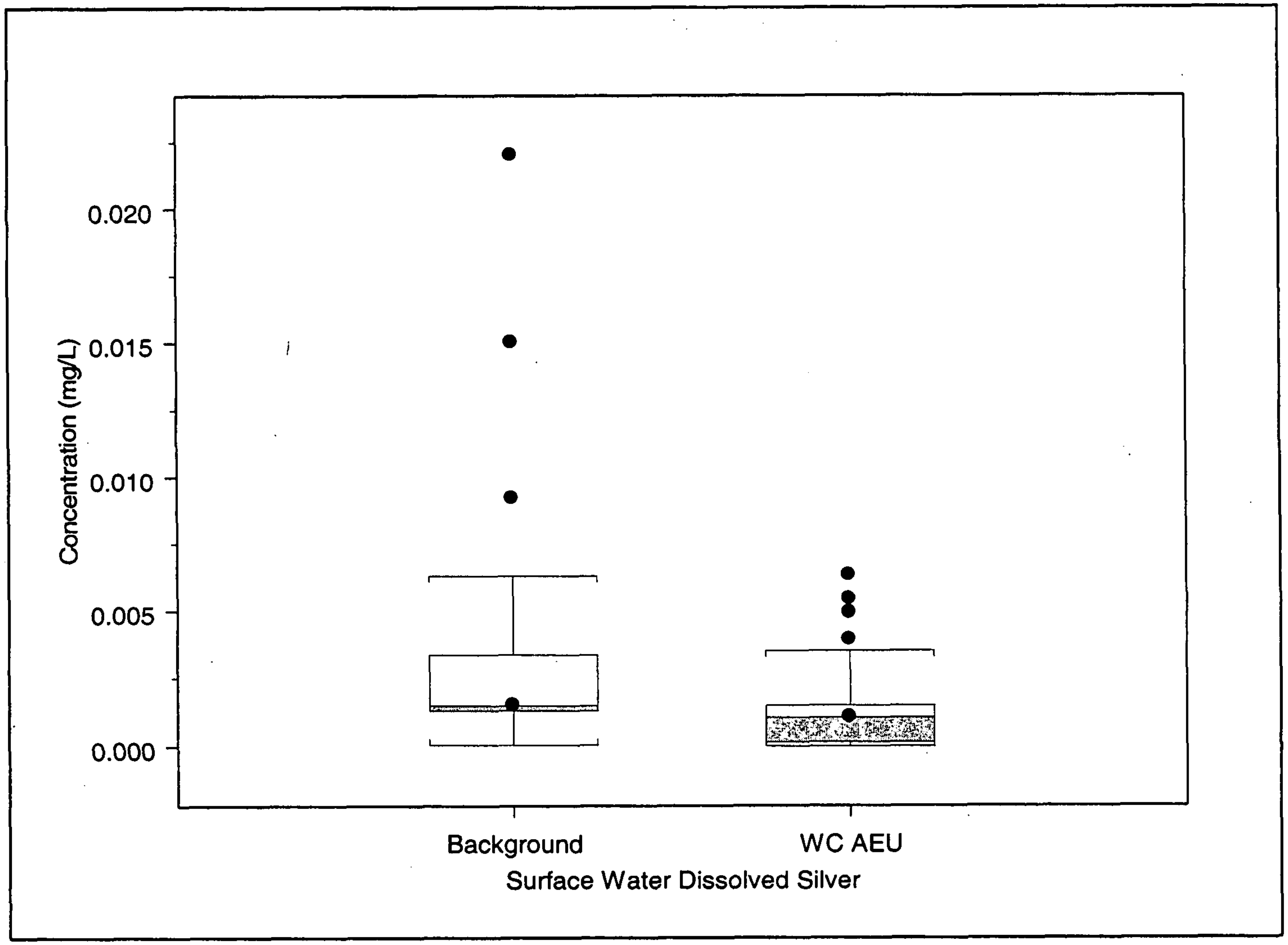
Figure A3.2.WC AEU.19
WC AEU Surface Water Dissolved Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.20
WC AEU Surface Water Dissolved Box Plots for Zinc

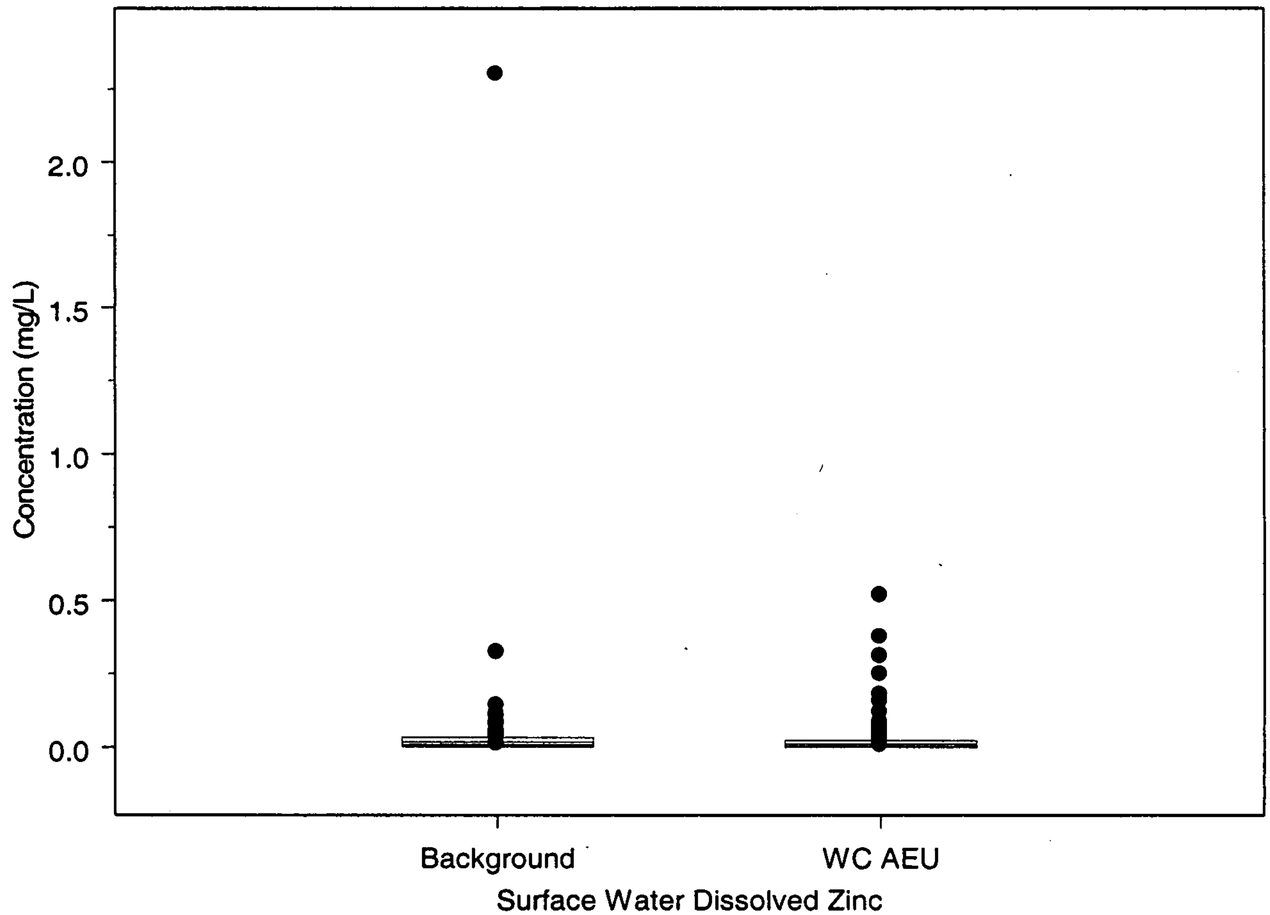


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Figure A3.2[illegible]C AEU.21
WC AEU Sediment Box Plots for Aluminum

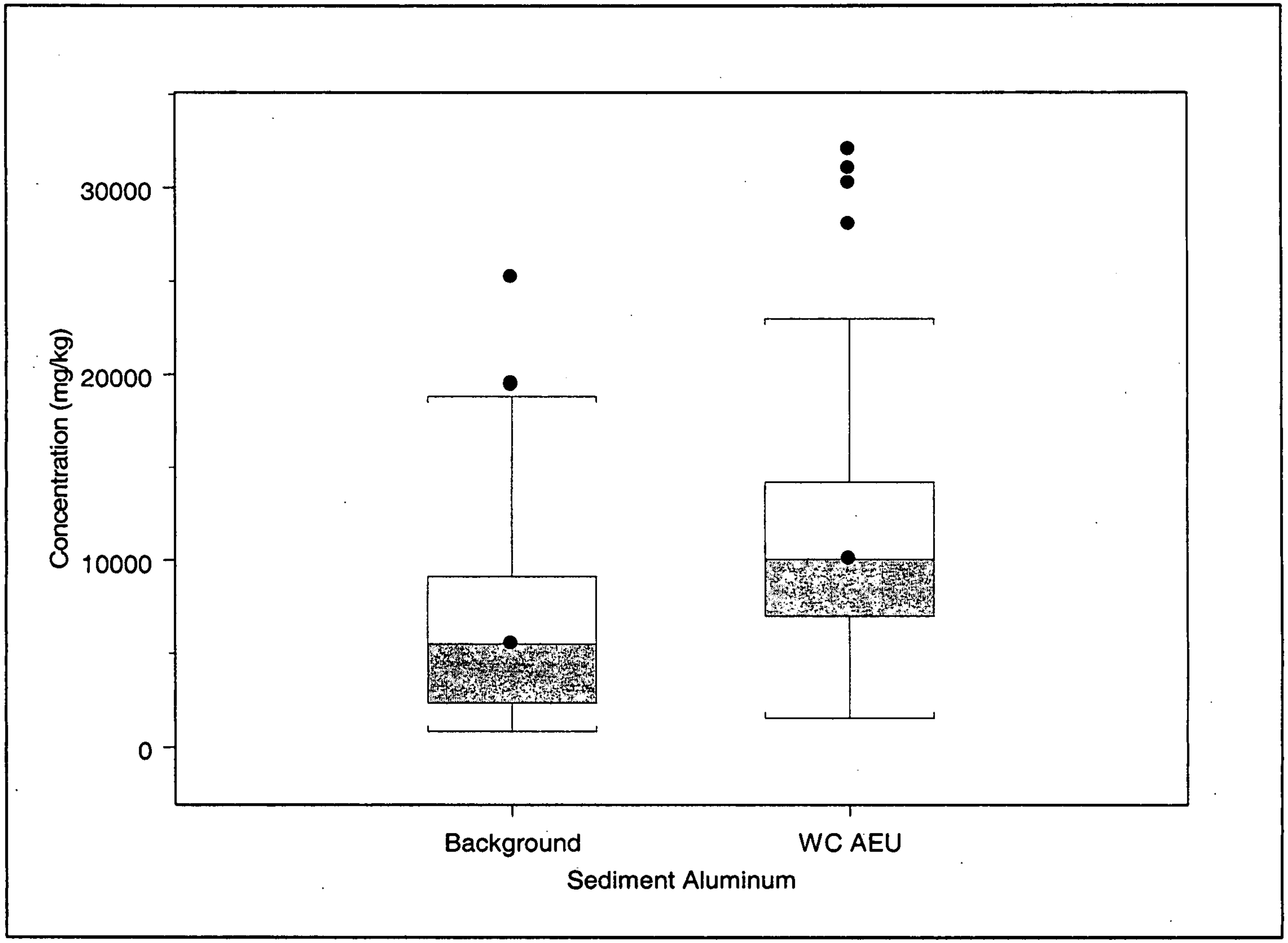

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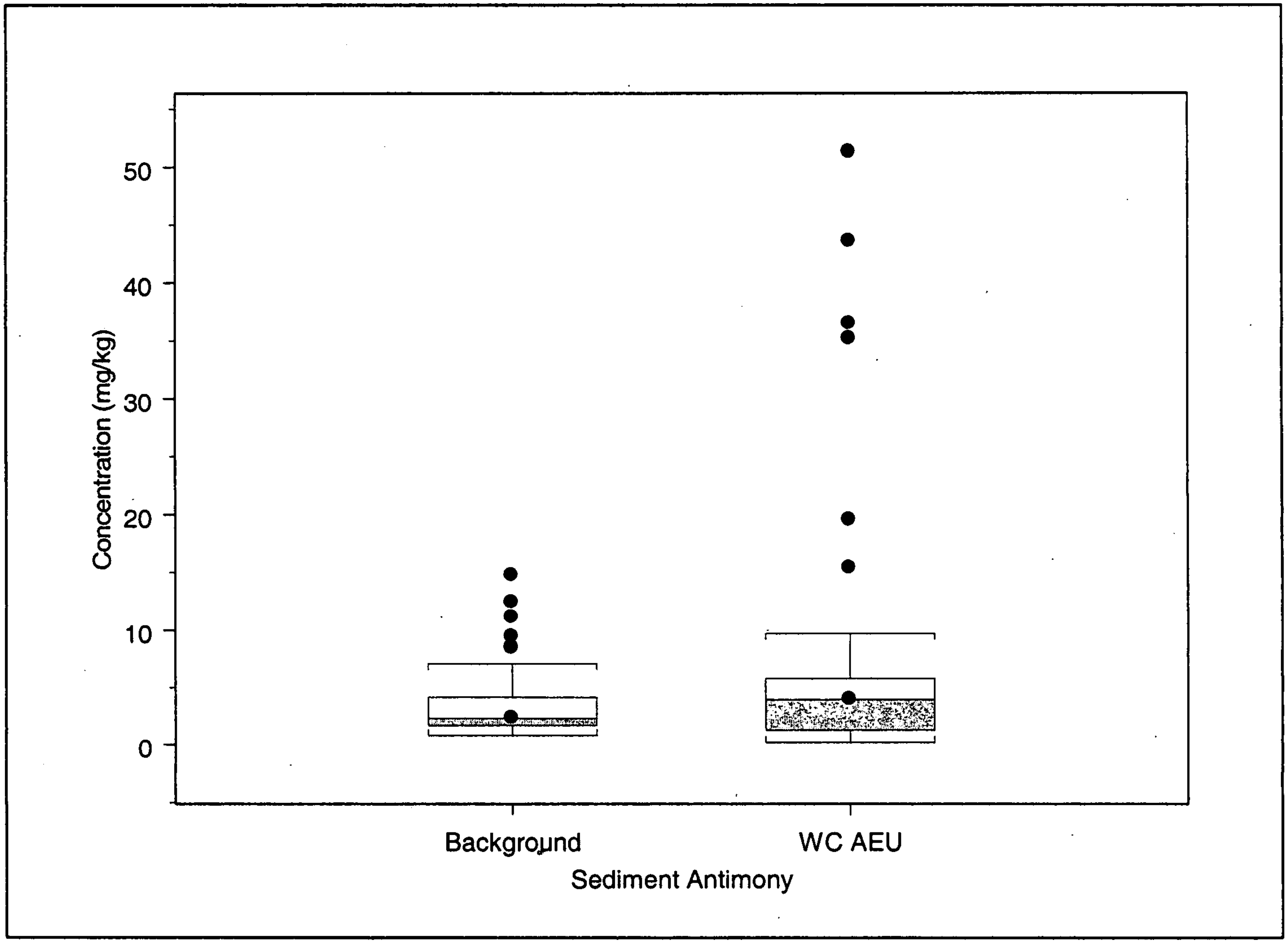
Figure A3.[illegible]C AEU.22
WC AEU Sediment Box Plots for Antimony



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.23
WC AEU Sediment Box Plots for Arsenic

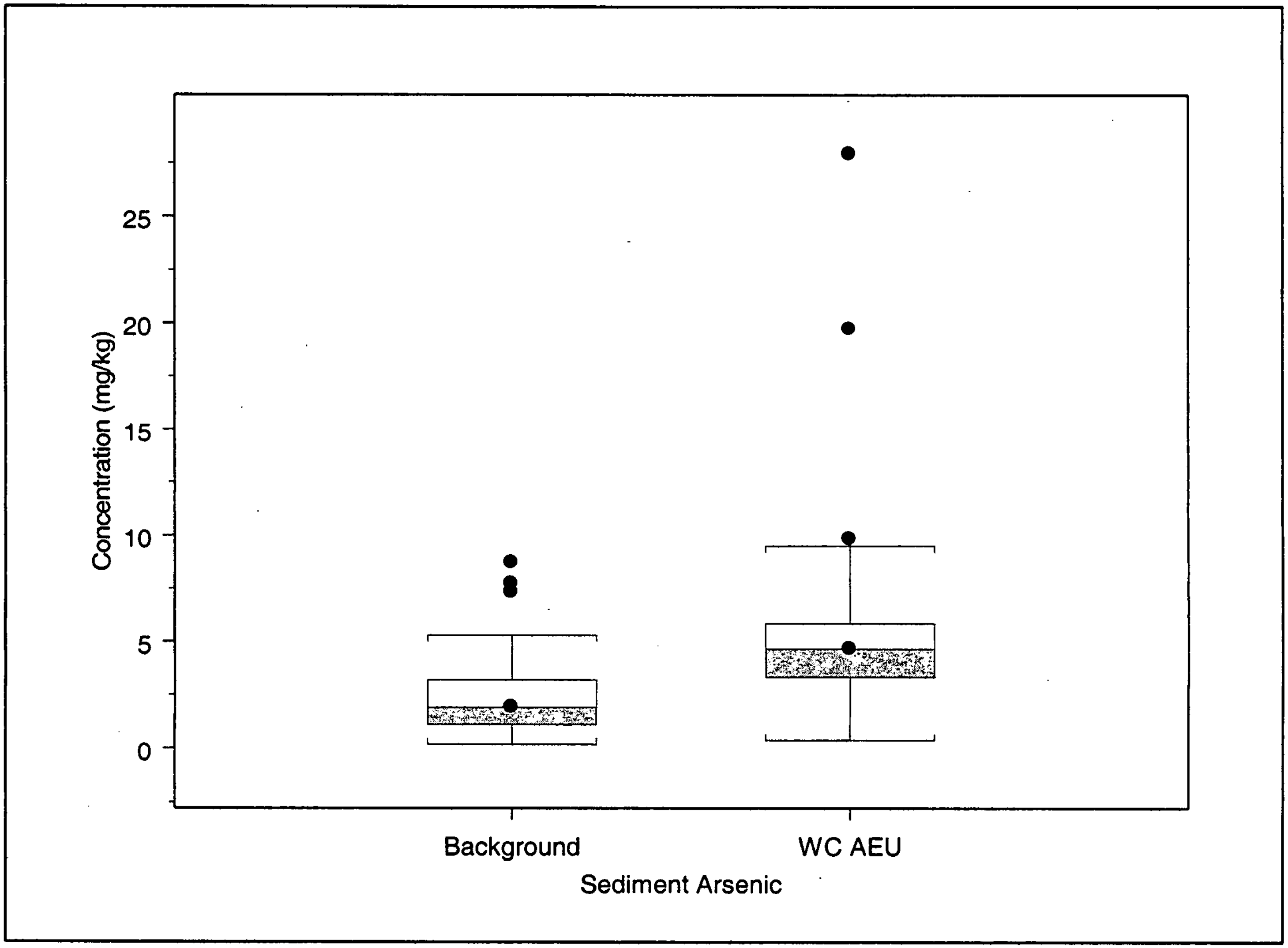


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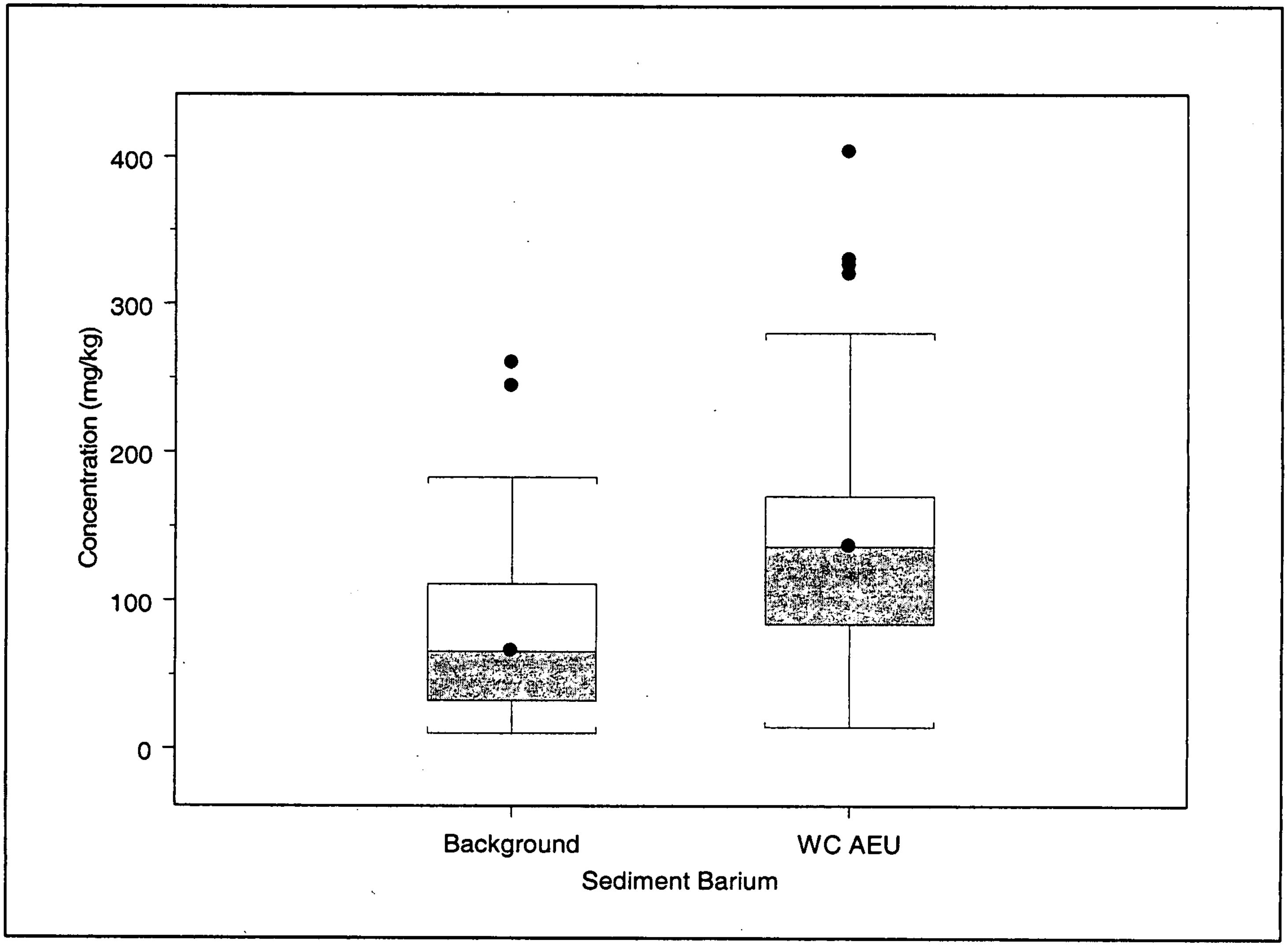
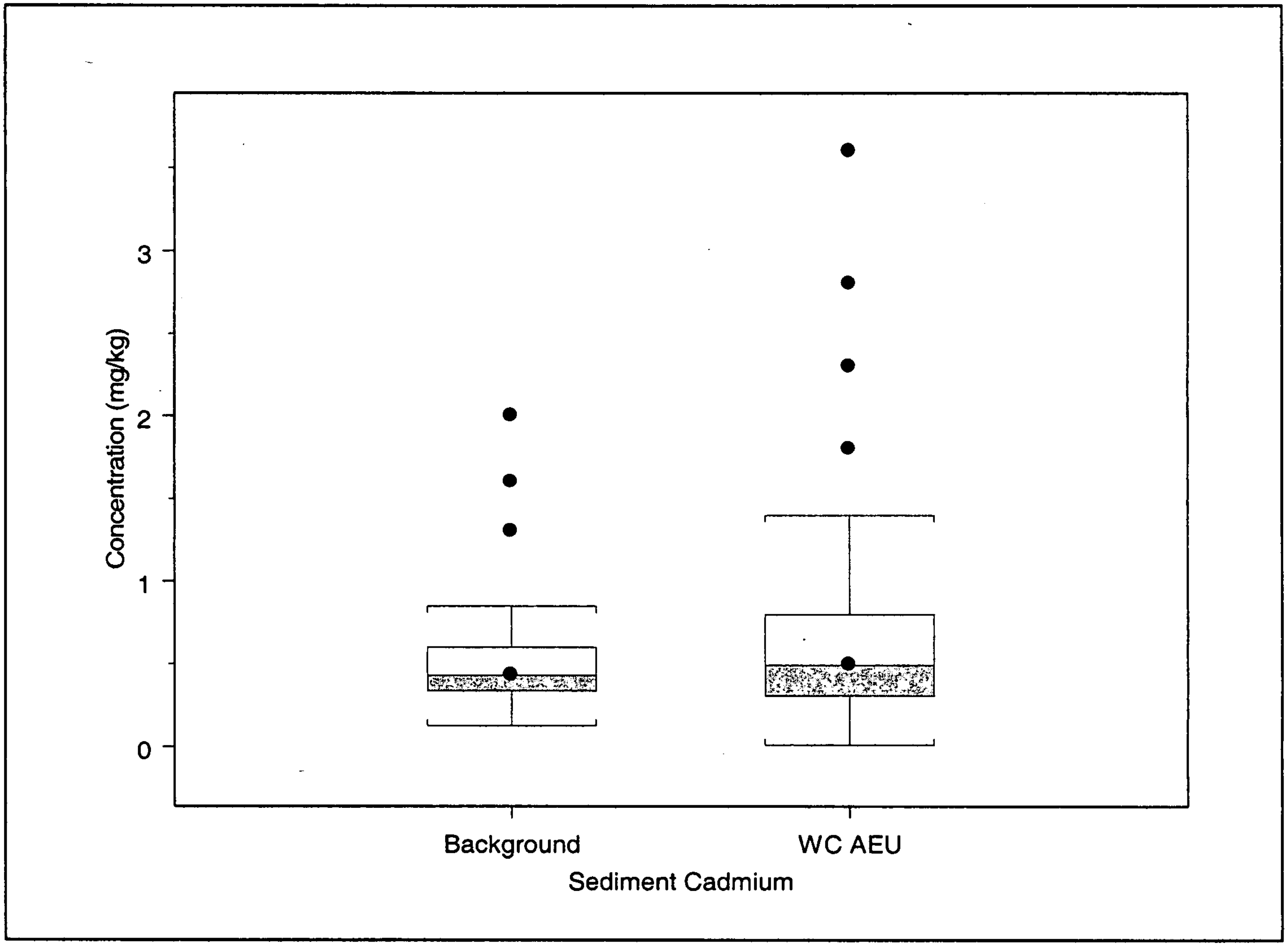
Figure A3.2.WC AEU.24
WC AEU Sediment Box Plots for Barium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.25
WC AEU Sediment Box Plots for Cadmium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.26
WC AEU Sediment Box Plots for Chromium

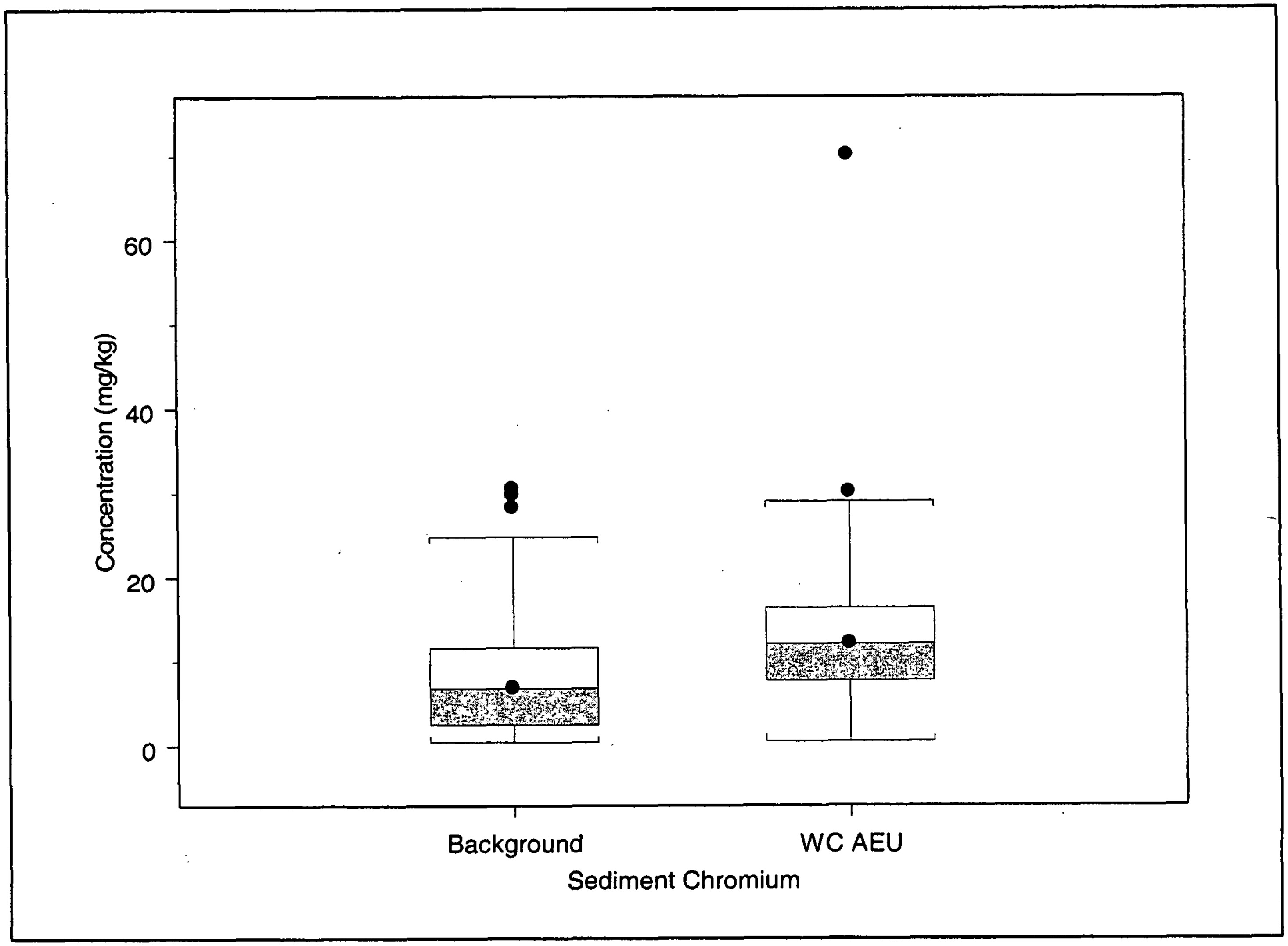


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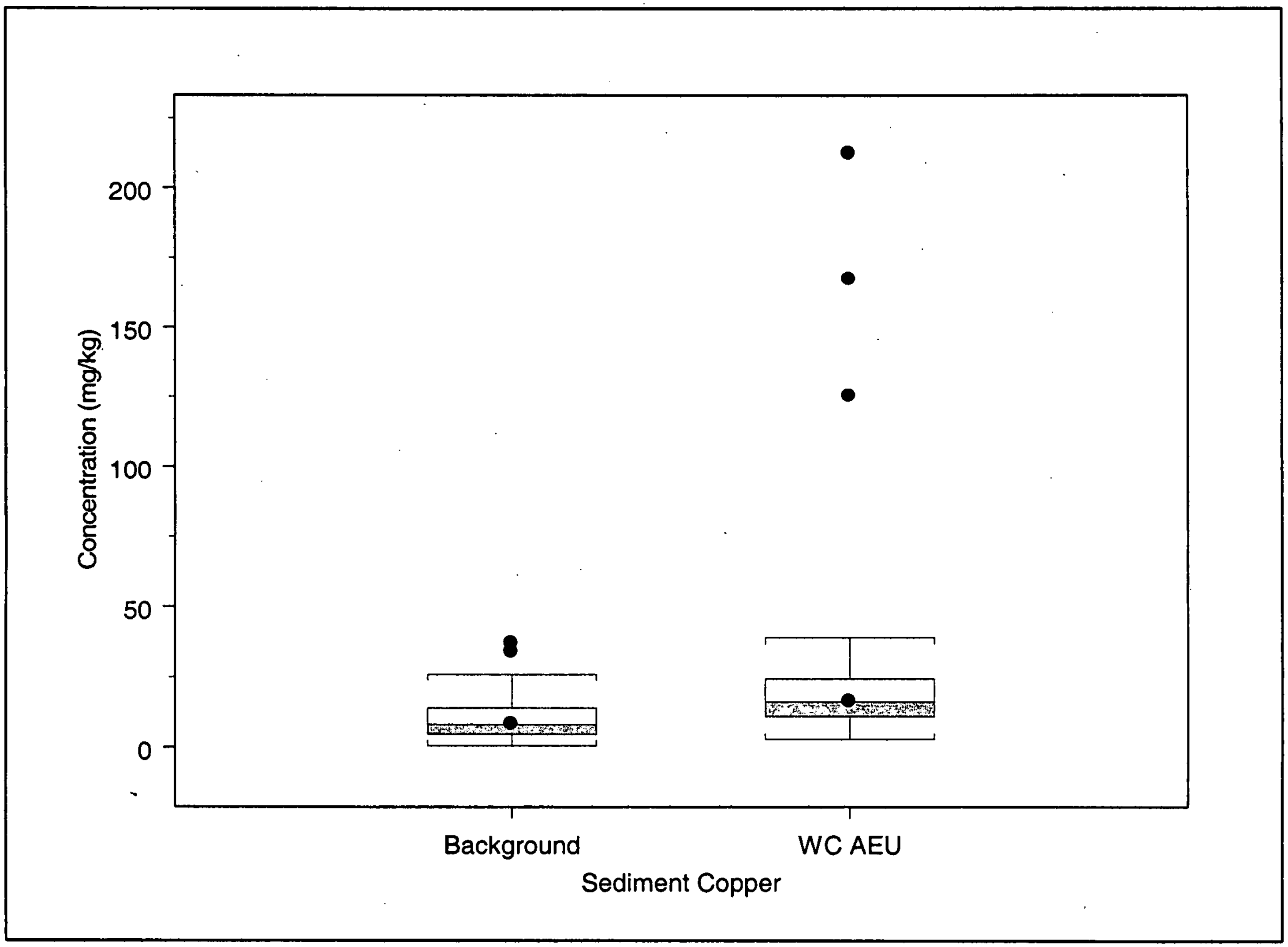
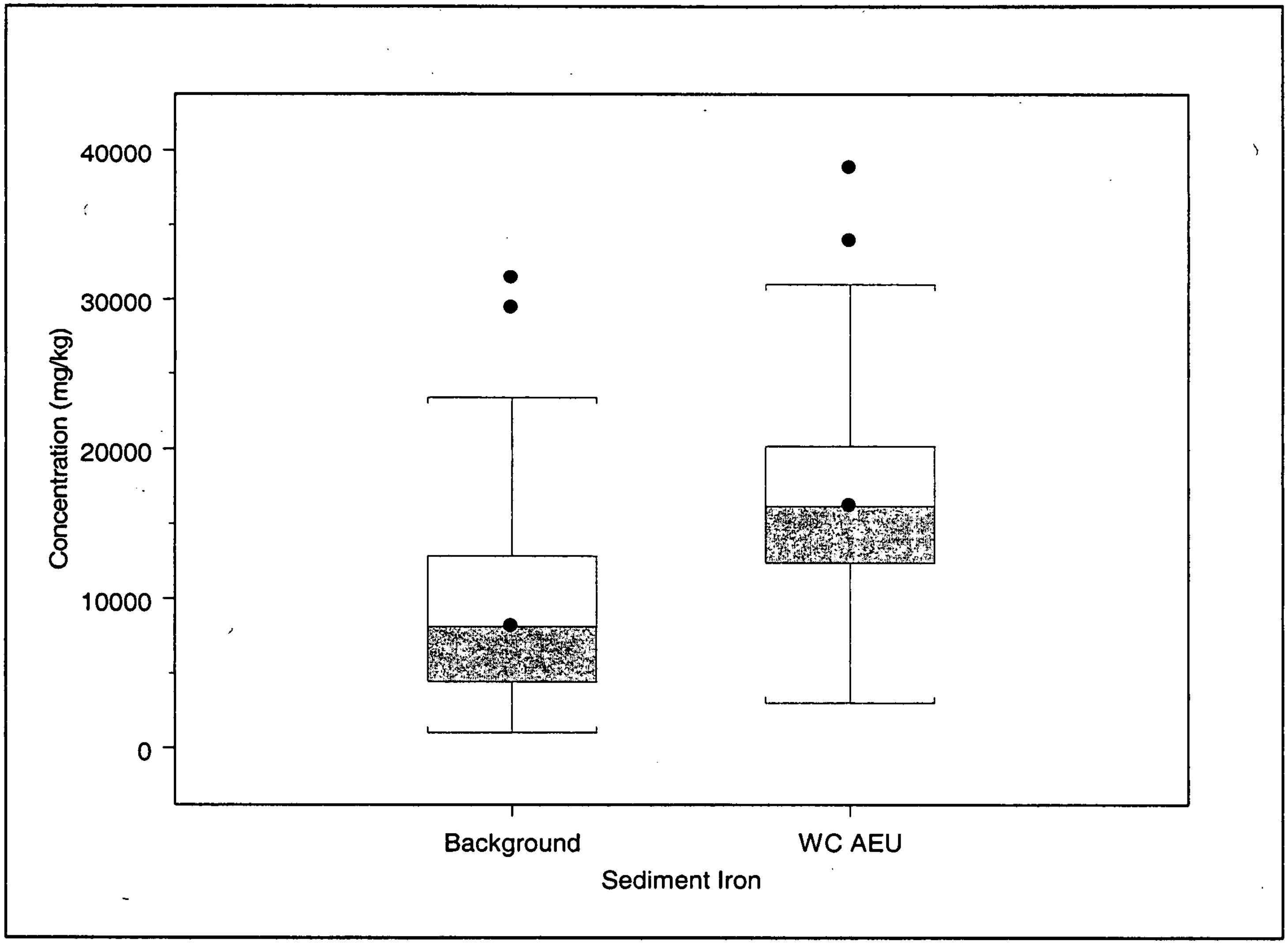
Figure A3.[illegible]WC AEU.27
WC AEU Sediment Box Plots for Copper



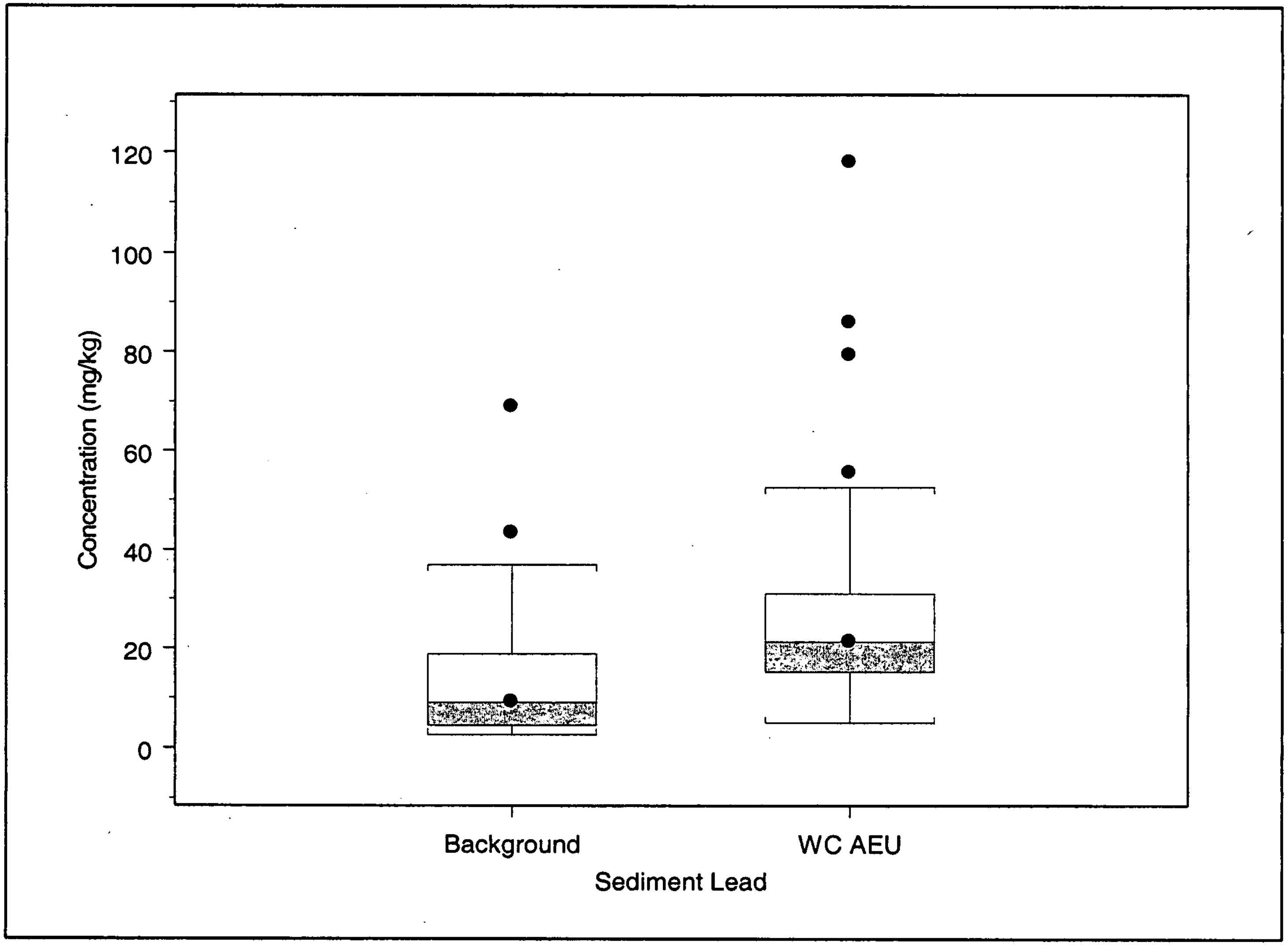
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.28
WC AEU Sediment Box Plots for Iron



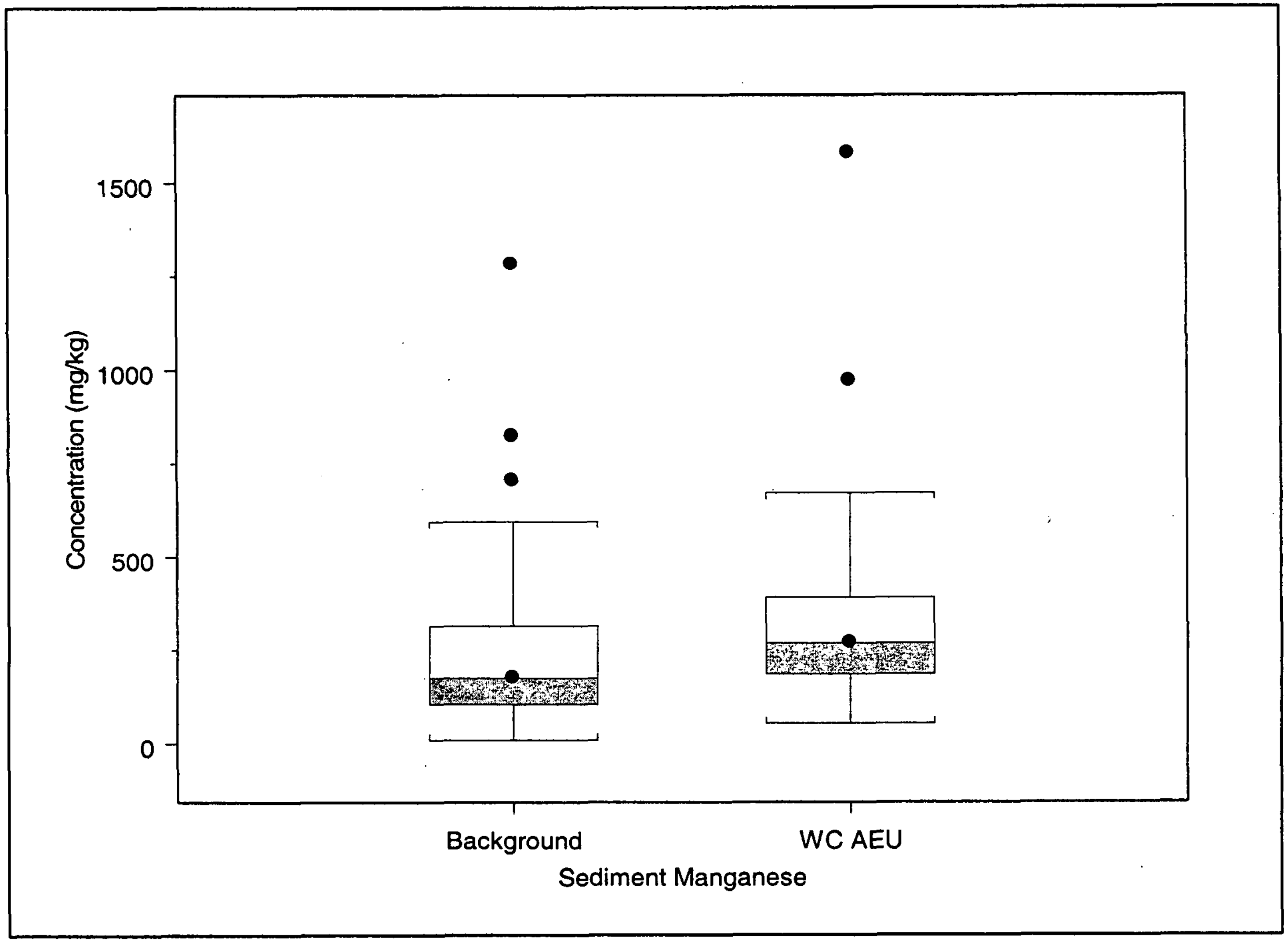
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.29
WC AEU Sediment Box Plots for Lead



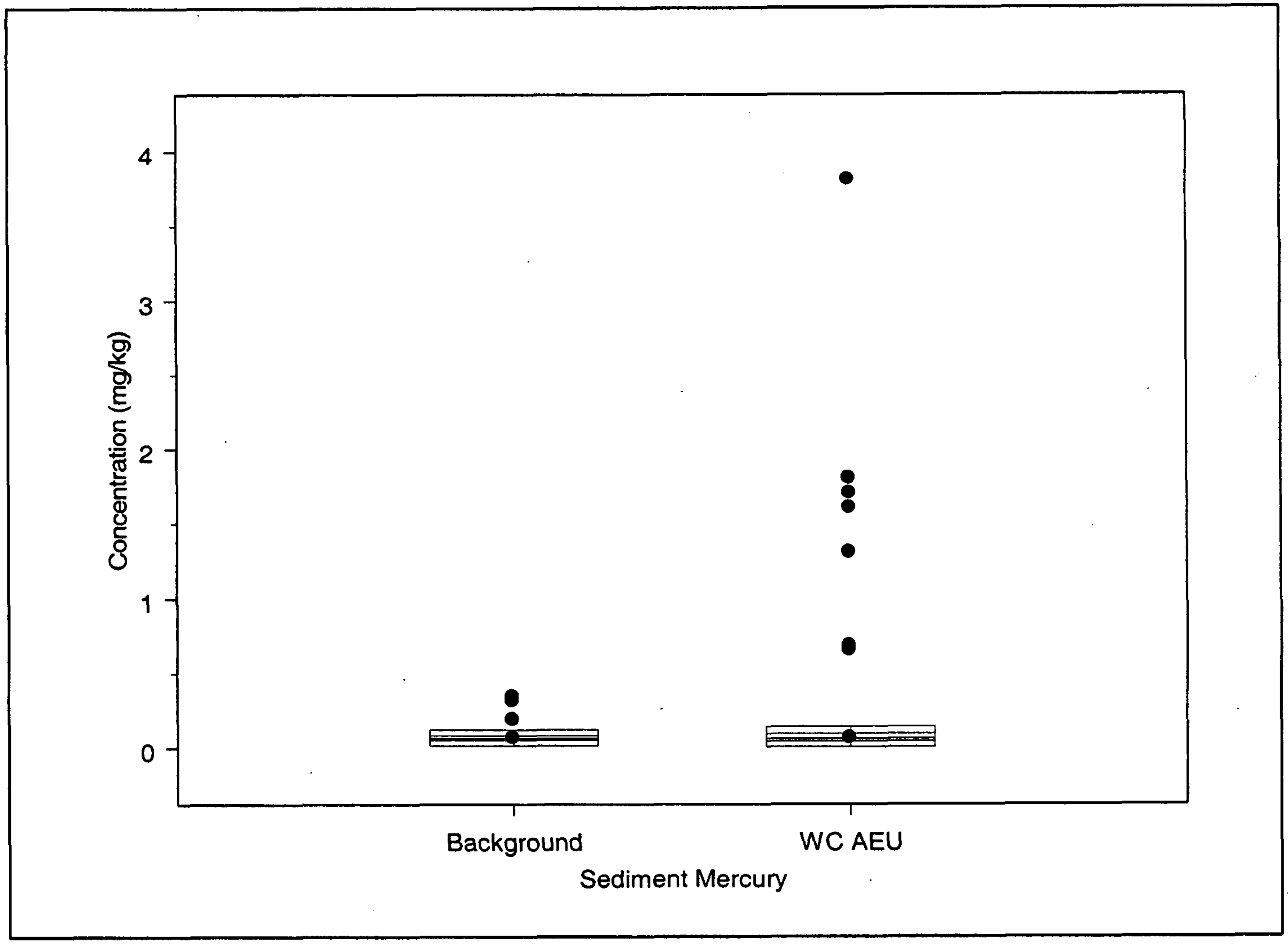
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.30
WC AEU Sediment Box Plots for Manganese



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]C AEU.31
WC AEU Sediment Box Plots for Mercury



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.WC AEU.32
WC AEU Sediment Box Plots for Nickel

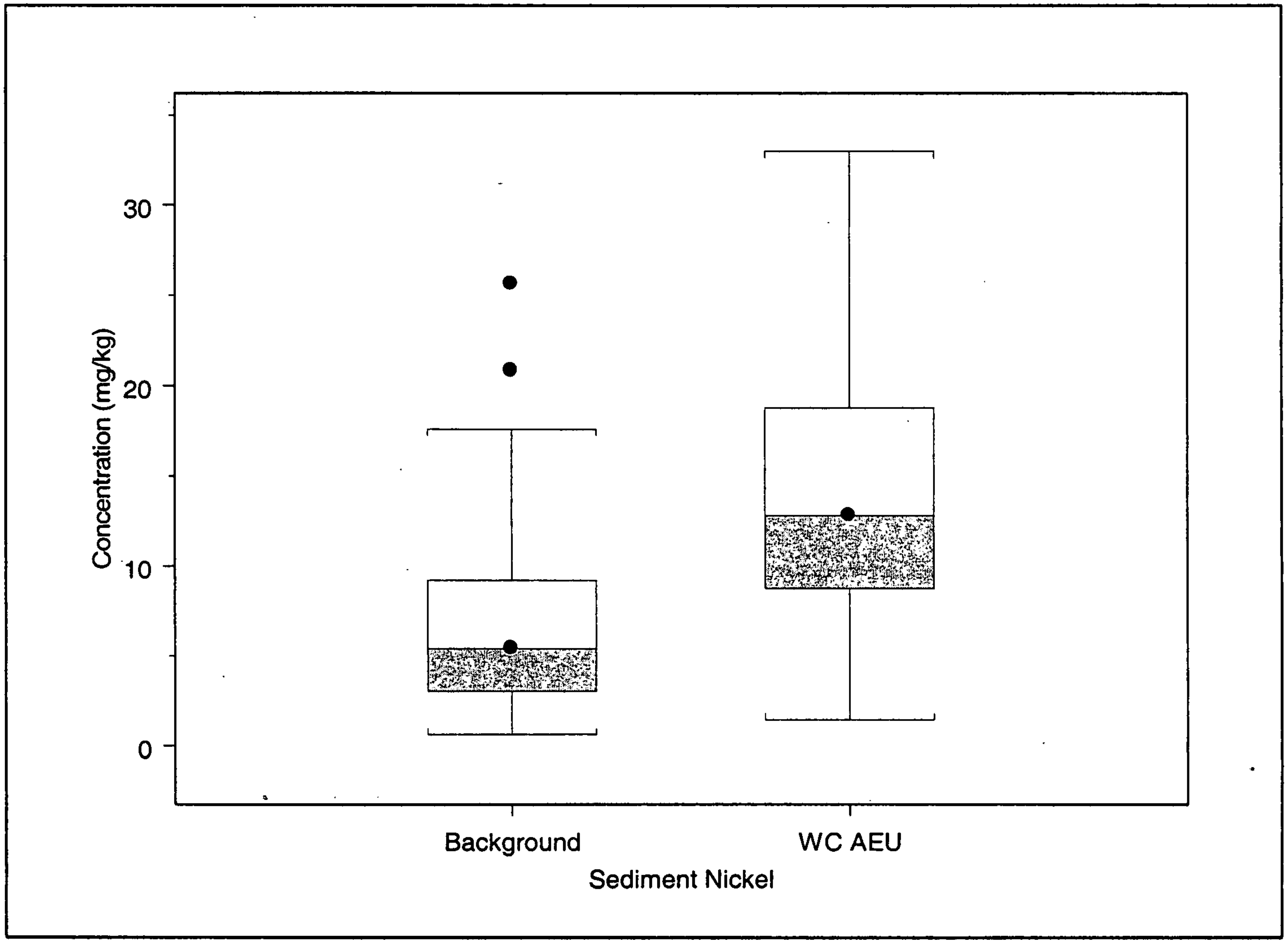


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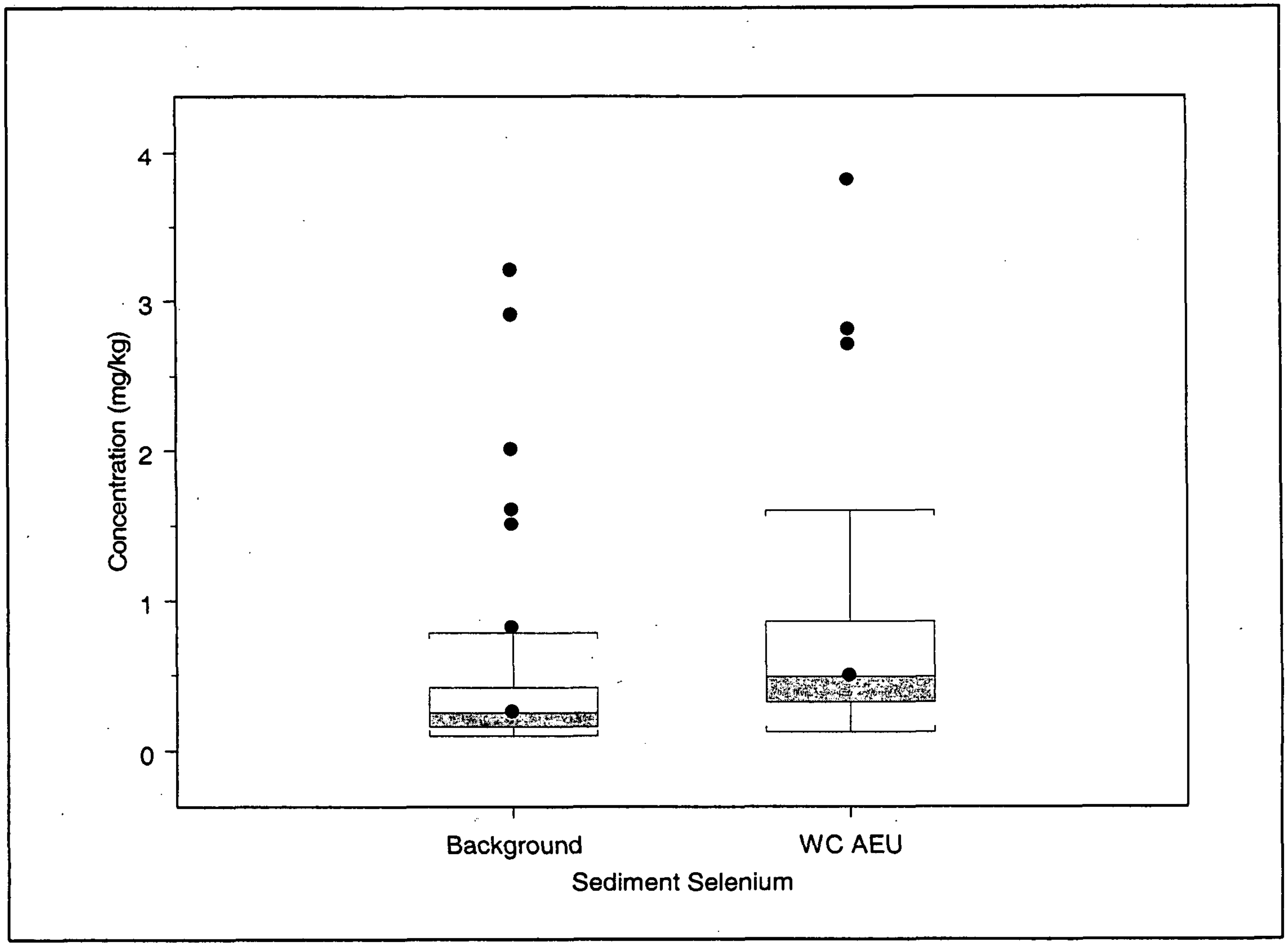
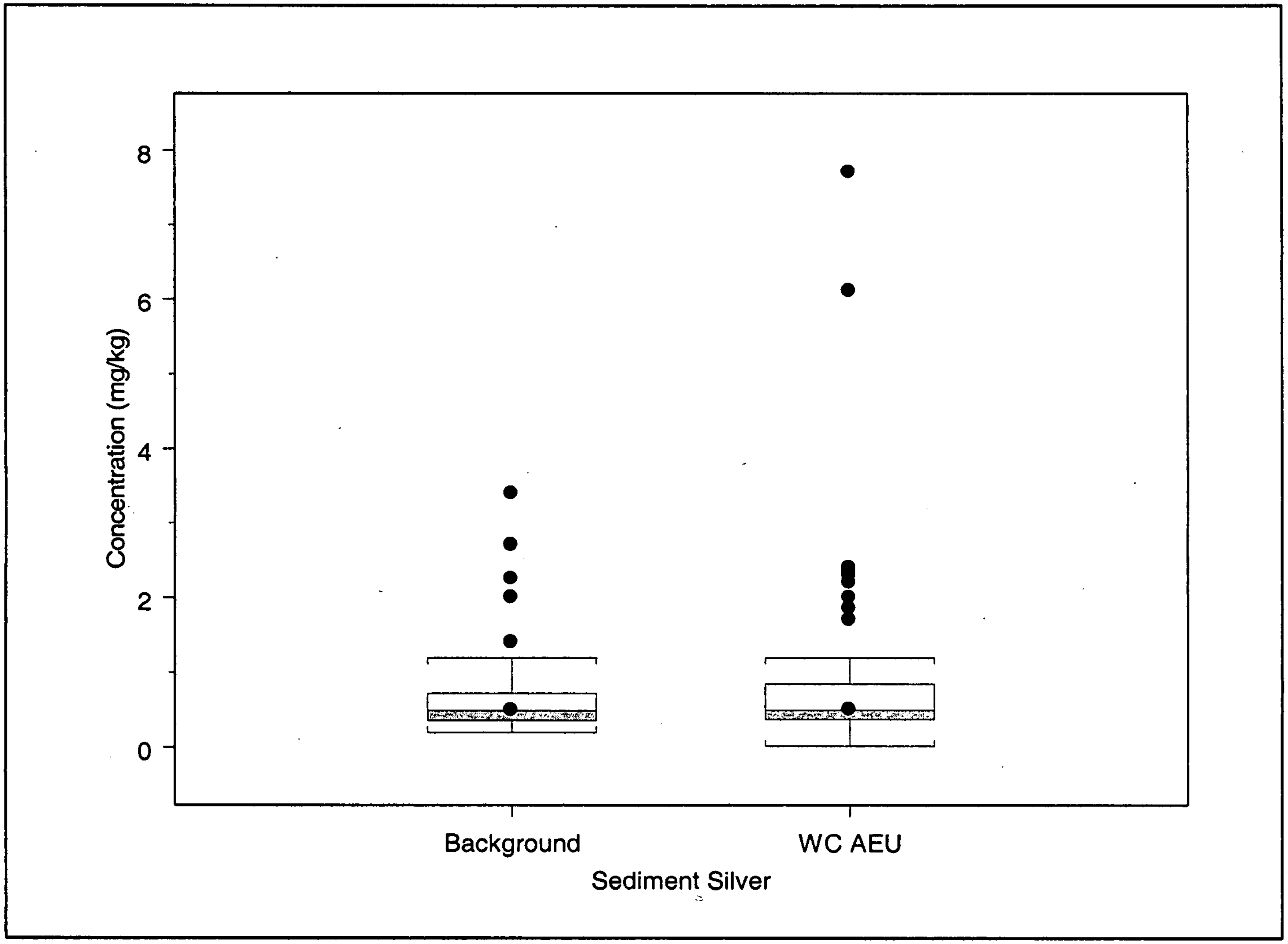
Figure A3.[illegible]C AEU.33
WC AEU Sediment Box Plots for Selenium



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.[illegible]C AEU.34
WC AEU Sediment Box Plots for Silver



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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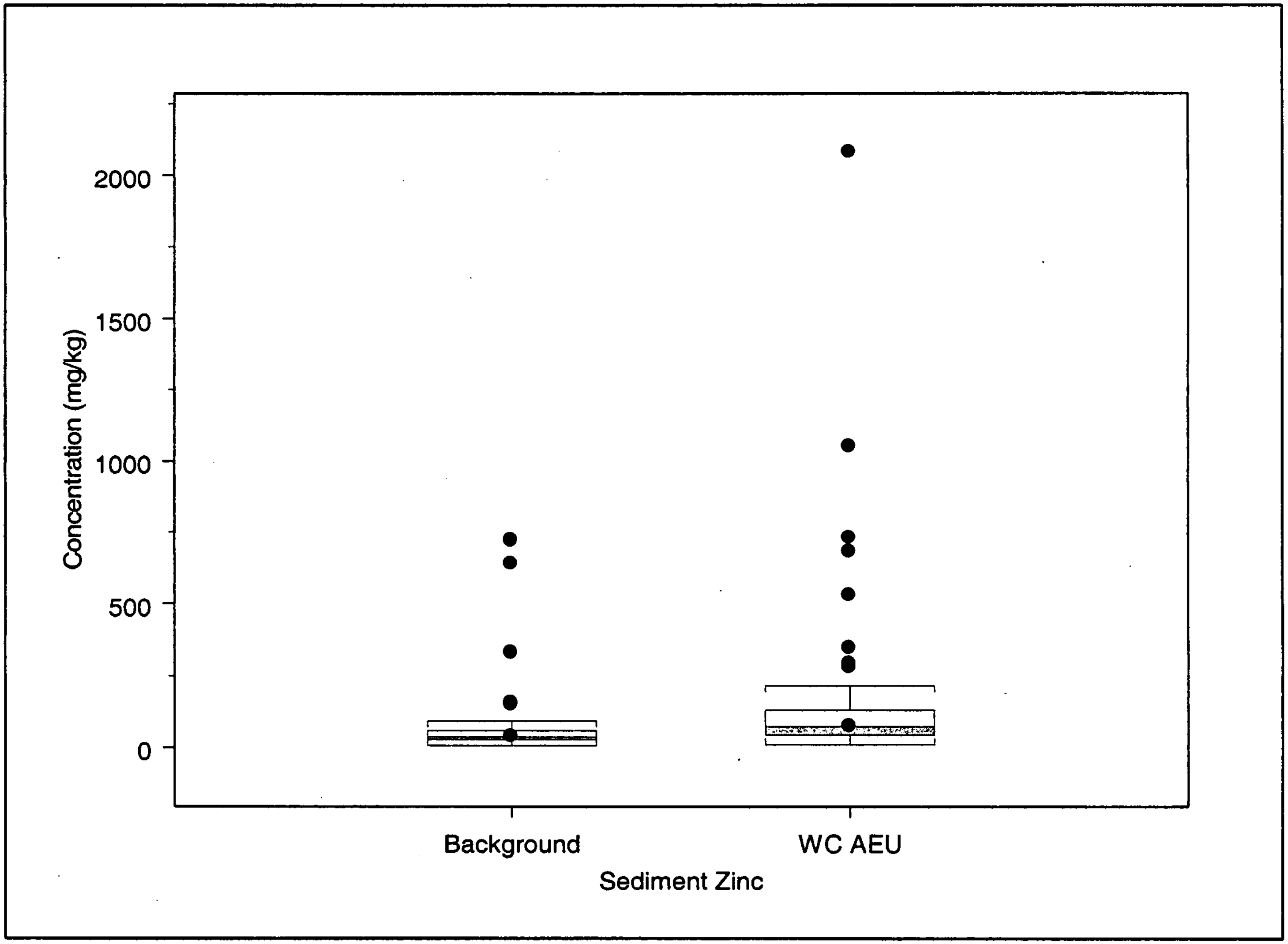
Figure A3.2.WC AEU.35
WC AEU Sediment Box Plots for Zinc



Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

VOLUME 15B2: ATTACHMENT 4

CRA Data Set For the AEU (CD)

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

VOLUME 15B2: ATTACHMENT 5

Alternative Toxicity Values and Site-Specific ESLs

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
μg	micrograms
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μm	micrometer
AEU	Aquatic Exposure Unit
AT	alternative toxicity
AWQC	Ambient Water Quality Criteria
BCG	biota concentration guideline
CB-PEC	consensus-based probable effects concentration
CB-TEC	consensus-based threshold effects concentration
CCC	criterion continuous concentration
CCME	Canadian Council of Ministers of the Environment
CDPHE	Colorado Department of Public Health and Environment
CMC	criterion maximum concentration
CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EqP	equilibrium partitioning

ERA	Ecological Risk Assessment
ERL	effect range low
ERM	effect range median
ESL	ecological screening level
HQ	hazard quotient
ISQG	interim sediment quality guideline
LEL	lowest effect level
LOAEL	lowest observed adverse effect level
MDC	maximum detected concentration
MENVIQ/EC	Ministere de l'Environnement du Quebec et Environnement Canada
mg	milligrams
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIDEQ	Michigan Department of Environmental Quality
MK AEU	McKay Ditch Aquatic Exposure Unit
NIPHEP	National Institute of Public Health and Environmental Protection
NN AEU	No Name Gulch Aquatic Exposure Unit
NW AEU	North Walnut Creek Aquatic Exposure Unit
NYSDEC	New York State Department of Environmental Conservation
OMOE	Ontario Ministry of the Environment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PEC	probable effect concentration

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PEL	probable effect level
ppm	parts per million
RC AEU	Rock Creek Aquatic Exposure Unit
RESRAD	Residual Radioactivity
RFETS	Rocky Flats Environmental Technology Site
SE AEU	Southeast Aquatic Exposure Unit
SQG	sediment quality guideline
SW AEU	South Walnut Creek Aquatic Exposure Unit
TEC	threshold effect concentration
TEF	toxic equivalency factor
TEQ	toxic equivalency quotient
TET	toxic effect threshold
TMDL	total maximum daily load
TNRCC	Texas Natural Resource Conservation Commission
UCL	upper confidence limit
UTL	upper tolerance limit
WC AEU	Woman Creek Aquatic Exposure Unit
WHO	World Health Organization

1.0 INTRODUCTION

The initial ecological contaminant of potential concern (ECOPC) identification screening evaluation of ecological contaminants of interest (ECOIs) at the Rocky Flats Environmental Technology Site (RFETS) compared maximum detected concentrations (MDCs) of each chemical to conservative ecological screening levels (ESLs) to identify ECOPCs.[1] The second step of this two-tiered risk evaluation considered more realistic exposure and effects characterization by calculating site-specific refinements to the ESLs and identifying alternative toxicity (AT) benchmark values to support the risk characterization of ECOPCs in the Aquatic Exposure Units (AEUs). Concentrations of ECOPCs in sediment and water samples from each AEU were compared to these refined ESL and AT values to provide an upper and lower bound of the potential for adverse effects. While ESLs are typically concentrations at which adverse effects are rarely observed, ATs represent an upper-bound concentration above which adverse effects are possible or probable. Concentrations between the ESL and AT values are within the range of uncertain toxicity, where adverse effects are occasionally observed. The use of both the lower- and upper-bound toxicity values for each ECOPC bracketed the potential for risk from each ECOPC and allowed an evaluation of the likelihood of potential risk.

Surface water and sediment ECOPCs, for which site-specific alternative ESL and AT values were derived, are presented for each AEU in Tables ES.1 and ES.2, respectively, of the Executive Summary in Appendix A, Volume 15B1. For many of these ECOPCs, ESLs had been previously identified in the Final Comprehensive Risk Assessment Work Plan and Methodology (DOE 2004) (hereafter referred to as the CRA Methodology). For others, however, ESLs and ATs were developed following the steps described in the CRA Methodology. Tables A5.1 and A5.2 present site-specific ESLs and AT values, respectively, that were used to evaluate surface water and sediment ECOPCs in the risk characterization process. Attachment 5 includes ESLs and AT values for the North Walnut Creek AEU (NW AEU), South Walnut Creek AEU (SW AEU), Woman Creek AEU (WC AEU), and No Name Gulch AEU (NN AEU). The attachment is the same for Volumes 15B1 and 15B2. Sources, endpoints, and toxicity information used for deriving surface water and sediment AT values and site-specific ESLs are described below.

2.0 SURFACE WATER ECOLOGICAL SCREENING LEVELS AND ALTERNATIVE TOXICITIES

Original surface water ESLs from the ECOPC identification process, developed in the CRA Methodology (DOE 2004), were used in the risk characterization phase of the AEU Ecological Risk Assessment (ERA) for most organic and some inorganic ECOPCs. Surface water ESLs were refined using site-specific water quality considerations (i.e.,

[1] As a precautionary step, ESLs were developed for a number of ECOIs not previously identified within the CRA Methodology. The methods followed for the development of these ESLs prescribe to those contained within the Methodology. These ESL values were not relied upon in the AEUs evaluated to date but are retained in the event they may be required for future AEU evaluation (for the NW AEU, SW AEU, and WC AEU).

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pH, hardness, and temperature) where water quality criteria affect ECOPC toxicity and equations were available for ESL recalculation. This pertained to ammonia, pentachlorophenol, and several divalent metals (barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc). In these cases, sitewide and AEU-specific water quality parameters (Table A5.3) were used for recalculation of ESLs, referred to as refined ESLs. AT values, derived from acute water quality standards, were also calculated using these site-specific water quality parameters (Table A5.4).

Both ESLs and ATs for surface water ECOPCs were consistent with regard to the type of benchmark calculated. The majority of the surface water ESLs and ATs represent Ambient Water Quality Criteria (AWQC) from the Colorado Department of Public Health and Environment (CDPHE) (CDPHE 2005a and 2005b). Other state and federal resources from agencies including the U.S. Environmental Protection Agency (EPA) (EPA 2002), Michigan Department of Environmental Quality (MIDEQ) (MIDEQ 2003), New York State Department of Environmental Conservation (NYSDEC) (NYSDEC 1994), and the U.S. Department of Energy (DOE) (DOE 1996c) were used when Colorado-specific benchmarks were not available.

The endpoints associated with these standards are:

- Criterion continuous concentration (CCC); and
- Criterion maximum concentration (CMC).

The CCC is the chronic ambient water quality criterion protective from long-term exposures. It is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. Chronic toxicity refers to effects through an extended time period and may be expressed in terms of an observation period equal to the lifetime of an organism or to the time span of more than one generation. Some chronic effects may be reversible; however, most are not. Chronic toxicity often is measured at sublethal endpoints associated with changes in physiological processes, reproductive impairment, reduced growth, or altered behavior. Chronic effects may be observed at the population level rather than in individuals. For example, if eggs fail to develop, reproductive fitness is reduced and the species population may be reduced or eliminated. Physiological stresses may also reduce individual health and result in a gradual population decline or absence from an area.

The CMC is recognized as being the acute ambient water quality criterion protective from short-duration exposures. It is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. Acute standards are generally represented by higher concentrations (i.e., exposures) as compared to chronic standards. Generally, the concentrations that organisms can experience and survive is higher for short-term (i.e., acute) than for long-term (i.e., chronic) exposures. Acute toxicity refers to effects occurring in a short time period where death is often the endpoint. As such, acute toxicity measures typically focus on individual effects rather than on population or community effects. While acute toxicity is often measured at the individual level, it can have effects on overall populations if sufficient numbers of individuals are affected.

Water quality standards presented in Table A5.1 are protective of aquatic life and their uses assuming the 4-day average concentration of a chemical does not exceed the CCC more than once every 3 years on average, and assuming the 1-hour average concentration does not exceed the CMC more than once every 3 years on average. Both the CCC and CMC were developed to be protective of the vast majority of aquatic communities in the United States.

3.0 CHEMICAL-SPECIFIC REFINEMENTS TO SURFACE WATER SCREENING VALUES

3.1 ESL and AT Refinements for Inorganic ECOPCs

The ESL used for ECOPC selection was a default value for unionized ammonia (CDPHE 2005a). Concentrations of surface water ammonia from RFETS samples were reported as total aqueous ammonia and converted to the unionized fraction (using site-specific un-ionized fraction percentages – Table A5.4) in order to compare appropriate fractions of ammonia in the site samples to ESLs in the ECOPC selection (EPA 1985).

Ammonia toxicity is temperature- and pH-dependent. Although the chronic ESL was based on a default value and remained unchanged, refined calculations for determining unionized ammonia and the equation-based acute water quality criterion (AT value) included a pH and temperature component. A RFETS average pH of 7.5 was determined as a geometric mean of pH values from the entire site (n=666). Therefore, concentrations of unionized ammonia in site surface water were recalculated based on site-specific pH conditions (e.g., 1.24 percent at pH 7.5 and 20°C), as presented in Table A5.4. AEU-specific ESLs and ATs were calculated for AEUs where pH had been measured and that had an estimated water temperature of 20°C. A temperature of 20°C is a conservative value reflective of fall, winter, and spring stream flows when water is typically present in RFETS ephemeral streams. The resulting sitewide refined benchmark values for unionized ammonia are as follows:

- Chronic ambient water quality criterion: 0.02 milligrams per liter (mg/L) NO_2-N
- Sitewide acute ambient water quality criterion: 0.150 mg/L NO_2-N

Surface water quality summary statistics for the NW AEU, SW AEU, WC AEU, and NN AEU are presented in Table A5.4. The Rock Creek AEU (RC AEU), McKay Ditch AEU (MK AEU), and Southeast AEU (SE AEU) lacked available water quality information and, therefore, sitewide pH values were used for calculating refined ESLs and ATs (Table A5.4).

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A sitewide alternative to the chronic (ESL) and acute (AT) ammonia standards also was calculated for total aqueous ammonia based on the site-specific pH values and an estimated water temperature of 20°C. As noted above, this temperature estimation is a conservative value reflective of fall, winter, and spring stream flows when water is typically present in RFETS ephemeral streams. This criterion also is dependant on whether salmonid species are present, because they represent one of the most sensitive groups of organisms affected by ammonia toxicity (EPA 2002). However, because salmonids are not known to occur within the RFETS drainages, the criterion was calculated assuming salmonids were absent. The resulting sitewide refined values are as follows:

- Chronic ambient water quality criterion: 3.06 milligrams (mg) N/L
- Acute ambient water quality criterion: 19.9 mg N/L

The current aluminum criterion (CDPHE 2002; EPA 2002) is based on older guidance (EPA 1988; EPA 440/5-86-008) that was reviewed for the purpose of identifying the appropriate metal fraction for screening. Specifically, the CDPHE (2002) criterion was based on the 304(a) aquatic life criterion derived using 1985 guidelines (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, PB85-227049, January 1985) issued in the federal AWQC for aluminum (EPA 1988). This criterion reviews the complex aquatic chemistry and nature of aluminum toxicity to aquatic organisms.

Aluminum toxicity in surface water is complex because it has higher solubility in both low- and high-pH surface water than when pH is neutral. Aluminum also forms various soluble and insoluble complexes under various water conditions. Toxicity of aluminum has been related to both total and dissolved fractions under different water chemistry conditions due to this complex chemical behavior.

To develop appropriate criterion for potentially different water conditions, it was determined that the acid-soluble dissolved fraction of aluminum in surface water (a mild acid digestion prior to 0.45 micrometer [μm] filtration) was the most appropriate measure on which to base the toxicity guidance (EPA 1988). The primary consideration in the decision was the use of this criterion in monitoring total maximum daily load (TMDL). Aluminum values for RFETS are reported in both dissolved and total fractions, which are not entirely appropriate for comparisons to the ESL. Total aluminum may include fractions that occur in nontoxic forms, while dissolved aluminum represents more of the bioavailable metal, including the most toxic hydroxylated forms, but potentially excluding precipitates that could become bioavailable if water quality characteristics change. The EPA and State of Colorado have recognized that total aluminum measurements often measure nontoxic clay fractions in surface water and that the true exposure point concentration (EPC) falls between the dissolved and total fraction concentrations. However, the total aluminum fraction was selected as a basis for comparison to the standards as a conservative measure.

Tests considered when deriving these standards were based on particulate-phase toxicity, whereas aluminum-rich clay mineralogy may dominate streams and render the comparisons to total aluminum fractions inappropriate. In Colorado, the 750 micrograms per liter (µg/L) acute criterion value should be used instead of the 87 µg/L chronic value when pH is greater than 6.9 and hardness is more than 50 parts per million (ppm) (Colorado Basic Standards Work Group 2004). Because these conditions occur at RFETS, the 750 µg/L is appropriate as a chronic exposure ESL at this site. In addition to these geochemical arguments, the calculated AWQC final chronic value (748 µg/L) was lowered to 87 µg/L to protect two sensitive species (brook trout and striped bass) despite the fact that "many high-quality waters in the U.S. contain more than 87 µg/L aluminum when either total recoverable or dissolved constituents are measured" (Colorado Basic Standards Work Group 2004). Sensitive trout, whose protection was the basis for lowering the criterion, are not present in the Dry Creek watershed at RFETS. The absence of fish in most AEUs and the fact that invertebrates are less sensitive than vertebrates to aluminum are further reasons to use 750 µg/L in a refined screening evaluation.

In summary, total aluminum concentrations in surface water were compared to the 750-µg/L ESL as a conservative measure of potential chronic toxicity to freshwater organisms at RFETS.

Laboratory test results indicate that toxicity for some metals is reduced by water hardness. Therefore, the revised ESLs and ATs for barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc were derived from water hardness-based equations (MIDEQ 2003; CDPHE 2002). AEU-specific refinements for these metals were completed for the NW AEU, SW AEU, WC AEU, and NN AEU where data were available (Table A5.3). The site-specific hardness for RFETS (198 mg/L $CaCO_3$) was applied to these equations for the RC AEU, MK AEU, and SE AEU, as presented in Table A5.4.

3.2 ESL and AT Refinements for Organic ECOPCs

Pentachlorophenol toxicity is pH-dependent, and CDPHE (2002)guidance provided the following equations for determining site-specific acute and chronic criteria for this chemical:

- Acute = $e^{[1.005(\text{pH}) - 4.869]}$
- Chronic = $2 * e^{[1.005(\text{pH}) - 5.134]}$

AEU-specific refinements for pentachlorophenol were completed for the NW AEU, SW AEU, WC AEU, and NN AEU where pH data were available (Table A5.3). The site-specific pH from all RFETS water quality data (7.5) was applied to these equations for the RC AEU, MK AEU, and SE AEU because no AEU-specific pH measurements were available. The refined ESL and AT benchmarks for pentachlorophenol are presented in Table A5.1.

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3.3 ESL and AT Refinements for Radionuclides

An AT value of 8.49 pCi/L for radium-228 was derived from DOE (2002) using RESRAD-BIOTA Version 1.1 (beta). This benchmark represents the Level 3 biota concentration guideline (BCG) for radium-228 equivalent to the chronic maximum no-effect exposure of 1 rad/day that will ensure protection of the population. The Level 3 BCG is based on this dose calculated for aquatic species, while the Level 1 BCG used to calculate the ESL is based on the more radiosensitive aquatic and riparian receptors.

4.0 SEDIMENT ECOLOGICAL SCREENING LEVELS AND ALTERNATIVE TOXICITIES

Sediment ESLs provide a low value of no effects to threshold effects, below which effects are unlikely to occur. Upper-bound estimates of concentrations for each ECOPC, above which effects are likely to occur, were identified in the published literature and are referred to as AT values. Concentrations that occur between these upper- and lower-bound values are of uncertain but potential toxicity.

The hierarchy for identification and selection of ATs was as follows:

1. MacDonald et al., 2000a (organics and metals) and MacDonald et al., 2000b (PCBs) – consensus-based probable effects concentrations (CB-PECs);
2. EPA, 1997;
3. Ingersoll et al., 1996; and
4. Other literature sources.

An AT was selected for each ECOPC. The original sediment ESLs from the ECOPC identification process in the CRA Methodology were used in this assessment, along with ATs representative of a lowest observed adverse effect level (LOAEL) where available or similar. The use of these two values for each ECOPC would then bracket the estimated risk using the hazard quotient (HQ) approach. A description of the values for each ECOPC by media is provided below, and a summary of the AT values for each ECOPC is provided in Table A5.2.

The endpoints for the sediment toxicity values vary. In general, the median observed toxicity value from available studies was selected as the AT (MacDonald et al., 1999). Compared to the ranges reported in Table A5.2, these values represent a central tendency measure and were greater than the ESL. A description of the endpoints, as identified by the investigative studies from which they were drawn, is provided below.

Bolton et al., 1985. The benchmark value for fluoride was derived from this study using an equilibrium partitioning approach. The AT benchmark represents the chronic equilibrium partition-derived threshold concentration when organic carbon in sediment equals 1 percent.

CCME, 2002. The Canadian federal government has compiled a list of regularly updated screening environmental quality guidelines for surface water and sediments in Canada. The ESL and AT benchmarks for total dioxins were identified in this document as:

- An interim sediment quality guideline (ISQG); and
- A probable effect level (PEL).

ISQGs were determined to provide a concentration below which effects are considered unlikely, whereas the PELs are concentrations above which adverse effects may occur. These benchmarks are generally good predictors of the likelihood of no effects or adverse effects. These benchmarks are reported in sediment dry weight derived using an effects-range approach.

The ESL (0.00085 microgram per kilogram [µg/kg]) and the AT (0.0215 µg/kg) for dioxins (polychlorinated dibenzo-p-dioxins and dibenzo furans) were based on the consensus toxic equivalency factors (TEFs) developed by the World Health Organization (WHO) (1998). Dioxins and furans are ECOPCs that pose a potential for additive risk to sediment-dwelling organisms. A cumulative effect is expected due to a similar mode of toxic action from different congeners. However, all halogenated and aromatic hydrocarbons with dioxin-like properties (dioxins and furan congeners) do not exert the same degree of toxicity. Therefore, TEFs were used to normalize congener concentrations to their dioxin equivalent (Table A5.5).

Only dioxin and furans detected in at least 5 percent of sediment samples in at least one AEU were evaluated as total dioxin equivalents. The concentration of each ECOPC was multiplied by its TEF to calculate the dioxin toxic equivalency quotient (TEQ). Congeners not detected in a specific sample were included in this calculation for the ECOPC selection, with half the reporting limit used as a proxy concentration. These nondetected congeners were excluded from the refined risk characterization evaluation. All TEQs within a sample were summed, and the summed TEQ was compared to the ESL and AT for total dioxins (CCME 2002) presented in Table A5.2. Tier 2 statistical calculations (e.g., 95 percent upper tolerance limit [UTL] and 95 percent upper confidence limit [UCL]) were calculated using these summed TEQ concentrations derived from each sample if the summed TEQ concentrations were greater than the ESL.

Cubbage, et al., 1997. These Washington state sediment quality guidelines represent a probable apparent effects threshold approach to sediment quality value derived using MICROTOX (for acenaphthylene and for carbazole) endpoints with dry-weight values.

Ginn and Pastorak, 1992. The state of Washington has developed sediment quality standards for some polar and ionic organic compounds. These standards provide an indication that the potential for adverse effects may require additional evaluation. AT benchmarks for 4-methylphenol and pentachlorophenol were selected from this reference.

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Ingersoll et al., 1996. Sediment-effect concentrations were developed for a suite of chemicals based on laboratory data on the toxicity of contaminants associated with field-collected sediment to the amphipod *Hyalella azteca* and the midge *Chironomus riparius*. The sediment-effect concentrations are defined as the concentrations of individual contaminants in sediment below which toxicity is rarely observed and above which toxicity is frequently observed. Two types of sediment-effect concentrations were calculated from the data:

- Effect range low (ERL); and
- Effect range median (ERM).

The ERL is the lower 10th-percentile concentration associated with observations of biological effects. According to this method, concentrations below the ERL should rarely be associated with adverse effects (EPA 1996). The ERL for total polynuclear aromatic hydrocarbons (PAHs) was used as a surrogate for the dibenzo(a,h)anthracene AT benchmark, for which no other AT value was available. The ERM represents the chemical concentration above which adverse effects would frequently occur. For the purposes of this evaluation, the reported ERL was selected as the AT benchmark for aluminum, iron, manganese, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene.

Jones et al., 1997. This reference provides a compilation of available sediment ATs and various approaches for their development. The AT benchmark for 2-butanone represents a secondary chronic value for sediment derived using the EqP approach. The guidance recommends these values be used cautiously given that they are site-specific and calculated using a 1-percent organic carbon fraction.

MacDonald et al., 1999. Numeric standards for freshwater and marine, surface water, and sediment were gathered as part of a regional study contributing to the Georgia Basin Ecosystem Initiative, a federal-provincial partnership that provides a broad framework for action toward long-term sustainability in the Georgia Basin, British Columbia. Part of this effort was to determine applicable comparison standards for screening processes. Water quality, sediment quality, and tissue residue guidelines were reviewed for consideration as basic tools in evaluating environmental conditions for the development of water management strategies. This document provides a summary of all obtained, validated standards available in the literature at the time. Appendices are devoted to the summary of toxicity values by chemical and by media. The information for sediment ECOPCs was reviewed, and the range of reported ATs is summarized for each chemical in Table A5.2. Consistent types of toxicity values were relied upon to represent median-level effects thresholds as compared to the range of values reported. These AT values are as follows:

- The AT value for selenium represents a criterion in dry weight from Nagpal, et al. (1995). This was the only value available for total selenium in sediment.
- The AT value for acenaphthene represents a PEL from Nagpal, et al. (1995).

- The AT benchmark values for barium and silver were derived from this guidance and represent the Texas sediment quality guideline: 85th percentile level in reservoirs, dry weight (TNRCC 1996). The barium AT concentration represents the average of the observed toxicity values reviewed for this evaluation (reported range of 20 to 500 milligrams per kilogram [mg/kg]). These screening levels are based on percentile concentration from statewide historical data and are not health or toxicity based. While the guidelines are not enforceable, they provide a basis for evaluating contaminant concentrations in media at the site to which receptors are potentially exposed.

MacDonald et al., 2000a. Numeric sediment quality guidelines (SQGs) were compiled and evaluated for metals and organic compounds. Two SQGs were identified for each chemical:

- A consensus-based threshold effect concentration (TEC); and
- A consensus-based probable effect concentration (PEC).

The TECs were determined to provide a concentration below which effects are considered unlikely, whereas the PECs are concentrations above which adverse effects are likely. These benchmarks are generally good predictors of the likelihood of no effects or adverse effects. Consensus-based TECs for sediment correctly predicated toxicity from 34.3 percent of samples for mercury (n=79) to 88.9 percent of samples for total polychlorinated biphenyls (PCBs) (n = 120), while PECs for sediment correctly predicted samples to be toxic in 77 percent of samples for arsenic (n=150) to 100 percent of samples for mercury (n = 100) for metals, PAHs, and PCBs. Thus, there is confidence that these guidelines accurately predict the potential for adverse effects except for the low SEV for mercury, where there is greater uncertainty.

MacDonald et al., 2000b. Numeric SQGs were compiled and evaluated for PCBs, and a set of comparable SQGs were identified for certain inorganic and organic chemicals. The following SQGs were identified for each congener and for total PCBs:

- A consensus-based TEC;
- A lowest effect level (LEL) concentration; and
- A toxic effect threshold (TET) concentration.

The TEC for total PCBs was determined to provide a concentration below which effects are considered unlikely. The LEL, an alternative SQG selected due to the lack of TECs for individual PCB congeners, is a numerical threshold concentration protective of 85 to 90 percent of sediment-dwelling organisms. The TET, an alternative SQG selected due to the lack of PECs for individual PCB congeners, represents concentrations above which adverse effects are likely. TETs were reported to represent concentrations above which adverse effects are expected on 90 percent of sediment-dwelling organisms. These benchmarks were designed for sediments with 1-percent organic carbon; higher proportions would be protective of receptors and increase these toxicity value concentrations.

PCBs are ECOPCs that pose a potential for additive risk to sediment-dwelling organisms. A cumulative effect from PCBs is expected due to a similar mode of toxic action from different congeners. Only PCB congeners that were detected in at least 5 percent of sediment samples in at least one AEU were evaluated both as individual PCBs and jointly as total PCBs. These concentrations were evaluated against their respective ESL and AT benchmarks (MacDonald, et al. 2000a and 2000b). Aroclor 1254 and Aroclor 1260 were the only PCB congeners detected in at least 5 percent of the sediment samples. Concentrations of these PCBs in each sample were added to determine the total PCB concentration in the sample. Congeners not detected in a specific sample were included in this calculation with half the reporting limit used as a proxy concentration. Tier 1 and Tier 2 statistical calculations (e.g., 95 percent UTL and 95 percent UCL) were calculated using these total PCB concentrations derived from each sample.

An ESL for total PAHs was not provided in the CRA methodology. The consensus-based TEC (CB-TEC) and PEC (CB-PEC)were identified from MacDonald et al. (2000a) for use as the total PAH ESL and AT values, respectively, for comparison against summed PAH concentrations. The CB-TEC (1,610 ug/kg) and CB-PEC (22,850 ug/kg) were reported to predict the absence of toxicity or the presence of toxicity in 81.5 and 100 percent of samples (n=167), respectively.

MENVIQ/EC, 1992. The value for benzo(k)fluoranthene was derived from this study and represents the sediment quality TET using a screening-level concentration approach; i.e., TET when organic carbon in sediment equals 1 percent.

NYSDEC, 1994. The value for antimony was derived from this study using a screening-level concentration approach and represents the LEL in dry weight.

EPA, 1997. These values represent a guideline or sediment quality advisory level at 1 percent organic carbon using an equilibrium partitioning (EqP) approach. Equilibrium partitioning calculations were used to calculate AT benchmark concentrations (atrazine and bromomethane) in addition to ESLs for detected ECOIs where no previous ESL had been identified (1,2,4-trimethylbenzene, 1,3-dichlorocenzene, 1,3,5-trimethylbenzene, 2-butanone, 2,4,6-trichlorophenol, atrazine, benzyl alcohol, trans-1,2-dichloroethene). Chronic surface water AWQCs were used as the basis for calculating sediment ESLs, while acute AWQCs were used as the basis for calculating sediment AT benchmarks (Table A5.6), where:

$$EqP_{ESL} = ESL_{water} * Koc * foc$$

EqP = Equilibrium partitioning-based sediment ESL
ESL_{water} = Surface water ESL (chronic)
Koc = Organic carbon portioning coefficient
foc = Fraction organic carbon (assumed 1%)

$$EqP_{TT} = AT_{water} * Koc * foc$$

EqP = Equilibrium partitioning-based sediment AT
AT_{water} = Surface water AT (acute)
Koc = Organic carbon portioning coefficient
foc = Fraction organic carbon (assumed 1%)

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TABLES

Table A5.1
Alternative Toxicity Values for Surface Water ECOPCs

ECOPC	Units	Site-Wide[1] ESL	Site-Wide[1] AT	Woman Creek ESL	Woman Creek AT	North Walnut ESL	North Walnut AT	South Walnut ESL	South Walnut AT	Reference
Inorganic										
Aluminum (T)	μg/L	750	N/A	Same as site-wide						CDPHE 2005a
Ammonia (unionized)	μg/L	20	150	20	104	20	150	20	165	CDPHE 2005a
Ammonia (T)	μg/L	3,060	19,900	3,870	30,900	3,060	19,900	2,740	16,900	USEPA 1999
Antimony (T)	μg/L	240	2,300	Same as site-wide						MIDEQ 2003
Barium (T)	μg/L	908	5,181	731	4,172	1,115	6,363	934	5,330	MIDEQ 2003
Beryllium (T)	μg/L	13.56	244	8.1	146	22.1	398	14.5	261	MIDEQ 2003
Cadmium (D)	μg/L	3.71	8.97	3.2	7.2	4.3	11.1	3.8	9.2	CDPHE 2005a
Chromium (D)	μg/L	130	999	110	846	152	1,171	133	1022	CDPHE 2005a
Cobalt (T)	μg/L	100	740	Same as site-wide						MIDEQ 2003
Copper (D)	μg/L	16.1	25.7	14	21	19	31	16	26	CDPHE 2005a
Cyanide (T)	μg/L	0.5	5	Same as site-wide						CDPHE 2005a
Fluoride (T)	μg/L	2,120	10,200	Same as site-wide						NY State 1998
Iron (D)	μg/L	1,000	N/A	Same as site-wide						USEPA 2002
Lead (D)	μg/L	5.3	135	4.2	109	6.5	166	5.4	139	CDPHE 2005a
Lithium (T)	μg/L	96	1,700	Same as site-wide						MIDEQ 2003
Manganese (T)	μg/L	1,650	2,990	1,937	3,506	2,211	4,002	2,092	3,786	CDPHE 2005a
Mercury (D)	μg/L	0.77	1.4	Same as site-wide						CDPHE 2005a
Nickel (D)	μg/L	93	837	78	704	109	985	95	856	CDPHE 2005a
Nitrite (T)	μg/L	4,470	8,950	Same as site-wide						CDPHE 2005a
Selenium (T)	μg/L	4.6	18.4	Same as site-wide						CDPHE 2005a
Silver (D)	μg/L	1.04	6.61	0.7	4.7	1.5	9.2	1.1	6.9	CDPHE 2005a
Strontium (T)	μg/L	8,300	150,000	Same as site-wide						MIDEQ 2003
Tin (T)	μg/L	73	2,700	Same as site-wide						DOE 1996c
Vanadium (T)	μg/L	12	220	Same as site-wide						MIDEQ 2003
Zinc (D)	μg/L	211	210	178	176	249	247	216	214	CDPHE 2005a
Organic										
4,4'-DDT	μg/L	0.001	0.55	Same as site-wide						CDPHE 2005a
bis(2-ethylhexyl)phthalate	μg/L	28.5	285	Same as site-wide						MIDEQ 2003
Di-n-butylphthalate	μg/L	9.7	75	Same as site-wide						MIDEQ 2003
PCB-1254	μg/L	0.014	2	Same as site-wide						CDPHE 2005a
Pentachlorophenol	μg/L	6.69	28.8	7.86	20.5	11.06	28.8	12.48	32.5	CDPHE 2005a
Phenanthrene	μg/L	2.4	43	Same as site-wide						MIDEQ 2003
Phenol	μg/L	2,560	10,200	Same as site-wide						CDPHE 2005a
Radionuclides										
Americium-241	pCi/L	43.8	N/A	Same as site-wide						USDOE 2002[a]
Plutonium-239/240	pCi/L	18.7	N/A	Same as site-wide						USDOE 2002[a]
Radium-226	pCi/L	1.02	N/A	Same as site-wide						USDOE 2002[a]
Radium-228	pCi/L	0.849	8.49	Same as site-wide						USDOE 2002[a]
Uranium-233/234	pCi/L	20.1	N/A	Same as site-wide						USDOE 2002[a]
Uranium-235	pCi/L	21.7	N/A	Same as site-wide						USDOE 2002[a]
Uranium-238	pCi/L	22.3	N/A	Same as site-wide						USDOE 2002[a]

[1] Sitewide ESLs and AT values include Rock Creek, McKay Ditch, and Southeast AEUs.
[a] RESRAD-BIOTA version 1.1 (beta) used to derive AT for radionuclides
For conservative screening purposes the total and dissolved chronic and acute NAWQC criteria are represented by the chronic value.
Hardness dependant criteria were calculated based on site specific hardness values.
Site Wide hardness = 199; pH = 7.5 .
Woman Creek hardness = 162; pH = 7.16.
No Name Gulch hardness = 188; pH = 7.19.
North Walnut Creek hardness = 241; pH = 7.5.
South Walnut Creek hardness = 204; pH = 7.62.
Ammonium NAWQC were calculated based on site specific pH and temperature = 20°C.
PCB Value is for total PCBs.
Pentachlorophenol chronic criteria determined as exp(1.005*(pH)-5.134).
Pentachlorophenol acute criteria determined as (exp(1.005*(pH)-4.869))*2.
N/A = Not applicable or not available.
(T) = Total
(D) = Dissolved

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Table A5.2
Alternative Toxicity Values for Sediment ECOPCs

ECOPC[1]	Units	Reported Range of Benchmarks	(n)	ESL Value	Reference	Type of Value	Alternative Toxicity Value	Reference	Type of Value
Inorganics									
Aluminum	mg/kg	15,900 – 58,000	(3)	15,900	MacDonald et al., 1999	SQG	58,000	Ingersoll et al., 1996	ERM
Antimony (total)	mg/kg	2 – 500	(9)	2	MacDonald et al., 1999	SQG	3.2	NYSDEC, 1994	SLCA
Arsenic	mg/kg	3 – 150	(39)	9.79	MacDonald et al., 2000a	CB-TEC	33	MacDonald et al., 2000a	CB-PEC
Barium (total)	mg/kg	20 – 500	(6)	189	MacDonald et al., 1999	SQG	287	MacDonald et al., 1999	SQG
Cadmium	mg/kg	0.2 – 30	(34)	0.99	MacDonald et al., 2000a	CB-TEC	4.98	MacDonald et al., 2000a	CB-PEC
Chromium	mg/kg	6.25 – 600	(34)	43.4	MacDonald et al., 2000a	CB-TEC	111	MacDonald et al., 2000a	CB-PEC
Copper	mg/kg	8.4 – 840	(36)	31.6	MacDonald et al., 2000a	CB-TEC	149	MacDonald et al., 2000a	CB-PEC
Fluoride	mg/kg	0.01 – 96	(21)	0.01	MacDonald et al., 1999	ERL	7	Bolton et al., 1985	TET
Iron	mg/kg	20,000 – 290,000	(17)	20,000	MacDonald et al., 1999	LEL	280,000	Ingersoll et al., 1996	ERM
Lead	mg/kg	23 – 720	(42)	35.8	MacDonald et al., 2000a	CB-TEC	128	MacDonald et al., 2000a	CB-PEC
Manganese	mg/kg	300 – 1,800	(16)	630	MacDonald et al., 1999	TEL	1,700	Ingersoll et al., 1996	ERM
Mercury	mg/kg	0.1 – 15	(27)	0.18	MacDonald et al., 2000a	CB-TEC	1.06	MacDonald et al., 2000a	CB-PEC
Nickel	mg/kg	5 – 100	(31)	22.7	MacDonald et al., 2000a	CB-TEC	48.6	MacDonald et al., 2000a	CB-PEC
Selenium	mg/kg	0.95 – 5	(3)	0.95	MacDonald et al., 1999	SQG	1.73	MacDonald et al., 1999	SQG
Silver	mg/kg	0.5 - 4.5	(9)	1	Long et al., 1995	ERL	1.6	MacDonald et al., 1999	SQG
Zinc	mg/kg	50 – 3200	(42)	121	MacDonald et al., 2000a	CB-TEC	459	MacDonald et al., 2000a	CB-PEC
Organics									
1,2,4-Trimethylbenzene	µg/kg	-	-	122	EPA 1997b	EqP based	N/A	-	-
1,3,5-Trimethylbenzene	µg/kg	-	-	316	EPA 1997b	EqP based	N/A	-	-
1,3-Dichlorobenzene	µg/kg	-	-	122	EPA 1997b	EqP based	N/A	-	-
2,4,6-Trichlorophenol	µg/kg	-	-	59.3	EPA 1997b	EqP based	N/A	-	-
2-Butanone	µg/kg	270	(2)	84.2	EPA 1997b	EqP based	270	Jones et al., 1997	EqP based SCV
2-Methylnaphthalene	µg/kg	20 – 201	(8)	20.2	CCME 2002	ISQG	201	CCME 2002	PEL
4-Bromophenyl-phenylether	µg/kg	-	-	166	EPA 1997b	EqP based	N/A	-	-
4-Methylphenol	µg/kg	12.3 - 670	(2)	12.3	EPA,1997b	EqP based	670	Ginn and Pastorak, 1992	WS-SQS
Acenaphthene	µg/kg	6.71 – 100,000	(17)	6.71	CCME 2002	ISQG	89	MacDonald et al., 1999	PEL
Acenaphthylene	µg/kg	5.87 – 6,000	(13)	5.87	CCME 2002	ISQG	1,900	Cubbage et al., 1997	WS-SQS
Anthracene	µg/kg	6.8 – 41,000	(21)	57.2	MacDonald et al., 2000a	CB-TEC	845	MacDonald et al., 2000a	CB-PEC
Aroclor 1254	µg/kg	7.3 – 604	(16)	60	MacDonald et al., 2000b	LEL	300	MacDonald et al., 2000b	TET
Aroclor 1260	µg/kg	5 – 240	(6)	5	MacDonald et al., 2000b	LEL	200	MacDonald et al., 2000b	TET
Atrazine	µg/kg	0.3 - 230.4	(3)	16.8	EPA 1997b	EqP based	230.4	EPA 1997b	EqP based
Benzo(a)anthracene	µg/kg	108-1050	(2)	108	MacDonald et al., 2000a	CB-TEC	1,050	MacDonald et al., 2000a	CB-PEC
Benzo(a)pyrene	µg/kg	9.6 – 450,000	(27)	150	MacDonald et al., 2000a	CB-TEC	1,450	MacDonald et al., 2000a	CB-PEC
Benzo(g,h,i)perylene	µg/kg	10.4 – 21,000	(19)	13	MacDonald et al., 1999	ERL	280	Ingersoll et al., 1996	ERM
Benzo(k)fluoranthene	µg/kg	2.6 – 1,250,000	(9)	240	MacDonald et al., 1999	LEL	750	MENVIQ/EC 1992	TET
Benzyl Alcohol	µg/kg	-	-	1.35	EPA 1997b	EqP based	N/A	-	-
Bromomethane	µg/kg	3.43	(1)	3.43	EPA 1997b	EqP based	62.72	EPA 1997b	EqP based
Carbazole	µg/kg	140 -1,800	(4)	25.2	EPA 1997b	EqP based	1,600	Cubbage et al., 1997	WS-SQS
Chrysene	µg/kg	8.6 – 11,500	(25)	166	MacDonald et al., 2000a	CB-TEC	1,290	MacDonald et al., 2000a	CB-PEC
DDT	µg/kg	4.16 – 11,000	(5)	4.16	MacDonald et al., 2000a	CB-TEC	62.9	MacDonald et al., 2000a	CB-PEC
Dibenz(a,h)anthracene	µg/kg	5 – 3,500	(17)	33	MacDonald et al., 2000a	CB-TEC	240	Ingersoll et al., 1996	Total PAH ERL (surrogate)
Dichlorofluoromethane	µg/kg	-	-	52.6	EPA 1997b	EqP based	N/A	-	-

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Table A5.2
Alternative Toxicity Values for Sediment ECOPCs

ECOPC[1]	Units	Reported Range of Benchmarks[2]	(n)	ESL Value[3]	Reference	Type of Value	Alternative Toxicity Value	Reference	Type of Value
Fluoranthene	µg/kg	20 – 130,000	(28)	423	MacDonald et al., 2000a	CB-TEC	2,230	MacDonald et al., 2000a	CB-PEC
Fluorene	µg/kg	77.4 - 536	(21)	77.4	MacDonald et al., 2000a	CB-TEC	536	MacDonald et al., 2000a	CB-PEC
Heptachlor epoxide[3]	µg/kg		()	2.47	MacDonald et al., 2000a	CB-TEC	16.00	MacDonald et al., 2000a	CB-PEC
Heptachlor	µg/kg	0.132 - 50	(11)	0.132	EPA,1997b	EqP based	16	MacDonald et al., 2000a	CB-PEC
Indeno(1,2,3-cd)pyrene	µg/kg	10.4 – 6,000,000	(20)	17	MacDonald et al., 1999	TEL	250	Ingersoll et al., 1996	ERM
Lindane[3]	µg/kg		()	2.37	MacDonald et al., 2000a	CB-TEC	4.99	MacDonald et al., 2000a	CB-PEC
Methylene chloride[3]	µg/kg	500 – 500	()				500	Bolton et al., 1985	
Naphthalene	µg/kg	10 – 140,000	(21)	176	MacDonald et al., 2000a	CB-TEC	561	MacDonald et al., 2000a	CB-PEC
Pentachlorophenol	µg/kg	255 - 360	(2)	255	EPA 1997b	EqP based	360	Cubbage et al., 1997	WS-SQS
Phenanthrene	µg/kg	6.8 – 210,000	(27)	204	MacDonald et al., 2000a	CB-TEC	1,170	MacDonald et al., 2000a	CB-PEC
Pyrene	µg/kg	7.6 – 85,000	(25)	195	MacDonald et al., 2000a	CB-TEC	1,520	MacDonald et al., 2000a	CB-PEC
trans-1,2-Dichloroethene	µg/kg	-	-	657	EPA 1997b	EqP based	N/A	-	-
Total DDTs	µg/kg	1.19 - 4,450	(24)	5.28	MacDonald et al., 2000a	CB-TEC	572	MacDonald et al., 2000a	CB-PEC
Total PAHs	µg/kg	200 – 700,000	(17)	1610	MacDonald et al., 2000a	CB-TEC	22800	MacDonald et al., 2000a	CB-PEC
Total PCBs	µg/kg	2.9 – 40,000	(24)	40.0	MacDonald et al., 2000b	CB-TEC	676	MacDonald et al., 2000a	CB-PEC
TEQ - Dioxins	µg/kg	0.001 - 100	(8)	0.00085	CCME 2002	ISQG	0.0215	CCME 2002	PEL

[1] Metals as dissolved unless otherwise stated.

[2] Range of benchmarks is derrived from McDonald et al. 1999 and presented values.

[3] ESL values derrived from Table B-4 of CRA Methodology; or, from cited reference if not listed in Table B-4.

The hierarch of use of the alternative ESLs was as follows: MacDonald et al., 2000a,b as a preference: others (EPA, 1997b; Ingersoll et al., 1996 etc) have no preference as compared to each other. The best available, most appropriate value is reported as the Toxicity Threshold value.

CB-PEC = concensus-based probable effect concentration.
CB-TEC = concensus-based threshold effect concentration.
EqP = SW ESL * Koc * foc ; foc estimated at 1%.
ERL = Effects Range Low.
ERM = Effects Range Moderate.
ISQG = Interim Sediment Quality Guideline.
LEL = Lowest Effect Level.
MENVIQ/EC = Ministere de l'Environnement du Quebec / Environment Canada.
PEL = Probable Effect Level.
SCV = secondary chronic value.
SLCA = Screening Level Concentration Approach (minimum effect criteria).
SQAL = Sediment Quality Advisory Level (based on 1% foc).
SQG = Sediment Quality Guideline.
TEL = Threshold Effects Level.
TET = Toxic Effect Threshold at 1% OC.
WS-SQS = Washington State Sediment Quality Standard.
N/A = Not applicable.
- = Not available.

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Table A5.3
Refined Water ESLs and Alternative Toxicity Values

SW ESLs (µg/L)	SW TT (µg/L)	SW ESL (µg/L)		Woman Creek		North Walnut		South Walnut							
Analyte	Units	ESL (Chronic)	TT (Acute)	ESL (Chronic)	TT (Acute)	ESL (Chronic)	TT (Acute)	ESL (Chronic)	TT (Acute)	CF_c	M_a	B_a	M_c	B_c	Source
Unionized Ammonia	mg/L	0.02	0.15	0.02	0.104	0.02	0.15	0.02	0.165						CDPHE 2005a
Total Aqueous Ammonia (early life stages present)	mg/L	3.06	-	3.87	-	3.06	-	2.74	-	-	-	-	-	-	EPA 1999
Total Aqueous Ammonia (salmonids absent)	mg/L	-	19.9	-	30.9	-	19.9	-	16.5	-	-	-	-	-	EPA 1999
Barium, Total	µg/L	907.84	5,181	731.07	4,172	1,115	6,363	934.05	5,330	-	1.0629	1.1869	1.0629	2.9285	MIDEQ 2002
Beryllium, Total	µg/L	13.56	244	8.10	146	22.11	398	14.51	261	-	2.5279	-10.7689	2.5279	-7.8785	MIDEQ 2002
Cadmium, Dissolved	µg/L	3.71	8.97	3.20	7.19	4.28	11.05	3.79	9.23	0.9142	1.128	-3.6867	0.7852	-2.715	CDPHE 2005a
Chromium III, Dissolved	µg/L	130	999	110	846	152	1,171	133	1022	0.86	0.819	2.5736	0.819	0.534	CDPHE 2005a
Copper, Dissolved	µg/L	16.1	25.7	13.5	21.2	19.0	30.8	16.5	26.3	0.96	0.9422	-1.7408	0.8545	-1.7428	CDPHE 2005a
Lead, Dissolved	µg/L	5.3	135	4.2	109	6.5	166	5.4	139	0.6871	1.273	-1.46	1.273	-4.705	CDPHE 2005a
Manganese, Total	µg/L	2,073	3,752	1,937	3,506	2,211	4,002	2,092	3,786	-	0.3331	6.4676	0.3331	5.8743	CDPHE 2005a
Nickel, Dissolved	µg/L	93	837	78	704	109	985	95	856	0.997	0.846	2.253	0.846	0.0554	CDPHE 2005a
Silver, Dissolved	µg/L	1.04	6.61	0.73	4.65	1.45	9.21	1.09	6.92	-	1.72	-6.52	1.72	-9.06	CDPHE 2005a
Zinc, Dissolved	µg/L	211	210	178	176	249	247	216	214	0.986	0.8473	0.8618	0.8473	0.8699	CDPHE 2005a

Site specific hardness of 198.61, pH 7.5, and water temperature of 20°C were used in site-wide calculations.
Site specific hardness of 162, pH 7.16, and water temperature of 20°C were used in calculations for Woman Creek AEU.
Site specific hardness of 188, pH 7.19, and water temperature of 20°C were used in calculations for No Name AEU.
Site specific hardness of 241, pH 7.5, and water temperature of 20°C were used in calculations for North Walnut AEU.
Site specific hardness of 204, pH 7.62, and water temperature of 20°C were used in calculations for South Walnut AEU.
Ammonia criteria based on one hr (acute ESL) and 30 day average (chronic ESL) concentrations in mg/L not exceeded more than once every 3 yrs on average. In addition, the highest 4 day average within the 30day period
Hardness adjusted metal ESLs determined using 198.61 mg/L CaCO3.
Ammonia ESLs determined using a pH of 7.5 and 20°C.
Acute ESL (dissolved) = exp(Ma[ln(hardness)]+Ba)*(CF).
Chronic ESL (dissolved) = exp(Mc[ln(hardness)]+Bc)*(CF).
Acute ESL (total) = exp(Ma[ln(hardness)]+Ba).
Chronic ESL (total) = exp(Mc[ln(hardness)]+Bc).
Where CF = metal specific total to dissolved conversion factor provided in EPA 2002.
- = Not available.

Table A5.4
Water Quality Parameters for Rocky Flats AEUs

AEU/Analyte	n	Minimum Value	Maximum Value	Mean Value	Standard Deviation
Site-Wide					
pH	666	1.7	11.7	**7.5**	6.5
Fraction of unionized ammonia in total aqueous ammonia (%)	-	-	-	**1.24**	-
Hardness (mg/L)	886	8.8	770	**199**	82
Woman Creek AEU					
pH	394	5	8.8	**7.2**	-
Fraction of unionized ammonia in total aqueous ammonia (%)	-	-	-	**0.626**	-
Total Organic Carbon (mg/L)	251	1	44	7.4	5.4
Hardness (mg/L)	152	46.3	470	**162**	62
North Walnut Creek AEU					
pH	118	1.7	11.7	**7.5**	
Fraction of unionized ammonia in total aqueous ammonia (%)	-	-	-	**1.24**	-
Total Organic Carbon (mg/L)	114	2	26	7.7	5.2
Hardness (mg/L)	378	20	770	**241**	125
South Walnut Creek AEU					
pH	98	6.6	9.8	**7.6**	
Fraction of unionized ammonia in total aqueous ammonia (%)	-	-	-	**1.56**	-
Total Organic Carbon (mg/L)	87	1.4	22	8.0	4.1
Hardness (mg/L)	355	8.8	570	**204**	106

Fraction of unionized ammonia calculated using the equation from USEPA 1985.
- = Not available.

Table A5.5

Unique Dioxins and Furans that are CRA Ready in the 4/27/05 Database (may include NLR data)

Dioxin Congener	Aquatic TEF[b]
1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.01
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.001
1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.01
Heptachlorodibenzofuran[a]	0.01
Heptachlorodibenzo-p-dioxin [a]	0.001
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.5
1,2,3,6,7,8-Hexachlorodibenzofuran	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.01
1,2,3,7,8,9-Hexachlorodibenzofuran	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.01
1,2,3,4,7,8-Hexachlorodibenzofuran	0.1
2,3,4,6,7,8-Hexachlorodibenzofuran	0.1
Hexachlorodibenzofuran [a]	0.1
Hexachlorodibenzo-p-dioxin [a]	0.5
1,2,3,7,8-Pentachlorodibenzofuran	0.05
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1
2,3,4,7,8-Pentachlorodibenzofuran	0.5
Pentachlorodibenzofuran [a]	0.5
Pentachlorodibenzo-p-dioxin [a]	1
2,3,7,8-Tetrachlorodibenzodioxin	1
2,3,7,8-Tetrachlorodibenzofuran	0.05
Tetrachlorodibenzo-p-dioxin [a]	1
Octachlorodibenzofuran	0.0001
Octachlorodibenzo-p-dioxin	0.0001

[a] The highest TEF within the series was assigned for results listed as generic dioxin/furan.
Sources: WHO 1997; Van den Berg et al. (1998).

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Table A5.6
Equilibrium Partitioning Calculations for Deriving Sediment ESL and AT Benchmarks

Chemical	SW AT (µg/L)	SW ESL (µg/L)	Koc	foc	EqP based Sediment Benchmark	Type
1,2,4-Trimethylbenzene	310	17.0	717.60	0.01	122	ESL
2,4,6-Trichlorophenol	79	5.0	1,186.00	0.01	59	ESL
Atrazine	-	7.30	230.40	0.01	17	ESL
Atrazine	100	100	230.40	0.01	230	AT
1,3,5-Trimethylbenzene	810	45.0	703.00	0.01	316	ESL
1,3-Dichlorobenzene	200	28.0	434.00	0.01	122	ESL
Benzyl Alcohol	150	8.60	15.66	0.01	1.35	ESL
trans-1,2-Dichloroethene	28,000	1,500.00	43.79	0.01	657	ESL
2-butanone	-	2,200	3.827	0.01	84	ESL
Bromomethane	640	640.00	9.80	0.01	63	AT

EqP = ESL_{water} * Koc * foc.

- = Not available.

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

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Chemical Risk Characterization Lines of Evidence in Support of the Risk Characterization

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ACRONYMS AND ABBREVIATIONS

AEU	Aquatic Exposure Unit
bgs	below ground surface
CRA	Comprehensive Risk Assessment
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
ESL	ecological screening level
NW AEU	North Walnut Creek Aquatic Exposure Unit
SW AEU	South Walnut Creek Aquatic Exposure Unit
WC AEU	Woman Creek Aquatic Exposure Unit

1.0 CHEMICAL RISK CHARACTERIZATION LINE OF EVIDENCE METHODS

The identified surface water and sediment ecological contaminants of potential concern (ECOPCs) were carried into the risk characterization process, and several data sets were generated in order to better understand current exposure conditions at the Aquatic Exposure Units (AEUs). Surface water data sets were queried to develop "post-1999" data summaries and sediment was evaluated to obtain a surface sediment (0-6 inches below ground surface [bgs]) data set.

An additional data interpretation step involved the evaluation of adjacent surface soils. As a line of evidence, sediment ECOPCs in adjacent surface soils were measured to provide an indication of future conditions in the AEUs in the case of runoff from these adjacent soils. If the ECOPC concentrations in adjacent surface soils are at or equal to the sediment concentrations, then a potential future exposure issue may exist as a result of overland runoff of these materials.

1.1 Surface Water

The AEU surface water ECOPC selection process relied upon the comprehensive data sets gathered from all samples collected on and after June 28, 1991. Given that water quality and chemical loading conditions are dynamic and are affected by variables such as site releases, accelerated action efforts, flow, and environmental buffering capacity, it was determined that a data set reflective of more current conditions could provide a line of evidence for the evaluation of surface water ECOPCs. Therefore, summary statistics were generated for surface water data from samples collected post-1999.

The post-1999 surface water data sets were statistically evaluated with a background comparison screen. Summary statistics and results of the background comparison are provided for the North Walnut Creek AEU (NW AEU) in Tables A6.1 through A6.3, South Walnut Creek AEU (SW AEU) in Tables A6.4 through A6.6, and Woman Creek AEU (WC AEU) in Tables A6.7 through A6.9.

1.2 Sediment

The AEU sediment ECOPC selection process relied upon the comprehensive data sets that included sediment samples collected from all depth fractions. Certain samples were collected from depths of over 9 bgs, which is not a relevant exposure media for aquatic life receptors. The surface sediment is more representative of the exposure media for aquatic species. As an additional line of evidence in risk characterization, all samples gathered from surface sediment (the top 6 inches) were compiled to develop a surface sediment data set for each AEU. Those sediment ECOPCs identified in the Comprehensive Risk Assessment (CRA) using the comprehensive data set were further evaluated by comparing the measured concentrations to the results of the surface sediment data set. This strategy is a line of evidence that more accurately describes the ongoing exposure conditions within an AEU. The results of the surface sediment data set

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were statistically summarized, and results are presented in Tables 6.10 through 6.12 for the NW AEU, Tables A6.13 through A6.15 for the SW AEU, and Tables 6.16 through A6.18 for the WC AEU.

1.3 Adjacent Surface Soils

Surface soils do not provide a direct exposure pathway to aquatic receptors. However, surface soils can potentially deposit into adjacent waterways via overland transport (runoff), in which case they represent a potential future exposure condition in the AEUs. In the interest of being conservative, adjacent surface soils (defined as any surface soil sample collected within 20 feet of the wetted edge of an AEU aquatic feature) were evaluated by comparing sediment ECOPC concentrations to surface soil concentrations. If, for example, cadmium was identified as a sediment ECOPC, then cadmium in adjacent surface soils were measured to determine if the concentrations were greater than the sediment result. If the soil result was greater, then a potential future exposure issue may exist. Conversely, if the soil concentration was less, then potential future sediment chemical concentration conditions may improve. The data for adjacent surface soils were summarized for the NW AEU, SW AEU, and WC AEU (Tables A6.19 through A6.21), and the sediment ecological screening levels (ESLs) were used as part of the evaluation process. The results of the adjacent surface soils evaluation are included in the lines of evidence presented in the risk characterization.

1.4 Total PAHs in Sediment

For sediments, total PAHs were evaluated if individual PAH constituents were identified as ECOPCs. The process for evaluating total PAHs was as follows;

1. PAH compounds detected in greater than 5 percent of the samples were included in the total calculations.
2. The sum of PAHs was determined for each sample, using ½ the detection limit for nondetected chemicals.
3. The maximum total PAH value was compared to the "total PAH" Ecological Screening Level (ESL) for the risk characterization screen, and
4. The total detected PAHs for each sample was calculated for surface sediment and compared to the ESL for the risk characterization screen.

Tables A6.22 and A6.23 provide the sum total PAH values by sample, and the total maximum detected PAH values for NW AEU. Tables A6.24 and A6.25 provide similar information for SW AEU, while Tables A6.26 and A6.27 provide information for WC AEU.

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Table A6.1
Summary of Post-1999 Surface Water ECOI Data in the NW AEU

Analyte	Total Number of Detects	Total Number of Samples	Total Detection Frequency (%)	Range of Reported Detection Limits	Total Minimum Detected Concentration	Total Maximum Detected Concentration	Total Arithmetic Mean Concentration	Total Standard Deviation
Inorganics (mg/L) (Total)								
Aluminum	331	331	100	0.002 - 0.0454	0.00655	217	15.0	23.6
Antimony	236	331	71.3	0.00028 - 0.0036	4.80E-04	0.0315	0.00288	0.00455
Barium	331	331	100	0.00002 - 0.001	1.60E-04	1.42	0.207	0.176
Beryllium	376	500	75.2	0.00002 - 0.001	2.00E-05	0.0118	5.69E-04	0.00107
Boron	1	1	100	0.0083 - 0.0083	0.180	0.180	0.180	N/A
Calcium	331	331	100	0.0016 - 0.52	0.0381	303	65.9	51.2
Cobalt	308	331	93.1	0.00006 - 0.002	1.80E-04	0.0741	0.00449	0.00755
Lithium	326	331	98.5	0.00002 - 0.0228	8.00E-05	0.499	0.0359	0.0457
Magnesium	331	331	100	0.00098 - 0.073	0.00833	74	13.1	10.9
Molybdenum	311	331	94.0	0.0001 - 0.004	3.20E-04	0.0285	0.00293	0.00352
Nitrate / Nitrite	447	475	94.1	0.003 - 10	0.0240	690	76.2	106
Potassium	328	331	99.1	0.00025 - 21.5	0.383	674	14.6	46.0
Selenium	168	331	50.8	0.00055 - 0.005	8.20E-04	0.00530	0.00120	9.23E-04
Silica	1	1	100	0.067 - 0.067	3.70	3.70	3.70	N/A
Sodium	331	331	100	0.0004 - 6	0.0646	6,460	280	605
Strontium	331	331	100	0.00002 - 0.001	2.00E-04	2.05	0.399	0.344
Thallium	25	331	7.55	0.00002 - 0.0081	7.80E-04	0.00520	7.33E-04	5.30E-04
Tin	41	331	12.4	0.00048 - 0.006	5.50E-04	0.00920	7.26E-04	7.75E-04
Titanium	1	1	100	0.00094 - 0.00094	0.00470	0.00470	0.00470	N/A
Uranium	43	273	15.8	0.00002 - 0.0378	5.96E-04	0.0220	0.00267	0.00242
Vanadium	322	331	97.3	0.00002 - 0.00544	1.30E-04	0.434	0.0308	0.0461
Inorganics (mg/L) (Dissolved)								
Arsenic	12	34	35.3	0.00015 - 0.0028	6.40E-04	0.00410	8.54E-04	8.48E-04
Cadmium	54	201	26.9	1.6E-05 - 0.00023	1.60E-05	0.00200	8.85E-05	1.58E-04
Chromium	24	34	70.6	0.00011 - 0.0006	2.70E-04	0.00710	0.00156	0.00189
Copper	19	34	55.9	1.6E-05 - 0.0018	9.70E-04	0.00950	0.00204	0.00231
Iron	19	34	55.9	0.00339 - 0.016	0.00450	2.21	0.253	0.532
Lead	5	34	14.7	1.6E-05 - 0.0012	2.00E-04	0.00562	6.32E-04	0.00122
Manganese	24	34	70.6	0.00002 - 0.00069	6.60E-04	1.18	0.147	0.290
Mercury	3	34	8.82	1.4E-05 - 0.0001	1.40E-05	4.70E-05	3.02E-05	1.72E-05
Nickel	18	34	52.9	4.1E-05 - 0.0034	3.00E-04	0.00500	0.00143	0.00133
Silver	11	201	5.47	5E-06 - 0.0007	1.60E-04	0.0324	3.00E-04	0.00230
Uranium	13	31	41.9	3E-06 - 0.068	0.00231	0.0756	0.0129	0.0173
Zinc	28	34	82.4	3.5E-05 - 0.0065	0.00200	0.150	0.0338	0.0362
Organics (ug/L)								
1,1,1-Trichloroethane	4	63	6.35	0.15 - 5	0.370	2	0.576	0.351
1,1,2,2-Tetrachloroethane	1	63	1.59	0.2 - 5	0.100	0.100	0.517	0.264
1,1,2-Trichloro-1,2,2-trifluoroethane	3	41	7.32	0.11 - 5	7	19.8	2.09	3.87
1,1-Dichloroethane	1	63	1.59	0.16 - 5	0.300	0.300	0.518	0.262
1,1-Dichloroethene	4	63	6.35	0.14 - 10	0.200	3	0.595	0.477
1,3-Dichlorobenzene	1	63	1.59	0.073 - 5	0.820	0.820	0.529	0.263
1,4-Dichlorobenzene	1	63	1.59	0.073 - 5	0.200	0.200	0.517	0.263
2-Butanone	1	38	2.63	0.93 - 100	16	16	4.82	2.10
2-Hexanone	1	42	2.38	0.7 - 50	4	4	4.48	1.09
4-Nitroaniline	1	7	14.3	26 - 56.2	1.10	1.10	21.1	10.2
Acetone	5	39	12.8	1.9 - 100	3	40.8	6.21	6.02
Benzene	1	63	1.59	0.11 - 5	4.70	4.70	0.587	0.587
Benzoic Acid	1	4	25	52.1 - 56.2	17.5	17.5	24.9	4.99
Bromodichloromethane	1	63	1.59	0.15 - 5	0.290	0.290	0.522	0.257
Carbon Disulfide	1	42	2.38	0.19 - 5	0.100	0.100	1.07	0.927
Carbon Tetrachloride	8	63	12.7	0.14 - 10	8.25	310	15.5	58.5
Chloroform	15	63	23.8	0.14 - 10	0.200	120	5.92	22.7
cis-1,2-Dichloroethene	4	43	9.30	0.15 - 10	0.300	2	0.570	0.390
Dimethoate	1	1	100	0.52 - 0.52	0.620	0.620	0.620	N/A
Dimethylphthalate	1	7	14.3	10 - 11.2	0.790	0.790	4.57	1.68
Di-n-butylphthalate	2	7	28.6	10 - 11.2	1.50	2	4.30	1.76
Ethylbenzene	1	63	1.59	0.076 - 5	0.430	0.430	0.519	0.261
Methylene Chloride	10	63	15.9	0.12 - 10	0.100	15	0.850	1.88
PCB-1254	2	9	22.2	0.074 - 0.5	0.260	0.700	0.301	0.150
Tetrachloroethene	5	62	8.06	0.16 - 5	0.230	7	0.752	1.08
Toluene	7	63	11.1	0.15 - 10	0.300	10	0.725	1.28
Trichloroethene	2	63	3.17	0.2 - 5	0.500	0.910	0.530	0.263
Radionuclides (pCi/L)								
Americium-241	663	663	100	0.0045 - 0.463	-0.007	84	0.479	3.76
Gross Alpha	15	15	100	2.09 - 301	0.117	521	57.1	135
Gross Beta	15	15	100	1.4 - 77.8	-3.2	398	39.3	101
Neptunium-237	19	19	100	0.141 - 1.02	-0.263	0.238	-0.00767	0.105
Plutonium-239/240	681	681	100	0.0052 - 0.304	-0.016	259	1.07	11.1
Tritium	130	130	100	160 - 386	-351	575	24.7	148

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Table A6.1
Summary of Post-1999 Surface Water ECOI Data in the NW AEU

Analyte	Total Number of Detects	Total Number of Samples	Total Detection Frequency (%)	Range of Reported Detection Limits	Total Minimum Detected Concentration	Total Maximum Detected Concentration	Total Arithmetic Mean Concentration	Total Standard Deviation
Uranium-233/234	871	871	100	0.006 - 0.437	-0.028	236	4.77	11.1
Uranium-235	871	871	100	0.0041 - 0.414	-0.0614	9.07	0.172	0.406
Uranium-238	871	871	100	0.0089 - 0.437	-0.011	156	3.46	7.31

N/A= Not applicable.

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Table A6.2
Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples) - 2000 - 2005 Data NW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	mg/L	138	NONPARAMETRIC	46	16	GAMMA	45	WRS	1.000	No
Antimony	mg/L	137	NONPARAMETRIC	15	16	NORMAL	26	N/A	N/A	N/A
Arsenic	mg/L	129	NONPARAMETRIC	5	16	GAMMA	35	N/A	N/A	N/A
Barium	mg/L	140	NONPARAMETRIC	68	16	NONPARAMETRIC	100	WRS	1.31E-11	Yes
Beryllium	mg/L	134	NONPARAMETRIC	3	16	GAMMA	18	N/A	N/A	N/A
Cadmium	mg/L	136	NONPARAMETRIC	7	55	NONPARAMETRIC	27	N/A	N/A	N/A
Calcium	mg/L	141	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	5.85E-14	Yes
Chromium	mg/L	136	NONPARAMETRIC	5	16	NONPARAMETRIC	71	N/A	N/A	N/A
Cobalt	mg/L	139	NONPARAMETRIC	4	16	GAMMA	18	N/A	N/A	N/A
Copper	mg/L	138	NONPARAMETRIC	33	16	NONPARAMETRIC	56	WRS	1.000	No
Iron	mg/L	137	LOGNORMAL	80	16	GAMMA	56	WRS	1.000	No
Lead	mg/L	133	NONPARAMETRIC	24	16	GAMMA	15	N/A	N/A	N/A
Lithium	mg/L	134	NONPARAMETRIC	34	16	NORMAL	82	WRS	0.002	Yes
Magnesium	mg/L	141	NONPARAMETRIC	82	16	NONPARAMETRIC	97	WRS	7.10E-12	Yes
Manganese	mg/L	139	LOGNORMAL	81	16	GAMMA	71	WRS	0.994	No
Mercury	mg/L	135	NONPARAMETRIC	7	16	NONPARAMETRIC	9	N/A	N/A	N/A
Molybdenum	mg/L	139	NONPARAMETRIC	14	16	NONPARAMETRIC	65	N/A	N/A	N/A
Nickel	mg/L	134	NONPARAMETRIC	7	16	NONPARAMETRIC	53	N/A	N/A	N/A
Potassium	mg/L	134	NONPARAMETRIC	66	16	GAMMA	97	WRS	2.65E-14	Yes
Selenium	mg/L	133	NONPARAMETRIC	8	16	NORMAL	50	N/A	N/A	N/A
Silver	mg/L	141	NONPARAMETRIC	6	55	NONPARAMETRIC	5	N/A	N/A	N/A
Sodium	mg/L	141	NONPARAMETRIC	99	16	NORMAL	100	WRS	0	Yes
Strontium	mg/L	139	NONPARAMETRIC	76	16	NONPARAMETRIC	97	WRS	1.11E-09	Yes
Thallium	mg/L	134	NONPARAMETRIC	3	14	GAMMA	16	N/A	N/A	N/A
Tin	mg/L	133	NONPARAMETRIC	8	16	LOGNORMAL	6	N/A	N/A	N/A
Uranium	mg/L	N/A	N/A	N/A	11	GAMMA	42	N/A	N/A	N/A
Vanadium	mg/L	139	NONPARAMETRIC	9	16	NONPARAMETRIC	24	N/A	N/A	N/A
Zinc	mg/L	138	NONPARAMETRIC	57	16	NONPARAMETRIC	82	WRS	0.003	Yes
Americium-241	pCi/L	22	NONPARAMETRIC	100	N/A	N/A	100	WRS	0.178	No
Plutonium-239/240	pCi/L	23	NONPARAMETRIC	100	N/A	N/A	100	WRS	0.673	No
Uranium-233/234	pCi/L	27	NONPARAMETRIC	100	16	NORMAL	100	WRS	1.35E-09	Yes
Uranium-235	pCi/L	35	NONPARAMETRIC	100	16	GAMMA	100	WRS	0.001	Yes
Uranium-238	pCi/L	36	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	3.32E-09	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

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Table A6.3

Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data NW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)					
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	>Bkg
Anthracene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Benzo(a)anthracene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Benzo(a)pyrene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Benzyl Alcohol	ug/L	N/A	N/A	N/A	7	NONPARAMETRIC	0	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	ug/L	3	0	17	6	NORMAL	0	N/A	N/A	N/A
Carbon Disulfide	ug/L	N/A	N/A	N/A	42	NONPARAMETRIC	2	N/A	N/A	N/A
Di-n-butylphthalate	ug/L	1	0	6	7	NONPARAMETRIC	29	N/A	N/A	N/A
PCB-1254	ug/L	N/A	N/A	N/A	9	NONPARAMETRIC	22	N/A	N/A	N/A
Phenanthrene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Pyrene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Aluminum	mg/L	166	NONPARAMETRIC	82	331	NONPARAMETRIC	100	WRS	0	Yes
Antimony	mg/L	169	NONPARAMETRIC	10	331	NONPARAMETRIC	71	N/A	N/A	N/A
Arsenic	mg/L	161	NONPARAMETRIC	23	331	LOGNORMAL	91	WRS	0	Yes
Barium	mg/L	172	NONPARAMETRIC	78	331	NONPARAMETRIC	100	WRS	0	Yes
Beryllium	mg/L	167	NONPARAMETRIC	13	500	LOGNORMAL	75	N/A	N/A	N/A
Boron	mg/L	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Cadmium	mg/L	165	NONPARAMETRIC	5	333	NONPARAMETRIC	76	N/A	N/A	N/A
Calcium	mg/L	172	NONPARAMETRIC	100	331	GAMMA	100	WRS	0	Yes
Chromium	mg/L	167	NONPARAMETRIC	29	502	NONPARAMETRIC	94	WRS	1.51E-07	Yes
Cobalt	mg/L	171	NONPARAMETRIC	17	331	LOGNORMAL	93	N/A	N/A	N/A
Copper	mg/L	164	NONPARAMETRIC	46	331	NONPARAMETRIC	99	WRS	0	Yes
Iron	mg/L	172	NONPARAMETRIC	97	331	NONPARAMETRIC	100	WRS	0	Yes
Lead	mg/L	166	NONPARAMETRIC	45	331	LOGNORMAL	89	WRS	0	Yes
Lithium	mg/L	166	NONPARAMETRIC	49	331	NONPARAMETRIC	98	WRS	0	Yes
Magnesium	mg/L	172	NONPARAMETRIC	86	331	NONPARAMETRIC	100	WRS	0	Yes
Manganese	mg/L	171	LOGNORMAL	91	331	LOGNORMAL	100	t-Test_LN	1.51E-08	Yes
Mercury	mg/L	162	NONPARAMETRIC	11	303	NONPARAMETRIC	19	N/A	N/A	N/A
Molybdenum	mg/L	167	NONPARAMETRIC	22	331	NONPARAMETRIC	94	WRS	1.000	No
Nickel	mg/L	167	NONPARAMETRIC	26	331	NONPARAMETRIC	99	WRS	1.71E-04	Yes
Nitrate	mg/L	129	NONPARAMETRIC	61	475	NONPARAMETRIC	94	WRS	0	Yes
Potassium	mg/L	167	NONPARAMETRIC	74	331	NONPARAMETRIC	99	WRS	0	Yes
Selenium	mg/L	162	NONPARAMETRIC	14	331	NONPARAMETRIC	51	N/A	N/A	N/A
Silica	mg/L	90	NONPARAMETRIC	98	1	0	100	WRS	N/A	N/A
Silver	mg/L	170	NONPARAMETRIC	6	330	NONPARAMETRIC	12	N/A	N/A	N/A
Sodium	mg/L	172	NONPARAMETRIC	99	331	NONPARAMETRIC	100	WRS	0	Yes
Strontium	mg/L	168	NONPARAMETRIC	80	331	GAMMA	100	WRS	0	Yes
Thallium	mg/L	166	NONPARAMETRIC	6	331	NONPARAMETRIC	8	N/A	N/A	N/A
Tin	mg/L	161	NONPARAMETRIC	12	331	NONPARAMETRIC	12	N/A	N/A	N/A
Titanium	mg/L	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Total Petroleum Hydrocarbons	mg/L	N/A	N/A	N/A	2	0	0	N/A	N/A	N/A

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Table A6.3
Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data NW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Uranium	mg/L	9	GAMMA	22	273	NONPARAMETRIC	16	N/A	N/A	N/A
Vanadium	mg/L	171	NONPARAMETRIC	34	331	NONPARAMETRIC	97	WRS	0	Yes
Zinc	mg/L	N/A	N/A	74	331	NONPARAMETRIC	96	WRS	0	Yes
Americium-241	pCi/L	101	NONPARAMETRIC	100	663	NONPARAMETRIC	100	WRS	0	Yes
Gross Alpha	pCi/L	87	NONPARAMETRIC	100	15	GAMMA	100	WRS	5.42E-06	Yes
Gross Beta	pCi/L	87	NONPARAMETRIC	100	15	NONPARAMETRIC	100	WRS	2.62E-04	Yes
Neptunium-237	pCi/L	N/A	N/A	N/A	19	NORMAL	100	N/A	N/A	N/A
Plutonium-239/240	pCi/L	107	NONPARAMETRIC	100	681	NONPARAMETRIC	100	WRS	0	Yes
Tritium	pCi/L	96	NONPARAMETRIC	100	130	NONPARAMETRIC	100	WRS	1.000	No
Uranium-233/234	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0	Yes
Uranium-235	pCi/L	74	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	1.08E-08	Yes
Uranium-238	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

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Table A6.4
Summary of Post-1999 Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/L) (Total)										
Aluminum	398	405	98.3	0.002	-	0.0564	0.0110	325	10.2	23.4
Ammonia	894	1024	87.3	0.015	-	1	0.0260	21	1.91	2.91
Antimony	314	405	77.5	0.00028	-	0.0356	4.30E-04	0.108	0.00617	0.0117
Barium	404	405	99.8	0.00002	-	0.0018	0.0159	2.30	0.214	0.227
Beryllium	370	539	68.6	0.00002	-	0.001	2.00E-05	0.0159	4.78E-04	0.00103
Boron	1	1	100	0.0052	-	0.0052	0.0650	0.0650	0.0650	N/A
Calcium	404	405	99.8	0.00008	-	0.52	6.91	1,118	72.5	79.8
Chloride	60	60	100	0.5	-	2.4	1.10	340	108	85.0
Cobalt	336	405	83.0	0.00006	-	0.002	1.70E-04	0.0781	0.00348	0.00755
Cyanide	2	2	100	0.00172	-	0.00172	0.00459	0.0365	0.0205	0.0226
Fluoride	58	60	96.7	0.035	-	0.1	0.0600	9.60	0.444	1.21
Lithium	401	405	99.0	0.00002	-	0.0228	0.00160	1.71	0.0276	0.0902
Magnesium	404	405	99.8	0.00002	-	0.198	0.154	87.9	15.8	14.8
Molybdenum	372	405	91.9	0.00002	-	0.004	2.80E-04	0.606	0.00454	0.0304
Nitrate / Nitrite	1,137	1,169	97.3	0.01	-	6	0.0110	1,200	4.77	40.9
Nitrite	652	655	99.5	0.001	-	0.5	0.0200	6.60	0.707	0.974
Phosphorus	728	729	99.9	0.01	-	0.95	0.150	20	2.26	1.77
Potassium	403	405	99.5	0.0001	-	1.63	0.872	94.8	8.34	8.87
Selenium	158	405	39.0	0.00045	-	0.817	7.10E-04	0.0339	0.00109	0.00185
Silica	1	1	100	0.023	-	0.023	9.30	9.30	9.30	N/A
Silicon	49	49	100	0.00005	-	0.0016	0.0284	36.2	8.87	7.64
Sodium	404	405	99.8	0.00022	-	3.5	1.69	3,240	201	359
Strontium	404	405	99.8	0.00002	-	0.001	0.0320	3.51	0.479	0.474
Sulfate	59	60	98.3	0.1	-	1	3	67	17.8	12.6
Thallium	27	405	6.67	0.00002	-	0.0346	2.00E-04	0.00490	7.19E-04	5.10E-04
Tin	54	398	13.6	0.00002	-	0.007	5.75E-04	0.00680	6.91E-04	6.95E-04
Titanium	1	1	100	0.00097	-	0.00097	0.00960	0.00960	0.00960	N/A
Uranium	53	291	18.2	0.00002	-	0.0378	0.00290	0.0402	0.00340	0.00458
Vanadium	386	405	95.3	0.00002	-	0.00544	1.60E-04	0.527	0.0223	0.0438
Inorganics (mg/L) (Dissolved)										
Arsenic	10	48	20.8	0.000111	-	0.01	3.20E-04	0.0108	9.64E-04	0.00156
Cadmium	79	198	39.9	0.00007	-	0.005	8.00E-05	0.00210	1.58E-04	2.55E-04
Chromium	15	50	30.0	0.00012	-	0.01	2.80E-04	0.00760	6.54E-04	0.00134
Copper	34	48	70.8	0.00008	-	0.025	3.10E-04	0.00710	0.00190	0.00126
Iron	37	48	77.1	0.00111	-	0.1	0.0122	0.990	0.0902	0.160
Lead	6	48	12.5	0.0000682	-	0.003	5.10E-04	0.00160	4.44E-04	3.14E-04
Manganese	46	48	95.8	0.00002	-	0.015	2.00E-04	1.40	0.139	0.282
Mercury	8	48	16.7	0.000023	-	0.0002	6.30E-05	3.10E-04	6.67E-05	6.61E-05
Nickel	29	48	60.4	0.000205	-	0.04	5.20E-04	0.00290	0.00151	0.00136
Silver	27	370	7.30	0.000011	-	0.01	1.40E-05	7.50E-04	9.14E-05	8.79E-05
Uranium	11	34	32.4	0.000015	-	0.068	0.00300	0.0120	0.00795	0.00948
Zinc	43	48	89.6	0.00008	-	0.02	0.00900	0.760	0.0947	0.152
Organics (ug/L)										
1,1,1-Trichloroethane	8	161	4.97	0.15	-	10	0.300	5.50	1.27	1.37
1,1,2-Trichloro-1,2,2-trifluoroethane	5	68	7.35	0.11	-	5	1.31	39	2.51	4.61
1,1-Dichloroethane	6	161	3.73	0.16	-	10	0.180	1.70	1.23	1.31
1,1-Dichloroethene	3	161	1.86	0.14	-	10	0.510	5	1.23	1.33

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Table A6.4
Summary of Post-1999 Surface Water ECOI Data in the SW AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
1,3-Dichlorobenzene	2	157	1.27	0.073	-	11	0.440	0.570	1.10	1.17
1,4-Dichlorobenzene	46	157	29.3	0.073	-	11	0.100	4.10	1.29	1.21
2-Butanone	2	80	2.50	0.93	-	100	0.900	15	5.57	7.35
2-Chloroethyl vinyl ether	7	56	12.5	0	-	5	0	0	1.33	1.11
4-Nitroaniline	1	14	7.14	1.7	-	84	5.30	5.30	24.6	8.01
Acetone	29	79	36.7	1.9	-	100	2	63.1	6.55	9.20
Benzene	2	161	1.24	0.11	-	10	0.100	1	1.20	1.30
Bromodichloromethane	14	161	8.70	0.15	-	10	0.100	0.400	1.19	1.32
Bromoform	1	161	0.621	0.18	-	10	0.100	0.100	1.21	1.31
Butylbenzylphthalate	1	14	7.14	1.6	-	33	1.60	1.60	5.74	3.25
Carbon Tetrachloride	20	161	12.4	0.14	-	10	0.200	18	1.54	2.37
Chloroform	97	161	60.2	0.14	-	10	0.100	17.5	2.24	2.15
Chloromethane	1	161	0.621	0.21	-	10	0.740	0.740	1.37	1.51
cis-1,2-Dichloroethene	15	70	21.4	0.14	-	5	0.150	210	6.97	31.5
Dichlorodifluoromethane	2	150	1.33	0.2	-	10	0.280	0.360	1.10	1.19
Diethylphthalate	1	14	7.14	0.74	-	33	2	2	4.95	0.864
Dimethoate	1	2	50	0.51	-	0.52	67	67	33.6	47.2
Dimethylphthalate	2	14	14.3	0.65	-	33	0.930	3.60	5.58	3.36
Di-n-butylphthalate	2	14	14.3	1	-	33	1	6	4.95	1.17
Methylene Chloride	45	161	28.0	0.12	-	10	0.100	30	1.86	3.12
Naphthalene	1	77	1.30	0.15	-	11	1.10	1.10	1.77	1.47
N-Nitrosomorpholine	1	2	50	10	-	33	1	1	8.75	11.0
Tetrachloroethene	23	157	14.6	0.16	-	10	0.200	44	1.93	4.55
Toluene	39	161	24.2	0.15	-	10	0.100	6	1.21	1.36
trans-1,2-Dichloroethene	1	150	0.667	0.092	-	5	0.700	0.700	0.895	0.861
Trichloroethene	35	161	21.7	0.16	-	10	0.100	66	2.04	6.32
Vinyl Chloride	5	161	3.11	0.09	-	10	0.800	9.70	1.45	1.67
Radionuclide (pCi/L)										
Americium-241	1,006	1,006	100	0.00627	-	0.178	-0.01	15	0.164	0.902
Gross Alpha	128	128	100	0.48	-	15.6	-1.05	16.9	0.866	1.74
Gross Beta	127	127	100	0.15	-	25.7	0.51	18.1	7.24	3.04
Plutonium-239/240	1,013	1,013	100	0.004	-	0.5	-0.023	84.8	0.338	2.91
Tritium	177	177	100	60	-	379	-286.3	400	-2.63	119
Uranium-233/234	851	851	100	0.0061	-	0.559	0.016	17.9	1.15	1.36
Uranium-235	851	851	100	0.0043	-	0.379	-0.0654	0.538	0.0456	0.0551
Uranium-238	851	851	100	0.007	-	0.385	-0.002	16.4	1.12	1.21

N/A= Not applicable.

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Table A6.5

Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples) - 2000 - 2005 Data SW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	mg/L	138	NONPARAMETRIC	46	16	GAMMA	40	WRS	1.000	No
Antimony	mg/L	137	NONPARAMETRIC	15	16	NORMAL	58	N/A	N/A	N/A
Arsenic	mg/L	129	NONPARAMETRIC	5	16	GAMMA	21	N/A	N/A	N/A
Barium	mg/L	140	NONPARAMETRIC	68	16	NONPARAMETRIC	100	WRS	0.00E+00	Yes
Beryllium	mg/L	134	NONPARAMETRIC	3	16	GAMMA	6	N/A	N/A	N/A
Cadmium	mg/L	136	NONPARAMETRIC	7	55	NONPARAMETRIC	40	N/A	N/A	N/A
Calcium	mg/L	141	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	0.00E+00	Yes
Chromium	mg/L	136	NONPARAMETRIC	5	16	NONPARAMETRIC	30	N/A	N/A	N/A
Cobalt	mg/L	139	NONPARAMETRIC	4	16	GAMMA	40	N/A	N/A	N/A
Copper	mg/L	138	NONPARAMETRIC	33	16	NONPARAMETRIC	71	WRS	1.000	No
Iron	mg/L	137	LOGNORMAL	80	16	GAMMA	77	WRS	1.000	No
Lead	mg/L	133	NONPARAMETRIC	24	16	GAMMA	13	N/A	N/A	N/A
Lithium	mg/L	134	NONPARAMETRIC	34	16	NORMAL	98	WRS	0.000	Yes
Magnesium	mg/L	141	NONPARAMETRIC	82	16	NONPARAMETRIC	100	WRS	0.00E+00	Yes
Manganese	mg/L	139	LOGNORMAL	81	16	GAMMA	96	WRS	0.000	Yes
Mercury	mg/L	135	NONPARAMETRIC	7	16	NONPARAMETRIC	17	N/A	N/A	N/A
Molybdenum	mg/L	139	NONPARAMETRIC	14	16	NONPARAMETRIC	85	N/A	N/A	N/A
Nickel	mg/L	134	NONPARAMETRIC	7	16	NONPARAMETRIC	60	N/A	N/A	N/A
Potassium	mg/L	134	NONPARAMETRIC	66	16	GAMMA	100	WRS	1.77E-11	Yes
Selenium	mg/L	133	NONPARAMETRIC	8	16	NORMAL	48	N/A	N/A	N/A
Silver	mg/L	141	NONPARAMETRIC	6	55	NONPARAMETRIC	7	N/A	N/A	N/A
Sodium	mg/L	141	NONPARAMETRIC	99	16	NORMAL	100	WRS	0.00E+00	Yes
Strontium	mg/L	139	NONPARAMETRIC	76	16	NONPARAMETRIC	100	WRS	0.00E+00	Yes
Thallium	mg/L	134	NONPARAMETRIC	3	14	GAMMA	10	N/A	N/A	N/A
Tin	mg/L	133	NONPARAMETRIC	8	16	LOGNORMAL	4	N/A	N/A	N/A
Uranium	mg/L	N/A	N/A	N/A	11	GAMMA	32	N/A	N/A	N/A
Vanadium	mg/L	139	NONPARAMETRIC	9	16	NONPARAMETRIC	46	N/A	N/A	N/A
Zinc	mg/L	138	NONPARAMETRIC	57	16	NONPARAMETRIC	90	WRS	1.81E-13	Yes
Uranium-233/234	pCi/L	27	NONPARAMETRIC	100	16	NORMAL	100	WRS	1.98E-05	Yes
Uranium-235	pCi/L	35	NONPARAMETRIC	100	16	GAMMA	100	WRS	1.51E-03	Yes
Uranium-238	pCi/L	36	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	3.14E-05	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

Table A6.6

Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data SW AEU

Analyte	Units	Statistical Distribution Testing Results: Background			Statistical Distribution Testing Results: NW AEU (excluding background samples)			Background Comparison Test		
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	> Bkg
1,1,2-Trichloro-1,2,2-trifluoroethane	ug/L	N/A	N/A	N/A	N/A	N/A	7	N/A	N/A	N/A
4-Methylphenol	ug/L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	ug/L	3	0	17	6	NORMAL	0	N/A	N/A	N/A
Carbon Disulfide	ug/L	N/A	N/A	N/A	42	NONPARAMETRIC	0	N/A	N/A	N/A
Tetrachloroethene	ug/L	1	0	1	N/A	N/A	15	N/A	N/A	N/A
Trichloroethene	ug/L	4	NORMAL	4	N/A	N/A	22	N/A	N/A	N/A
Aluminum	mg/L	166	NONPARAMETRIC	82	331	NONPARAMETRIC	98	WRS	0	Yes
Ammonia	mg/L	1	0	0	N/A	N/A	87	N/A	N/A	N/A
Antimony	mg/L	169	NONPARAMETRIC	10	331	NONPARAMETRIC	78	N/A	N/A	N/A
Arsenic	mg/L	161	NONPARAMETRIC	23	331	LOGNORMAL	86	WRS	0	Yes
Barium	mg/L	172	NONPARAMETRIC	78	331	NONPARAMETRIC	100	WRS	0	Yes
Beryllium	mg/L	167	NONPARAMETRIC	13	500	LOGNORMAL	69	N/A	N/A	N/A
Boron	mg/L	N/A	N/A	N/A	1	NONPARAMETRIC	100	N/A	N/A	N/A
Cadmium	mg/L	165	NONPARAMETRIC	5	333	NONPARAMETRIC	78	N/A	N/A	N/A
Calcium	mg/L	172	NONPARAMETRIC	100	331	GAMMA	100	WRS	0	Yes
Chloride	mg/L	165	NONPARAMETRIC	95	N/A	N/A	100	WRS	0	Yes
Chromium	mg/L	167	NONPARAMETRIC	29	502	NONPARAMETRIC	84	WRS	0.968	No
Cobalt	mg/L	171	NONPARAMETRIC	17	331	LOGNORMAL	83	N/A	N/A	N/A
Copper	mg/L	164	NONPARAMETRIC	46	331	NONPARAMETRIC	96	WRS	1.15E-12	Yes
Cyanide	mg/L	128	NONPARAMETRIC	5	N/A	N/A	100	N/A	N/A	N/A
Fluoride	mg/L	118	NONPARAMETRIC	95	N/A	N/A	97	WRS	0.981	No
Iron	mg/L	172	NONPARAMETRIC	97	331	NONPARAMETRIC	99	WRS	0	Yes
Lead	mg/L	166	NONPARAMETRIC	45	331	LOGNORMAL	78	WRS	5.31E-11	Yes
Lithium	mg/L	166	NONPARAMETRIC	49	331	NONPARAMETRIC	99	WRS	0	Yes
Magnesium	mg/L	172	NONPARAMETRIC	86	331	NONPARAMETRIC	100	WRS	0	Yes
Manganese	mg/L	171	LOGNORMAL	91	331	LOGNORMAL	100	t-Test_LN	2.78E-09	Yes
Mercury	mg/L	162	NONPARAMETRIC	11	303	NONPARAMETRIC	14	N/A	N/A	N/A
Molybdenum	mg/L	167	NONPARAMETRIC	22	331	NONPARAMETRIC	92	WRS	1.00	No
Nickel	mg/L	167	NONPARAMETRIC	26	331	NONPARAMETRIC	95	WRS	0.992	No
Nitrate	mg/L	129	NONPARAMETRIC	61	475	NONPARAMETRIC	97	WRS	0	Yes
Nitrite	mg/L	77	NONPARAMETRIC	3	N/A	N/A	100	N/A	N/A	N/A
Phosphorus	mg/L	N/A	N/A	N/A	N/A	N/A	100	N/A	N/A	N/A
Potassium	mg/L	167	NONPARAMETRIC	74	331	NONPARAMETRIC	100	WRS	0	Yes
Selenium	mg/L	162	NONPARAMETRIC	14	331	NONPARAMETRIC	39	N/A	N/A	N/A
Silica	mg/L	90	NONPARAMETRIC	98	1	NONPARAMETRIC	100	WRS	N/A	N/A
Silicon	mg/L	1	0	100	N/A	N/A	100	WRS	N/A	N/A
Silver	mg/L	170	NONPARAMETRIC	6	330	NONPARAMETRIC	30	N/A	N/A	N/A
Sodium	mg/L	172	NONPARAMETRIC	99	331	NONPARAMETRIC	100	WRS	0	Yes
Strontium	mg/L	168	NONPARAMETRIC	80	331	GAMMA	100	WRS	2.42E-10	Yes

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Table A6.6

Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data SW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Sulfate	mg/L	165	GAMMA	96	N/A	N/A	98	WRS	0.996	No
Thallium	mg/L	166	NONPARAMETRIC	6	331	NONPARAMETRIC	7	N/A	N/A	N/A
Tin	mg/L	161	NONPARAMETRIC	12	331	NONPARAMETRIC	14	N/A	N/A	N/A
Titanium	mg/L	N/A	N/A	N/A	1	NONPARAMETRIC	100	N/A	N/A	N/A
Total Petroleum Hydrocarbons	mg/L	N/A	N/A	N/A	2	NONPARAMETRIC	0	N/A	N/A	N/A
Uranium	mg/L	9	GAMMA	22	273	NONPARAMETRIC	18	N/A	N/A	N/A
Vanadium	mg/L	171	NONPARAMETRIC	34	331	NONPARAMETRIC	95	WRS	2.02E-05	Yes
Zinc	mg/L	N/A	N/A	74	331	NONPARAMETRIC	97	WRS	0	Yes
Americium-241	pCi/L	101	NONPARAMETRIC	100	663	NONPARAMETRIC	100	WRS	0	Yes
Gross Alpha	pCi/L	87	NONPARAMETRIC	100	15	GAMMA	100	WRS	1.000	No
Gross Beta	pCi/L	87	NONPARAMETRIC	100	15	NONPARAMETRIC	100	WRS	0	Yes
Plutonium-239/240	pCi/L	107	NONPARAMETRIC	100	681	NONPARAMETRIC	100	WRS	0	Yes
Tritium	pCi/L	96	NONPARAMETRIC	100	130	NONPARAMETRIC	100	WRS	1.000	No
Uranium-233/234	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	2.20E-13	Yes
Uranium-235	pCi/L	74	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0.016	Yes
Uranium-238	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

Table A6.7
Summary of Post-1999 Surface Water ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/L) (Total)										
Aluminum	171	177	96.6	0.002	-	0.06	0.0203	415	11.4	39.5
Antimony	66	176	37.5	0.00028	-	0.0014	6.20E-04	0.00260	6.81E-04	4.86E-04
Barium	177	177	100	0.00002	-	0.0008	0.0207	2.56	0.185	0.238
Beryllium	112	220	50.9	0.00002	-	0.00031	3.00E-05	0.0255	5.63E-04	0.00217
Calcium	177	177	100	0.0016	-	0.4	11.4	185	67.7	39.6
Chloride	21	21	100	0.1	-	1	5.10	170	62.4	49.2
Cobalt	133	177	75.1	0.00006	-	0.0023	1.70E-04	0.112	0.00355	0.0108
Fluoride	20	21	95.2	0.03	-	0.1	0.100	0.550	0.325	0.147
Lithium	171	177	96.6	0.00002	-	0.0228	0.00330	0.277	0.0172	0.0258
Magnesium	177	177	100	0.00098	-	0.0636	2.21	51.9	15.4	9.41
Molybdenum	155	177	87.6	0.0002	-	0.0007	4.07E-04	0.0155	0.00187	0.00233
Nitrate / Nitrite	7	7	100	0.01	-	0.2	2.20	5.40	3.91	1.30
Potassium	175	177	98.9	0.0021	-	1.54	0.870	50	4.59	5.24
Selenium	70	177	39.5	0.00064	-	0.0024	6.40E-04	0.00740	0.00109	0.00114
Sodium	177	177	100	0.00038	-	3.5	2.27	1,430	89.5	166
Strontium	177	177	100	0.00002	-	0.0007	0.0538	1.31	0.427	0.267
Sulfate	21	21	100	0.1	-	4	3.90	350	40.2	73.0
Thallium	16	177	9.04	0.00002	-	0.0024	3.64E-04	0.00370	6.90E-04	4.76E-04
Tin	16	177	9.04	0.00048	-	0.0029	8.30E-04	0.00600	6.35E-04	5.32E-04
Vanadium	155	177	87.6	0.00002	-	0.00544	2.20E-04	0.747	0.0228	0.0725
Inorganics (mg/L) (Dissolved)										
Arsenic	2	16	12.5	0.000111	-	0.01	1.70E-04	5.80E-04	7.75E-04	6.23E-04
Cadmium	11	55	20	0.000016	-	0.005	9.00E-05	3.90E-04	8.55E-05	8.76E-05
Chromium	7	16	43.8	0.00012	-	0.01	3.10E-04	0.00830	8.79E-04	0.00199
Copper	10	16	62.5	0.00008	-	0.025	4.90E-04	0.0131	0.00176	0.00306
Iron	10	16	62.5	0.00111	-	0.1	0.00790	0.284	0.0521	0.0806
Lead	2	16	12.5	0.000111	-	0.003	1.40E-04	7.10E-04	4.50E-04	2.90E-04
Manganese	15	16	93.8	0.00002	-	0.015	9.90E-04	0.0130	0.00381	0.00369
Mercury	2	16	12.5	0.000014	-	0.0002	5.20E-05	2.10E-04	4.60E-05	4.77E-05
Nickel	7	16	43.8	0.00022	-	0.04	4.10E-04	9.60E-04	0.00139	0.00235
Silver	3	55	5.45	0.000005	-	0.01	1.50E-04	0.00160	1.59E-04	2.17E-04
Uranium	5	11	45.5	0.000005	-	0.2	0.00330	0.00908	0.0151	0.0137
Zinc	16	16	100	0.00008	-	0.02	0.0440	0.308	0.0791	0.0662
Organics (ug/L)										
1,1,2-Trichloro-1,2,2-trifl	3	22	13.6	0.2	-	5	0.200	0.300	1.52	1.10
Acetone	3	21	14.3	1.9	-	10	3.70	8.70	4.84	1.61
Benzene	2	36	5.56	0.17	-	1	0.100	0.200	0.451	0.125
Bromodichloromethane	1	36	2.78	0.2	-	1	0.960	0.960	0.484	0.129
Bromoform	1	36	2.78	0.2	-	1	1.90	1.90	0.510	0.259
Carbon Tetrachloride	1	36	2.78	0.19	-	1	0.700	0.700	0.476	0.107
Chloroform	9	36	25	0.17	-	1	0.200	21	1.20	3.45
cis-1,2-Dichloroethene	14	31	45.2	0.14	-	2	0.390	3	0.815	0.553
Dichlorodifluoromethane	1	36	2.78	0.22	-	1	0.260	0.260	0.473	0.0789
Methylene Chloride	11	36	30.6	0.12	-	2	0.100	1	0.504	0.193
Tetrachloroethene	18	36	50	0.2	-	2	0.200	40	10.0	12.7
Toluene	7	36	19.4	0.15	-	1	0.100	1.10	0.460	0.171
Trichloroethene	18	36	50	0.16	-	2	0.670	8.81	1.50	1.64
Radionuclides (pCi/L)										
Americium-241	420	420	100	0.00603	-	0.129	-0.012	13.5	0.193	1.00
Gross Alpha	10	10	100	0.436	-	3.18	0.241	5.69	1.97	1.93
Gross Beta	10	10	100	0.568	-	3.35	0.888	11	5.63	3.02
Plutonium-239/240	429	429	100	0.0069	-	0.101	-0.014	119	1.59	9.08
Strontium-89/90	0	0	0		-		N/A	N/A	0	N/A
Tritium	61	61	100	170	-	378	-227	406.9	21.6	137
Uranium-233/234	374	374	100	0.014	-	0.756	0.024	12.2	1.52	1.80
Uranium-235	374	374	100	0.014	-	0.583	-0.096	0.628	0.0650	0.0961
Uranium-238	374	374	100	0.018	-	0.581	-0.00867	30.8	1.95	4.60

N/A= Not applicable.

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Table A6.8
Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples) - 2000 - 2005 Data WC AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	mg/L	138	NONPARAMETRIC	46	16	GAMMA	44	WRS	0.999	No
Antimony	mg/L	137	NONPARAMETRIC	15	16	NORMAL	19	N/A	N/A	N/A
Arsenic	mg/L	129	NONPARAMETRIC	5	16	GAMMA	13	N/A	N/A	N/A
Barium	mg/L	140	NONPARAMETRIC	68	16	NONPARAMETRIC	100	WRS	1.33E-08	Yes
Beryllium	mg/L	134	NONPARAMETRIC	3	16	GAMMA	6	N/A	N/A	N/A
Cadmium	mg/L	136	NONPARAMETRIC	7	55	NONPARAMETRIC	20	N/A	N/A	N/A
Calcium	mg/L	141	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	4.69E-09	Yes
Chromium	mg/L	136	NONPARAMETRIC	5	16	NONPARAMETRIC	44	N/A	N/A	N/A
Cobalt	mg/L	139	NONPARAMETRIC	4	16	GAMMA	6	N/A	N/A	N/A
Copper	mg/L	138	NONPARAMETRIC	33	16	NONPARAMETRIC	63	WRS	1.000	No
Iron	mg/L	137	LOGNORMAL	80	16	GAMMA	63	WRS	1.000	No
Lead	mg/L	133	NONPARAMETRIC	24	16	GAMMA	13	N/A	N/A	N/A
Lithium	mg/L	134	NONPARAMETRIC	34	16	NORMAL	81	WRS	0.003	Yes
Magnesium	mg/L	141	NONPARAMETRIC	82	16	NONPARAMETRIC	94	WRS	2.82E-09	Yes
Manganese	mg/L	139	LOGNORMAL	81	16	GAMMA	94	WRS	1.000	No
Mercury	mg/L	135	NONPARAMETRIC	7	16	NONPARAMETRIC	13	N/A	N/A	N/A
Molybdenum	mg/L	139	NONPARAMETRIC	14	16	NONPARAMETRIC	63	N/A	N/A	N/A
Nickel	mg/L	134	NONPARAMETRIC	7	16	NONPARAMETRIC	44	N/A	N/A	N/A
Potassium	mg/L	134	NONPARAMETRIC	66	16	GAMMA	94	WRS	4.32E-09	Yes
Selenium	mg/L	133	NONPARAMETRIC	8	16	NORMAL	75	N/A	N/A	N/A
Silver	mg/L	141	NONPARAMETRIC	6	55	NONPARAMETRIC	5	N/A	N/A	N/A
Sodium	mg/L	141	NONPARAMETRIC	99	16	NORMAL	100	WRS	1.42E-10	Yes
Strontium	mg/L	139	NONPARAMETRIC	76	16	NONPARAMETRIC	100	WRS	5.40E-09	Yes
Thallium	mg/L	134	NONPARAMETRIC	3	14	GAMMA	14	N/A	N/A	N/A
Tin	mg/L	133	NONPARAMETRIC	8	16	LOGNORMAL	0	N/A	N/A	N/A
Uranium	mg/L	N/A	N/A	N/A	11	GAMMA	45	N/A	N/A	N/A
Vanadium	mg/L	139	NONPARAMETRIC	9	16	NONPARAMETRIC	69	N/A	N/A	N/A
Zinc	mg/L	138	NONPARAMETRIC	57	16	NONPARAMETRIC	100	WRS	1.92E-09	Yes
Strontium-89/90	pCi/L	28	NONPARAMETRIC	100	2	0	100	WRS	0.966	No
Uranium-233/234	pCi/L	27	NONPARAMETRIC	100	16	NORMAL	100	WRS	6.19E-07	Yes
Uranium-235	pCi/L	35	NONPARAMETRIC	100	16	GAMMA	100	WRS	0.002	Yes
Uranium-238	pCi/L	36	NONPARAMETRIC	100	16	NONPARAMETRIC	100	WRS	1.01E-05	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

Table A6.9

Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data WC AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)					
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	> Bkg
Carbon Disulfide	ug/L	N/A	N/A	N/A	42	NONPARAMETRIC	0	N/A	N/A	N/A
Pyrene	ug/L	N/A	N/A	N/A	7	NORMAL	0	N/A	N/A	N/A
Aluminum	mg/L	166	NONPARAMETRIC	82	331	NONPARAMETRIC	97	WRS	2.47E-04	Yes
Antimony	mg/L	169	NONPARAMETRIC	10	331	NONPARAMETRIC	38	N/A	N/A	N/A
Arsenic	mg/L	161	NONPARAMETRIC	23	331	LOGNORMAL	65	WRS	0.261	No
Barium	mg/L	172	NONPARAMETRIC	78	331	NONPARAMETRIC	100	WRS	0	Yes
Beryllium	mg/L	167	NONPARAMETRIC	13	500	LOGNORMAL	51	N/A	N/A	N/A
Cadmium	mg/L	165	NONPARAMETRIC	5	333	NONPARAMETRIC	57	N/A	N/A	N/A
Calcium	mg/L	172	NONPARAMETRIC	100	331	GAMMA	100	WRS	0	Yes
Chloride	mg/L	165	NONPARAMETRIC	95	N/A	N/A	100	WRS	1.29E-05	Yes
Chromium	mg/L	167	NONPARAMETRIC	29	502	NONPARAMETRIC	80	WRS	1.000	No
Cobalt	mg/L	171	NONPARAMETRIC	17	331	LOGNORMAL	75	N/A	N/A	N/A
Copper	mg/L	164	NONPARAMETRIC	46	331	NONPARAMETRIC	94	WRS	0.075	Yes
Fluoride	mg/L	118	NONPARAMETRIC	95	N/A	N/A	95	WRS	0.618	No
Iron	mg/L	172	NONPARAMETRIC	97	331	NONPARAMETRIC	99	WRS	0.002	Yes
Lead	mg/L	166	NONPARAMETRIC	45	331	LOGNORMAL	65	WRS	0.604	No
Lithium	mg/L	166	NONPARAMETRIC	49	331	NONPARAMETRIC	97	WRS	2.32E-10	Yes
Magnesium	mg/L	172	NONPARAMETRIC	86	331	NONPARAMETRIC	100	WRS	0	Yes
Manganese	mg/L	171	LOGNORMAL	91	331	LOGNORMAL	99	t-Test_LN	0.008	Yes
Mercury	mg/L	162	NONPARAMETRIC	11	303	NONPARAMETRIC	15	N/A	N/A	N/A
Molybdenum	mg/L	167	NONPARAMETRIC	22	331	NONPARAMETRIC	88	WRS	1.00	No
Nickel	mg/L	167	NONPARAMETRIC	26	331	NONPARAMETRIC	95	WRS	1.000	No
Nitrate	mg/L	129	NONPARAMETRIC	61	475	NONPARAMETRIC	100	WRS	1.54E-05	Yes
Potassium	mg/L	167	NONPARAMETRIC	74	331	NONPARAMETRIC	99	WRS	0	Yes
Selenium	mg/L	162	NONPARAMETRIC	14	331	NONPARAMETRIC	40	N/A	N/A	N/A
Silver	mg/L	170	NONPARAMETRIC	6	330	NONPARAMETRIC	14	N/A	N/A	N/A
Sodium	mg/L	172	NONPARAMETRIC	99	331	NONPARAMETRIC	100	WRS	0	Yes
Strontium	mg/L	168	NONPARAMETRIC	80	331	GAMMA	100	WRS	0	Yes
Sulfate	mg/L	165	GAMMA	96	N/A	N/A	100	WRS	0.228	No
Thallium	mg/L	166	NONPARAMETRIC	6	331	NONPARAMETRIC	9	N/A	N/A	N/A
Tin	mg/L	161	NONPARAMETRIC	12	331	NONPARAMETRIC	9	N/A	N/A	N/A
Total Petroleum Hydrocarbons	mg/L	N/A	N/A	N/A	2	NONPARAMETRIC	0	N/A	N/A	N/A
Uranium	mg/L	9	GAMMA	22	273	NONPARAMETRIC	25	WRS	0.433	No
Vanadium	mg/L	171	NONPARAMETRIC	34	331	NONPARAMETRIC	88	WRS	0.975	No
Zinc	mg/L	N/A	N/A	74	331	NONPARAMETRIC	77	WRS	6.53E-05	Yes
Americium-241	pCi/L	101	NONPARAMETRIC	100	663	NONPARAMETRIC	100	WRS	2.36E-05	Yes
Gross Alpha	pCi/L	87	NONPARAMETRIC	100	15	GAMMA	100	WRS	0.213	No
Gross Beta	pCi/L	87	NONPARAMETRIC	100	15	NONPARAMETRIC	100	WRS	0.020	Yes
Plutonium-239/240	pCi/L	107	NONPARAMETRIC	100	681	NONPARAMETRIC	100	WRS	2.52E-12	Yes

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Table A6.9
Statistical Distribution and Comparison to Background for Surface Water, Total Analyses (excluding background samples) - 2000 - 2005 Data WC AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)					
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	> Bkg
Tritium	pCi/L	96	NONPARAMETRIC	100	130	NONPARAMETRIC	100	WRS	0.999	No
Uranium-233/234	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	9.66E-15	Yes
Uranium-235	pCi/L	74	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0.001	Yes
Uranium-238	pCi/L	77	NONPARAMETRIC	100	871	NONPARAMETRIC	100	WRS	0	Yes

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 081105_A1.

Table A6.10
Summary of Surface Sediment ECOI Data in the NW AEU

Analyte	Number of Detections	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	68	68	100	1.3 - 200	1,700	26,000	11,395	6,615
Antimony	7	63	11.1	0.22 - 17	0.390	41.4	3.50	6.28
Arsenic	67	68	98.5	0.15 - 10	0.570	11	5.27	2.28
Barium	68	68	100	0.01 - 200	22	260	118	59.4
Beryllium	47	68	69.1	0.01 - 5	0.190	1.50	0.662	0.356
Boron	16	16	100	1 - 5.2	2.90	16	8.61	3.47
Cadmium	29	67	43.3	0.027 - 5	0.0800	4.40	0.722	0.789
Calcium	68	68	100	0.66 - 5,000	950	140,000	13,498	18,662
Cesium	3	47	6.38	4.51 - 1,000	4.40	5.50	29.0	48.8
Chloride	12	17	70.6	25 - 25	48.9	394	105	113
Chromium	66	68	97.1	0.058 - 10	2.20	66.5	13.8	9.03
Chromium VI	6	21	28.6	0.005 - 0.005	0.00500	0.00800	0.00374	0.00209
Cobalt	63	68	92.6	0.06 - 50	1.80	20.1	6.98	3.36
Copper	68	68	100	0.045 - 25	6	77.6	18.0	9.23
Fluoride	12	21	57.1	2.5 - 2.5	2.38	16.7	3.30	3.56
Iron	68	68	100	1.2 - 100	5,050	37,100	15,843	5,915
Lead	68	68	100	0.18 - 3	5.20	234	23.5	27.5
Lithium	53	68	77.9	0.03 - 100	1.80	24	8.41	5.50
Magnesium	68	68	100	0.36 - 5,000	721	6,200	2,994	1,345
Manganese	68	68	100	0.02 - 15	84	1,760	378	318
Mercury	22	64	34.4	0.005 - 0.2	0.0160	0.260	0.0689	0.0460
Molybdenum	22	68	32.4	0.12 - 200	0.330	6.20	1.74	1.26
Nickel	66	68	97.1	0.11 - 40	3.20	31.6	14.3	6.21
Nitrate / Nitrite	16	41	39.0	0.2 - 2.5	0.346	89.3	5.66	14.9
Nitrite	1	17	5.88	2.5 - 2.5	5.61	5.61	1.36	1.17
Potassium	64	68	94.1	1.2 - 5,000	402	4,300	1,853	934
Selenium	21	68	30.9	0.23 - 5	0.450	2.40	0.675	0.578
Silica	16	16	100	1.5 - 23	600	3,300	1,237	687
Silicon	33	33	100	0 - 12	64.9	1,960	651	433
Silver	9	63	14.3	0.071 - 10	0.0980	5	0.761	0.822
Sodium	66	68	97.1	0.32 - 5,000	60.3	2,100	524	407
Strontium	68	68	100	0.01 - 200	5.50	526	65.4	69.4
Sulfate	4	17	23.5	25 - 25	7.98	95.9	20.4	23.8
Thallium	7	67	10.4	0.27 - 10	0.400	1.60	0.419	0.304
Tin	12	66	18.2	0.26 - 200	0.920	15.5	5.42	5.69
Titanium	16	16	100	0.087 - 0.75	36	180	125	42.4
Uranium	1	21	4.76	1 - 39	4.30	4.30	4.96	4.01
Vanadium	68	68	100	0.06 - 50	6.70	59	30.5	12.8
Zinc	68	68	100	0.06 - 20	31.1	704	139	135
Organics (ug/kg)								
1,1,2,2-Tetrachloroethane	1	41	2.44	4.8 - 21	2	2	5.72	2.09
1234678-HpCDF	1	1	100	0.00286 - 0.00286	0.00251	0.00251	0.00251	N/A
123478-HxCDF	1	1	100	0.00286 - 0.00286	0.000566	0.000566	5.66E-04	N/A
123678-HxCDD	1	1	100	0.00286 - 0.00286	0.00122	0.00122	0.00122	N/A
123789-HxCDD	1	1	100	0.00286 - 0.00286	0.00106	0.00106	0.00106	N/A
2-Butanone	4	40	10	7 - 24	9	43	9.48	7.94
2-Methylnaphthalene	5	63	7.94	20 - 2,700	49	2,000	380	365
2-Methylphenol	1	63	1.59	31 - 2,700	200	200	364	294
4,4'-DDT	4	49	8.16	3.5 - 180	2.9	4.9	10.4	14.9
Acenaphthene	18	63	28.6	18 - 2,700	24	620	251	157
Acetone	4	39	10.3	10 - 24	16	230	25.1	43.5
Aldrin	1	48	2.08	1.8 - 89	54	54	6.48	10.2
Anthracene	27	63	42.9	18 - 2,700	20	970	245	200
Benzene	1	41	2.44	3.9 - 21	3	3	5.67	2.09
Benzo(a)anthracene	43	63	68.3	21 - 2,700	26	1,400	297	348
Benzo(a)pyrene	33	63	52.4	21 - 2,700	23	1,300	337	345
Benzo(b)fluoranthene	37	63	58.7	30 - 2,700	25	1,500	346	362
Benzo(g,h,i)perylene	24	63	38.1	17 - 2,700	37	900	311	294
Benzo(k)fluoranthene	26	63	41.3	33 - 2,700	35	1,200	330	323
Benzoic Acid	3	35	8.57	300 - 4,100	180	220	2,030	1,734
bis(2-ethylhexyl)phthalate	34	63	54.0	33 - 2,700	1	1,500	322	272
Butylbenzylphthalate	2	63	3.17	45 - 2,700	34	51	358	299
Carbazole	11	25	44	350 - 2,700	28	300	186	126
Chrysene	44	63	69.8	28 - 2,700	22	1,500	335	379
delta-BHC	1	49	2.04	1.8 - 89	13	13	5.62	7.45
Dibenz(a,h)anthracene	5	63	7.94	20 - 2,700	41	330	337	270
Dibenzofuran	5	63	7.94	21 - 2,700	26	300	358	299

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Table A6.10
Summary of Surface Sediment ECOI Data in the NW AEU

Analyte	Number of Detections	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Di-n-butylphthalate	23	63	36.5	21 - 2,700	31	190	307	319
Di-n-octylphthalate	1	63	1.59	25 - 2,700	45	45	361	296
Endosulfan I	1	49	2.04	1.8 - 89	20	20	5.28	6.79
Fluoranthene	47	63	74.6	23 - 2,700	44	3,100	513	614
Fluorene	14	63	22.2	19 - 2,700	21	650	327	286
Heptachlorodibenzo-p-dioxin	1	1	100	0.00286 - 0.00286	0.0199	0.0199	0.0199	N/A
Indeno(1,2,3-cd)pyrene	25	63	39.7	23 - 2,700	23	890	304	296
Methylene Chloride	1	40	2.50	3.5 - 21	9.3	9.3	8.97	5.15
Naphthalene	6	64	9.38	3.7 - 2,700	95	310	328	267
OCDD	1	1	100	0.00571 - 0.00571	0.161	0.161	0.161	N/A
OCDF	1	1	100	0.00571 - 0.00571	0.00883	0.00883	0.00883	N/A
PCB-1254	20	82	24.4	4.5 - 1,800	7.3	920	125	161
PCB-1260	1	79	1.27	1.5 - 1,800	180	180	113	129
Pentachlorophenol	1	63	1.59	120 - 6,800	39	39	1,516	1,460
Phenanthrene	45	63	71.4	18 - 2,700	26	3,300	440	596
Phenol	1	63	1.59	19 - 2,700	22	22	361	297
Pyrene	41	63	65.1	140 - 2,700	37	3,900	524	658
Tetrachloroethene	1	41	2.44	4.3 - 21	2	2	5.72	2.09
Toluene	6	41	14.6	3.4 - 21	3	31	6.62	4.47
Trichloroethene	3	41	7.32	3.8 - 21	3	13	5.85	2.31
Radionuclides (pCi/g)								
Americium-241	76	76	100	0 - 0.225	-0.0147	6.89	0.507	0.949
Cesium-134	41	41	100	0.03 - 0.2	-0.157	0.200	0.0857	0.0790
Cesium-137	57	57	100	0.03 - 0.2	0.00343	0.610	0.206	0.174
Gross Alpha	54	54	100	2 - 56	-6.20	39.6	18.6	8.89
Gross Beta	58	58	100	2.26 - 21	8.02	39.3	26.6	6.80
Plutonium-239/240	85	85	100	0 - 0.415	0.00200	22.4	1.53	3.04
Radium-226	39	39	100	0.12 - 0.51	-0.340	3.08	1.07	0.818
Radium-228	27	27	100	0.05 - 0.63	0.0400	2.40	1.58	0.437
Strontium-89/90	55	55	100	0.03 - 1	-0.140	1.80	0.258	0.408
Uranium-233/234	76	76	100	0 - 0.779	0.140	3.70	1.38	0.832
Uranium-235	76	76	100	0 - 0.993	-0.0523	0.285	0.0733	0.0619
Uranium-238	76	76	100	0 - 0.709	0.190	6.10	1.76	1.40

N/A= Not applicable.

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Table A6.11
Statistical Distribution and Comparison to Background for Surface Sediments (excluding background samples) for NW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			NW AEU (excluding background samples)					
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	> Background?
Aluminum	mg/kg	55	GAMMA	100	68	GAMMA	100	WRS	9.75E-06	Yes
Antimony	mg/kg	47	LOGNORMAL	11	63	NONPARAMETRIC	11	N/A	N/A	N/A
Arsenic	mg/kg	55	GAMMA	89	68	NORMAL	99	WRS	7.49E-11	Yes
Barium	mg/kg	54	GAMMA	100	68	NORMAL	100	WRS	1.06E-04	Yes
Cadmium	mg/kg	48	LOGNORMAL	10	67	NONPARAMETRIC	43	N/A	N/A	N/A
Chromium	mg/kg	55	GAMMA	85	68	GAMMA	97	WRS	5.88E-05	Yes
Copper	mg/kg	55	GAMMA	80	68	NONPARAMETRIC	100	WRS	6.53E-08	Yes
Fluoride	mg/kg	N/A	N/A	N/A	21	GAMMA	57	N/A	N/A	N/A
Iron	mg/kg	55	GAMMA	100	68	NORMAL	100	WRS	5.23E-08	Yes
Lead	mg/kg	55	LOGNORMAL	100	68	NONPARAMETRIC	100	WRS	1.79E-06	Yes
Manganese	mg/kg	55	GAMMA	100	68	LOGNORMAL	100	WRS	4.12E-05	Yes
Mercury	mg/kg	46	NONPARAMETRIC	4	64	NONPARAMETRIC	34	N/A	N/A	N/A
Nickel	mg/kg	53	GAMMA	72	68	NORMAL	97	WRS	2.71E-10	Yes
Selenium	mg/kg	54	NONPARAMETRIC	28	68	LOGNORMAL	31	WRS	1.49E-04	Yes
Silver	mg/kg	48	NONPARAMETRIC	6	63	NONPARAMETRIC	14	N/A	N/A	N/A
Zinc	mg/kg	55	NONPARAMETRIC	98	68	LOGNORMAL	100	WRS	1.54E-10	Yes
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	63	NONPARAMETRIC	8	N/A	N/A	N/A
4,4'-DDT	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	8	N/A	N/A	N/A
Acenaphthene	ug/kg	N/A	N/A	5	63	NONPARAMETRIC	29	N/A	N/A	N/A
Aldrin	ug/kg	N/A	N/A	N/A	48	NONPARAMETRIC	2	N/A	N/A	N/A
Anthracene	ug/kg	N/A	N/A	9	63	NONPARAMETRIC	43	N/A	N/A	N/A
Aquatic TEQ	ug/kg	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	12	63	LOGNORMAL	68	N/A	N/A	N/A
Benzo(a)pyrene	ug/kg	N/A	N/A	9	63	LOGNORMAL	52	N/A	N/A	N/A
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	5	63	NONPARAMETRIC	38	N/A	N/A	N/A
Benzo(k)fluoranthene	ug/kg	N/A	N/A	7	63	NONPARAMETRIC	41	N/A	N/A	N/A
Carbazole	ug/kg	N/A	N/A	N/A	25	NONPARAMETRIC	44	N/A	N/A	N/A
Chrysene	ug/kg	N/A	N/A	12	63	LOGNORMAL	70	N/A	N/A	N/A
delta-BHC	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	2	63	NONPARAMETRIC	8	N/A	N/A	N/A
Endosulfan I	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
Fluoranthene	ug/kg	N/A	N/A	14	63	LOGNORMAL	75	N/A	N/A	N/A
Fluorene	ug/kg	N/A	N/A	5	63	NONPARAMETRIC	22	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	5	63	NONPARAMETRIC	40	N/A	N/A	N/A
Naphthalene	ug/kg	N/A	N/A	N/A	64	NONPARAMETRIC	9	N/A	N/A	N/A
PCB-1254	ug/kg	N/A	N/A	5	82	NONPARAMETRIC	24	N/A	N/A	N/A
PCB-1260	ug/kg	N/A	N/A	N/A	79	NONPARAMETRIC	1	N/A	N/A	N/A
Phenanthrene	ug/kg	N/A	N/A	9	63	LOGNORMAL	71	N/A	N/A	N/A
Pyrene	ug/kg	N/A	N/A	14	63	NONPARAMETRIC	65	N/A	N/A	N/A
Total Dioxins	ug/kg	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Total PAHs	ug/kg	N/A	N/A	N/A	64	NONPARAMETRIC	77	N/A	N/A	N/A
Total PCBs	ug/kg	N/A	N/A	N/A	82	NONPARAMETRIC	24	N/A	N/A	N/A

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 090105_A1.

Table A6.12
Statistical Concentrations in Surface Sediments (including background samples) for NW AEU

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75th percentile	95th percentile	UCL[a]	UTL[b]	Maximum[c]
Aluminum	mg/kg	68	95% Approximate Gamma UCL	GAMMA	11,395	9,930	14,750	25,000	12,891	25,000	26,000
Antimony	mg/kg	63	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	3.50	0.590	5.48	9.58	8.44	9.60	41.4
Arsenic	mg/kg	68	95% Student's-t UCL	NORMAL	5.27	5.30	6.80	9.16	5.73	8.89	11.0
Barium	mg/kg	68	95% Student's-t UCL	NORMAL	118	119	149	216	130	212	260
Cadmium	mg/kg	67	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.722	0.460	0.745	1.64	1.14	1.65	4.40
Chromium	mg/kg	68	95% Approximate Gamma UCL	GAMMA	13.8	11.4	17.3	25.0	15.6	25.0	66.5
Copper	mg/kg	68	95% Student's-t UCL	NONPARAMETRIC	18.0	16.4	20.8	28.3	19.8	28.4	77.6
Fluoride	mg/kg	21	95% Approximate Gamma UCL	GAMMA	3.30	2.50	3.82	7.39	4.69	16.7	16.7
Iron	mg/kg	68	95% Student's-t UCL	NORMAL	15,843	15,050	19,300	24,000	17,040	25,226	37,100
Lead	mg/kg	68	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	23.5	19.1	24.8	39.5	38.0	40.6	234
Manganese	mg/kg	68	95% H-UCL	LOGNORMAL	378	320	411	1,012	433	839	1,760
Mercury	mg/kg	64	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.069	0.057	0.077	0.159	0.094	0.160	0.260
Nickel	mg/kg	68	95% Student's-t UCL	NORMAL	14.3	14.1	19.1	24.5	15.6	24.2	31.6
Selenium	mg/kg	68	95% H-UCL	LOGNORMAL	0.675	0.441	0.955	1.87	0.842	1.80	2.40
Silver	mg/kg	63	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.761	0.560	0.805	1.89	1.41	1.90	5.00
Zinc	mg/kg	68	95% H-UCL	LOGNORMAL	139	95.6	165	406	158	318	704
2-Methylnaphthalene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	380	250	393	1,300	580	1,350	2,000
4,4'-DDT	ug/kg	49	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	10.4	8.50	12.5	21.2	19.7	24.0	90.0
Acenaphthene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	251	235	280	500	337	500	900
Aldrin	ug/kg	48	99% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	6.48	5.50	6.50	23.7	21.2	30.0	54.0
Anthracene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	245	220	280	680	355	700	970
Aquatic TEQ	ug/kg	1	Too Few Observations To Calculate UCLs	0	1.41E-04	1.41E-04	1.41E-04	1.41E-04	N/A	N/A	1.41E-04
Benzo(a)anthracene	ug/kg	63	95% H-UCL	LOGNORMAL	297	205	295	1,075	383	851	1,750
Benzo(a)pyrene	ug/kg	63	95% H-UCL	LOGNORMAL	337	240	360	1,172	439	965	1,750
Benzo(g,h,i)perylene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	311	235	323	845	473	850	1,750
Benzo(k)fluoranthene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	330	240	345	1,075	507	1,100	1,750
Carbazole	ug/kg	25	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	186	190	230	445	296	500	500
Chrysene	ug/kg	63	95% H-UCL	LOGNORMAL	335	225	353	1,300	432	957	1,750
delta-BHC	ug/kg	49	99% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	5.62	5.50	6.50	12.6	16.2	13.0	44.5
Dibenz(a,h)anthracene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	337	245	353	770	486	800	1,750
Endosulfan I	ug/kg	49	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	5.28	5.50	6.50	11.0	9.51	12.0	44.5
Fluoranthene	ug/kg	63	95% H-UCL	LOGNORMAL	513	300	528	1,725	650	1,445	3,100
Fluorene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	327	245	385	785	484	800	1,750
Indeno(1,2,3-cd)pyrene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	304	230	323	845	466	850	1,750
Naphthalene	ug/kg	64	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	328	248	351	755	474	800	1,750
PCB-1254	ug/kg	82	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	125	105	135	264	235	265	920
PCB-1260	ug/kg	79	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	113	105	135	261	204	260	900
Phenanthrene	ug/kg	63	95% H-UCL	LOGNORMAL	440	240	375	1,725	559	1,258	3,300
Pyrene	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	524	350	493	1,745	885	1,750	3,900
Total Dioxins	ug/kg	1	Too Few Observations To Calculate UCLs	0	0.208	0.208	0.208	0.208	N/A	N/A	0.208
Total PAHs	ug/kg	64	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	3,300	2,193	3,004	11,013	5,846	11,040	16,410
Total PCBs	ug/kg	82	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	125	105	135	264	235	265	920

[a] UCL = 95% upper confidence limit on the mean; [b] UTL = 95% upper confidence limit on the 90th percentile value, [c] Maximum = maximum proxy result; may not be a detect.
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Table A6.13
Summary of Surface Sediment ECOI Data in the SW AEU

Analyte	NumDetects	NumSamples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	92.0	92.0	100	0.740 - 200	763	29,000	7,882	6,311
Antimony	23.0	91.0	25.3	0.170 - 60.0	0.270	15.9	2.74	3.30
Arsenic	85.0	91.0	93.4	0.150 - 10.0	0.690	21.6	3.93	2.89
Barium	92.0	92.0	100	0.0200 - 200	7.20	220	82.3	54.9
Beryllium	67.0	92.0	72.8	0.00900 - 5.00	0.110	2.10	0.505	0.400
Boron	18.0	21.0	85.7	0.390 - 2.40	1.20	30.0	5.66	6.45
Cadmium	43.0	92.0	46.7	0.0300 - 5.00	0.0360	6.20	0.609	0.771
Calcium	92.0	92.0	100	0.570 - 5,000	653	82,300	10,600	12,909
Cesium	9.00	49.0	18.4	2.00 - 1,000	1.80	13.6	9.59	14.7
Chloride	10.0	13.0	76.9	25.0 - 25.0	13.0	206	58.4	65.1
Chromium	85.0	92.0	92.4	0.0590 - 10.0	1.90	49.0	13.6	8.47
Chromium VI	6.00	16.0	37.5	0.00500 - 0.00500	0.00500	0.0130	0.00431	0.00295
Cobalt	78.0	92.0	84.8	0.0800 - 50.0	1.60	10.8	4.83	2.87
Copper	86.0	92.0	93.5	0.0480 - 25.0	4.30	324	19.1	33.6
Cyanide	1.00	5.00	20.0	0.160 - 0.190	0.230	0.230	0.161	0.0393
Fluoride	8.00	16.0	50.0	2.50 - 2.50	0.831	9.27	2.41	2.67
Iron	92.0	92.0	100	1.00 - 100	1,680	24,000	11,016	4,873
Lead	92.0	92.0	100	0.170 - 4.00	2.90	170	28.0	26.3
Lithium	75.0	92.0	81.5	0.00900 - 100	1.60	23.5	6.49	4.50
Magnesium	92.0	92.0	100	0.620 - 5,000	263	22,900	2,480	2,442
Manganese	92.0	92.0	100	0.00900 - 15.0	39.1	410	183	82.6
Mercury	20.0	73.0	27.4	0.00130 - 0.212	0.0170	0.150	0.0479	0.0296
Molybdenum	31.0	92.0	33.7	0.0800 - 200	0.260	7.70	1.29	1.22
Nickel	85.0	92.0	92.4	0.0800 - 40.0	2.90	216	13.2	22.7
Nitrate / Nitrite	12.0	29.0	41.4	0.200 - 2.50	0.157	12.9	1.78	2.64
Potassium	90.0	92.0	97.8	1.90 - 5,000	321	3,900	1,362	787
Selenium	12.0	91.0	13.2	0.140 - 5.00	0.330	1.80	0.425	0.286
Silica	21.0	21.0	100	2.80 - 11.0	259	2,000	873	432
Silicon	21.0	21.0	100	0 - 11.8	79.2	836	380	189
Silver	20.0	90.0	22.2	0.0610 - 10.0	0.160	39.3	1.67	5.33
Sodium	79.0	92.0	85.9	0.230 - 5,000	62.7	2,240	412	372
Strontium	92.0	92.0	100	0.00680 - 200	4.60	150	35.9	29.9
Sulfate	6.00	13.0	46.2	25.0 - 25.0	3.81	25.9	12.4	6.05
Thallium	12.0	92.0	13.0	0.250 - 10.0	0.300	1.20	0.378	0.208
Tin	9.00	92.0	9.78	0.180 - 200	1.50	39.5	3.53	5.47
Titanium	21.0	21.0	100	0.0820 - 0.350	57.0	330	153	64.9
Vanadium	84.0	92.0	91.3	0.0600 - 50.0	2.30	63.0	21.8	12.8
Zinc	92.0	92.0	100	0.0400 - 20.0	18.6	888	180	186
Organics (ug/kg)								
1,1-Dichloroethene	1.00	60.0	1.67	5.00 - 1,300	2.00	2.00	14.6	83.4
1,2,3-Trichlorobenzene	1.00	24.0	4.17	5.00 - 8.00	2.00	2.00	2.30	1.19
1,2,4-Trichlorobenzene	1.00	73.0	1.37	5.00 - 690	2.00	2.00	227	281
2-Butanone	4.00	61.0	6.56	6.00 - 1,300	3.00	38.0	27.8	116
2-Methylnaphthalene	1.00	55.0	1.82	31.0 - 720	41.0	41.0	322	273
4,4'-DDE	1.00	44.0	2.27	1.80 - 26.0	4.10	4.10	7.60	4.52
4-Methylphenol	1.00	55.0	1.82	23.0 - 720	47.0	47.0	319	273
Acenaphthene	11.0	55.0	20.0	28.0 - 720	26.0	180	217	133
Acetone	5.00	61.0	8.20	6.00 - 1,300	11.0	210	34.9	118
Anthracene	18.0	55.0	32.7	26.0 - 720	19.0	430	213	143
Benzo(a)anthracene	33.0	55.0	60.0	27.0 - 720	25.0	1,400	294	344
Benzo(a)pyrene	28.0	55.0	50.9	33.0 - 720	41.0	1,300	319	329
Benzo(b)fluoranthene	32.0	55.0	58.2	32.0 - 720	37.0	1,500	329	376
Benzo(g,h,i)perylene	24.0	55.0	43.6	26.0 - 720	43.0	1,100	302	304
Benzo(k)fluoranthene	29.0	55.0	52.7	35.0 - 720	31.0	920	287	299
Benzoic Acid	3.00	39.0	7.69	320 - 2,700	240	1,400	1,660	1,662
beta-BHC	1.00	44.0	2.27	1.80 - 13.0	28.0	28.0	4.40	4.28
bis(2-ethylhexyl)phthalate	38.0	55.0	69.1	51.0 - 720	28.0	8,800	625	1,328
Bromomethane	6.00	61.0	9.84	5.00 - 1,300	2.00	5.00	26.2	116
Butylbenzylphthalate	8.00	55.0	14.5	36.0 - 720	21.0	1,700	324	337
Carbazole	6.00	16.0	37.5	350 - 690	25.0	290	186	85.4
Carbon Tetrachloride	2.00	61.0	3.28	5.00 - 1,300	390	440	17.3	74.0
Chloroform	5.00	61.0	8.20	5.00 - 1,300	1.00	2.00	24.9	116
Chrysene	36.0	55.0	65.5	31.0 - 720	23.0	1,400	307	348
Dibenz(a,h)anthracene	13.0	55.0	23.6	27.0 - 720	21.0	360	282	274

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Table A6.13
Summary of Surface Sediment ECOI Data in the SW AEU

Analyte	NumDetects	NumSamples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Dibenzofuran	3.00	55.0	5.45	33.0	-	720	20.0	65.0	316	277
Dieldrin	1.00	44.0	2.27	3.00	-	26.0	4.60	4.60	7.61	4.51
Diethylphthalate	1.00	55.0	1.82	34.0	-	720	53.0	53.0	322	272
Dimethylphthalate	4.00	55.0	7.27	30.0	-	720	75.0	490	310	275
Di-n-butylphthalate	15.0	55.0	27.3	23.0	-	720	28.0	220	293	290
Di-n-octylphthalate	13.0	55.0	23.6	39.0	-	720	21.0	9,800	693	1,466
Ethylbenzene	2.00	61.0	3.28	5.00	-	1,300	1.40	9.00	25.2	116
Fluoranthene	40.0	55.0	72.7	25.0	-	720	33.0	2,700	471	565
Fluorene	9.00	55.0	16.4	30.0	-	720	21.0	180	295	278
Heptachlor epoxide	1.00	44.0	2.27	1.80	-	13.0	33.0	33.0	4.80	5.36
Hexachlorobutadiene	1.00	73.0	1.37	5.00	-	690	2.00	2.00	227	281
Indeno(1,2,3-cd)pyrene	28.0	55.0	50.9	25.0	-	720	30.0	910	269	298
Methoxychlor	1.00	44.0	2.27	0.940	-	130	2.70	2.70	37.7	23.1
Methylene Chloride	18.0	61.0	29.5	5.00	-	1,300	2.00	420	23.6	73.7
Naphthalene	4.00	73.0	5.48	5.00	-	690	2.00	59.0	223	282
PCB-1254	17.0	67.0	25.4	6.50	-	430	27.0	1,700	128	230
PCB-1260	5.00	67.0	7.46	1.60	-	430	53.0	2,000	119	250
Pentachlorophenol	3.00	55.0	5.45	73.0	-	2,700	420	1,100	1,359	1,463
Phenanthrene	35.0	55.0	63.6	28.0	-	720	35.0	1,800	356	396
Phenol	1.00	55.0	1.82	30.0	-	720	110	110	322	272
Pyrene	36.0	55.0	65.5	43.0	-	720	20.0	1,700	410	411
Tetrachloroethene	3.00	61.0	4.92	5.00	-	1,300	3.00	7.00	25.1	116
Toluene	9.00	60.0	15.0	5.00	-	1,300	3.00	82.0	18.6	84.0
Trichlorofluoromethane	12.0	24.0	50.0	5.00	-	8.00	1.00	5.00	2.19	1.17
Xylene	3.00	61.0	4.92	5.00	-	1,300	6.00	68.0	26.4	116
Radionuclides (pCi/g)										
Americium-241	140	140	100	0	-	0.564	-0.0140	1.83	0.226	0.373
Cesium-134	34.0	34.0	100	0.0185	-	0.200	-0.201	0.200	0.0521	0.0997
Cesium-137	42.0	42.0	100	0.0190	-	0.200	0.00400	0.959	0.124	0.149
Gross Alpha	50.0	50.0	100	2.00	-	56.0	6.50	160	20.1	22.1
Gross Beta	50.0	50.0	100	1.94	-	21.0	22.0	125	31.9	15.6
Plutonium-239/240	141	141	100	0	-	0.241	-0.0160	10.1	0.565	1.31
Radium-226	29.0	29.0	100	0.160	-	0.625	-9.84	1.59	0.185	1.98
Radium-228	21.0	21.0	100	0.0710	-	0.610	0.888	2.08	1.40	0.329
Strontium-89/90	40.0	40.0	100	0.0100	-	1.18	-0.110	1.06	0.102	0.206
Uranium-233/234	110	110	100	0.00480	-	0.306	0.294	9.81	1.10	0.949
Uranium-235	110	110	100	0	-	0.328	-0.0140	0.852	0.0628	0.0889
Uranium-238	110	110	100	0	-	0.339	0	59.0	1.66	5.58

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Table A6.14
Statistical Distribution and Comparison to Background for Surface Sediments (excluding background samples) for SW AEU

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			SW AEU (excluding background samples)			Test	1 - p	> Background?
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	mg/kg	55	GAMMA	100	92	LOGNORMAL	100	WRS	0.119	No
Antimony	mg/kg	47	LOGNORMAL	11	91	NONPARAMETRIC	25	N/A	N/A	N/A
Arsenic	mg/kg	55	GAMMA	89	91	GAMMA	93	WRS	1.00E-04	Yes
Barium	mg/kg	54	GAMMA	100	92	NONPARAMETRIC	100	WRS	0.264	No
Cadmium	mg/kg	48	LOGNORMAL	10	92	NONPARAMETRIC	47	N/A	N/A	N/A
Chromium	mg/kg	55	GAMMA	85	92	GAMMA	92	WRS	6.33E-05	Yes
Copper	mg/kg	55	GAMMA	80	92	NONPARAMETRIC	93	WRS	3.34E-05	Yes
Fluoride	mg/kg	N/A	N/A	N/A	16	NONPARAMETRIC	50	N/A	N/A	N/A
Iron	mg/kg	55	GAMMA	100	92	NORMAL	100	WRS	0.014	Yes
Lead	mg/kg	55	LOGNORMAL	100	92	LOGNORMAL	100	t-Test_LN	7.97E-05	Yes
Nickel	mg/kg	53	GAMMA	72	92	NONPARAMETRIC	92	WRS	4.15E-05	Yes
Selenium	mg/kg	54	NONPARAMETRIC	28	91	LOGNORMAL	13	N/A	N/A	N/A
Silver	mg/kg	48	NONPARAMETRIC	6	90	NONPARAMETRIC	22	N/A	N/A	N/A
Zinc	mg/kg	55	NONPARAMETRIC	98	92	LOGNORMAL	100	WRS	9.40E-12	Yes
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	55	NONPARAMETRIC	2	N/A	N/A	N/A
4,4'-DDE	ug/kg	N/A	N/A	N/A	44	NONPARAMETRIC	2	N/A	N/A	N/A
4-Methylphenol	ug/kg	N/A	N/A	16	55	NONPARAMETRIC	2	N/A	N/A	N/A
Acenaphthene	ug/kg	N/A	N/A	5	55	NONPARAMETRIC	20	N/A	N/A	N/A
Anthracene	ug/kg	N/A	N/A	9	55	NONPARAMETRIC	33	N/A	N/A	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	12	55	NONPARAMETRIC	60	N/A	N/A	N/A
Benzo(a)pyrene	ug/kg	N/A	N/A	9	55	LOGNORMAL	51	N/A	N/A	N/A
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	5	55	NONPARAMETRIC	44	N/A	N/A	N/A
Benzo(k)fluoranthene	ug/kg	N/A	N/A	7	55	NONPARAMETRIC	53	N/A	N/A	N/A
Bromomethane	ug/kg	N/A	N/A	N/A	61	NONPARAMETRIC	10	N/A	N/A	N/A
Carbazole	ug/kg	N/A	N/A	N/A	16	NORMAL	38	N/A	N/A	N/A
Chrysene	ug/kg	N/A	N/A	12	55	LOGNORMAL	65	N/A	N/A	N/A
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	2	55	NONPARAMETRIC	24	N/A	N/A	N/A
Fluoranthene	ug/kg	N/A	N/A	14	55	NONPARAMETRIC	73	N/A	N/A	N/A
Fluorene	ug/kg	N/A	N/A	5	55	NONPARAMETRIC	16	N/A	N/A	N/A
Heptachlor epoxide	ug/kg	N/A	N/A	N/A	44	NONPARAMETRIC	2	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	5	55	NONPARAMETRIC	51	N/A	N/A	N/A
PCB-1254	ug/kg	N/A	N/A	5	67	NONPARAMETRIC	25	N/A	N/A	N/A
PCB-1260	ug/kg	N/A	N/A	N/A	67	NONPARAMETRIC	7	N/A	N/A	N/A
Pentachlorophenol	ug/kg	N/A	N/A	N/A	55	NONPARAMETRIC	5	N/A	N/A	N/A
Phenanthrene	ug/kg	N/A	N/A	9	55	LOGNORMAL	64	N/A	N/A	N/A
Pyrene	ug/kg	N/A	N/A	14	55	NONPARAMETRIC	65	N/A	N/A	N/A
Total PAHs	ug/kg	N/A	N/A	N/A	73	NONPARAMETRIC	58	N/A	N/A	N/A
Total PCBs	ug/kg	N/A	N/A	N/A	67	NONPARAMETRIC	30	N/A	N/A	N/A

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data.

CRA Dataset ID: 090105_A1.

, N/A = not applicable; site and/or background detection frequency less than 20%.

Table A6.15
Statistical Concentrations in Surface Sediments (including background samples) for SW AEU

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75th percentile	95th percentile	UCL[a]	UTL[b]	Maximum[c]
Aluminum	mg/kg	92	95% H-UCL	LOGNORMAL	7,882	6,685	10,350	20,670	9,763	20,794	29,000
Antimony	mg/kg	91	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2.74	1.65	3.93	9.88	4.90	9.75	15.9
Arsenic	mg/kg	91	95% Approximate Gamma UCL	GAMMA	3.93	3.90	4.85	8.25	4.46	8.20	21.6
Barium	mg/kg	92	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	82.3	72.9	120	173	107	167	220
Cadmium	mg/kg	92	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.609	0.393	0.700	1.75	1.11	1.70	6.20
Chromium	mg/kg	92	95% Approximate Gamma UCL	GAMMA	13.6	11.8	18.3	27.9	15.3	27.0	49.0
Copper	mg/kg	92	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	19.1	14.1	18.8	36.0	34.4	33.0	324
Fluoride	mg/kg	16	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2.41	1.25	2.74	8.83	5.32	9.27	9.27
Iron	mg/kg	92	95% Student's-t UCL	NORMAL	11,016	10,900	14,425	19,845	11,860	18,512	24,000
Lead	mg/kg	92	95% H-UCL	LOGNORMAL	28.0	20.2	31.7	79.2	32.9	68.2	170
Nickel	mg/kg	92	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	13.2	10.2	15.0	21.0	23.5	20.9	216
Selenium	mg/kg	91	95% H-UCL	LOGNORMAL	0.425	0.345	0.485	0.940	0.473	0.866	1.80
Silver	mg/kg	90	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1.67	0.467	1.10	3.13	5.18	3.10	39.3
Zinc	mg/kg	92	95% H-UCL	LOGNORMAL	180	124	211	654	215	462	888
2-Methylnaphthalene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	322	230	368	715	482	750	1,800
4,4'-DDE	ug/kg	44	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	7.60	9.25	11.5	13.0	10.6	13.5	14.5
4-Methylphenol	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	319	225	368	715	480	750	1,800
Acenaphthene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	217	200	245	353	295	360	900
Anthracene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	213	200	250	381	297	430	900
Benzo(a)anthracene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	294	200	283	1,130	496	1,200	1,800
Benzo(a)pyrene	ug/kg	55	95% H-UCL	LOGNORMAL	319	220	310	1,060	383	800	1,800
Benzo(g,h,i)perylene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	302	220	293	841	480	1,100	1,800
Benzo(k)fluoranthene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	287	205	283	766	463	920	1,800
Bromomethane	ug/kg	61	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	26.2	5.50	6.50	10.5	119	10.5	650
Carbazole	ug/kg	16	95% Student's-t UCL	NORMAL	186	200	226	304	224	360	345
Chrysene	ug/kg	55	95% H-UCL	LOGNORMAL	307	205	305	1,200	389	849	1,800
Dibenz(a,h)anthracene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	282	220	278	595	443	700	1,800
Fluoranthene	ug/kg	55	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	471	240	570	1,800	947	1,800	2,700
Fluorene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	295	220	353	630	458	700	1,800
Heptachlor epoxide	ug/kg	44	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	4.80	4.78	6.00	7.00	8.33	18.5	33.0
Indeno(1,2,3-cd)pyrene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	269	200	268	763	444	910	1,800
PCB-1254	ug/kg	67	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	128	91.0	120	304	304	340	1,700
PCB-1260	ug/kg	67	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	119	95.0	123	211	310	215	2,000
Pentachlorophenol	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	1,359	1,000	1,375	3,575	2,219	3,750	9,000
Phenanthrene	ug/kg	55	95% H-UCL	LOGNORMAL	356	220	388	1,260	464	1,027	1,800
Pyrene	ug/kg	55	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	410	245	540	1,330	756	1,400	1,800
Total PAHs	ug/kg	73	99% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	2,230	1,769	2,575	7,679	5,342	9,015	15,300
Total PCBs	ug/kg	67	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	247	190	250	648	600	735	3,700

[a] UCL = 95% upper confidence limit on the mean; [b] UTL = 95% upper confidence limit on the 90th percentile value, [c] Maximum = maximum proxy result; may not be a detect.
CRA Dataset ID: 090105_A1.

Table A6.16
Summary of Surface Sediment ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)										
Aluminum	78	78	100	4.1	-	200	1,140	31,000	10,727	6,632
Antimony	7	73	9.59	0.39	-	60	0.820	51.3	6.26	9.36
Arsenic	76	78	97.4	0.12	-	10	0.480	27.9	4.93	3.79
Barium	77	78	98.7	0.14	-	200	14.6	404	132	79.0
Beryllium	54	75	72	0.066	-	5	0.110	6.70	0.737	0.814
Boron	10	10	100	1.1	-	2.3	4.60	14	8.67	2.76
Cadmium	21	74	28.4	0.028	-	5	0.130	3.60	0.645	0.585
Calcium	78	78	100	2.9	-	5,000	673	48,200	10,129	10,174
Cesium	10	62	16.1	2	-	1,000	0.680	5.20	32.5	31.9
Chromium	77	78	98.7	0.21	-	10	1.50	70.1	12.6	9.27
Chromium VI	1	4	25	0.005	-	0.005	0.0120	0.0120	0.00488	0.00475
Cobalt	74	77	96.1	0.11	-	50	1.30	13.1	7.00	3.20
Copper	73	78	93.6	0.063	-	25	2.20	212	22.2	31.4
Fluoride	1	4	25	2.5	-	2.5	20.3	20.3	5.93	9.58
Iron	78	78	100	0.68	-	100	2,660	38,800	15,487	7,628
Lead	78	78	100	0.29	-	6.6	2.60	118	25.6	18.0
Lithium	64	75	85.3	0.34	-	100	1.70	28	8.54	5.50
Magnesium	78	78	100	4.2	-	5,000	448	6,600	2,697	1,510
Manganese	78	78	100	0.089	-	15	53	1,580	309	222
Mercury	17	76	22.4	0.0053	-	0.339	0.0150	3.80	0.156	0.478
Molybdenum	23	76	30.3	0.3	-	200	0.560	11.7	2.13	2.02
Nickel	66	78	84.6	0.27	-	40	2.20	33	13.1	7.47
Nitrate / Nitrite	42	58	72.4	0.02	-	7.4	0.429	32	3.24	5.72
Potassium	68	77	88.3	47	-	5,000	276	4,200	1,590	946
Selenium	29	71	40.8	0.2	-	5	0.300	3.80	0.622	0.628
Silica	10	10	100	5	-	11	720	1,600	1,189	327
Silicon	43	43	100	0	-	32.3	83.8	1,890	452	395
Silver	11	74	14.9	0.11	-	10	0.850	7.70	0.910	1.15
Sodium	67	76	88.2	5.27	-	5,000	36.6	2,060	210	264
Strontium	77	78	98.7	0.073	-	400	4.80	167	53.2	37.1
Thallium	12	73	16.4	0.26	-	10	0.230	10	0.615	1.43
Tin	21	77	27.3	0.98	-	200	3.40	77.2	10.9	13.9
Titanium	10	10	100	0.12	-	0.33	53	300	166	77.4
Vanadium	78	78	100	0.58	-	50	4.90	68.6	28.1	13.7
Zinc	78	78	100	0.4	-	20	10.6	2,080	149	277
Organics (ug/kg)										
1234678-HpCDF	1	1	100	0.00271	-	0.00271	8.07E-04	8.07E-04	8.07E-04	N/A
2,4-Dinitrophenol	1	52	1.92	220	-	4,100	890	890	1,512	867
2-Butanone	7	48	14.6	10	-	82	3	380	20.0	58.5
2-Methylnaphthalene	1	55	1.82	35	-	820	110	110	316	179
4,4'-DDT	1	55	1.82	3.8	-	200	18	18	16.5	16.2
4,6-Dinitro-2-methylphenol	1	54	1.85	290	-	4,100	750	750	1,493	856
4-Methyl-2-pentanone	1	49	2.04	10	-	25	3	3	7.62	2.31
4-Methylphenol	4	55	7.27	26	-	820	68	510	311	186
Acenaphthene	3	55	5.45	31	-	820	74	510	293	146
Acetone	14	53	26.4	10	-	82	9	890	50.1	132
Aldrin	2	55	3.64	1.9	-	99	0	0	8.14	8.79
alpha-Chlordane	2	55	3.64	1.9	-	990	0	0	80.4	88.7
Anthracene	5	55	9.09	31	-	820	90	470	296	147
Benzo(a)anthracene	9	55	16.4	36	-	820	22	1,200	293	214
Benzo(a)pyrene	7	55	12.7	36	-	820	37	970	303	200
Benzo(b)fluoranthene	6	55	10.9	97	-	820	84	1,500	315	232
Benzo(g,h,i)perylene	4	55	7.27	29	-	820	45	630	310	182
Benzo(k)fluoranthene	5	55	9.09	73	-	820	72	690	307	183
Benzoic Acid	3	50	6	510	-	3,900	240	660	1,506	900
beta-BHC	2	55	3.64	1.9	-	99	0	0	8.14	8.79
bis(2-ethylhexyl)phthalate	30	56	53.6	57	-	1,200	49	2,600	389	476
Butylbenzylphthalate	3	56	5.36	78	-	1,200	57	210	309	183
Chrysene	12	56	21.4	49	-	1,200	41	1,200	288	211
delta-BHC	2	55	3.64	1.9	-	99	0	0	8.14	8.79
Dibenz(a,h)anthracene	2	55	3.64	35	-	820	220	530	315	172
Dibenzofuran	1	55	1.82	36	-	820	230	230	318	177
Diethylphthalate	1	56	1.79	47	-	1,200	79	79	313	179
Di-n-butylphthalate	13	56	23.2	53	-	1,200	39	390	282	204

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Table A6.16
Summary of Surface Sediment ECOI Data in the WC AEU

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Di-n-octylphthalate	3	56	5.36	44 - 1,200	21	210	309	183
Endosulfan I	2	55	3.64	1.9 - 190	0	0	8.41	8.95
Fluoranthene	17	56	30.4	66 - 1,200	31	2,900	307	390
Fluorene	1	55	1.82	33 - 820	400	400	321	177
gamma-BHC (Lindane)	1	55	1.82	1.9 - 99	4.40	4.40	8.68	9.41
gamma-Chlordane	2	27	7.41	16 - 990	0	0	104	119
Heptachlor	2	55	3.64	1.9 - 99	0	0	8.14	8.79
Heptachlor epoxide	2	55	3.64	1.9 - 99	0	0	8.14	8.79
Heptachlorodibenzo-p-dioxin	1	1	100	0.00271 - 0.00271	0.00509	0.00509	0.00509	N/A
Indeno(1,2,3-cd)pyrene	4	55	7.27	40 - 820	24	500	311	171
Methylene Chloride	13	53	24.5	5 - 41	2	220	14.5	33.9
Naphthalene	1	55	1.82	57 - 820	300	300	319	177
OCDD	1	1	100	0.00542 - 0.00542	0.0306	0.0306	0.0306	N/A
OCDF	1	1	100	0.00542 - 0.00542	0.00128	0.00128	0.00128	N/A
PCB-1254	11	63	17.5	9.4 - 2,000	19	250	156	184
Pentachlorophenol	1	55	1.82	200 - 4,100	950	950	1,494	845
Phenanthrene	14	56	25	31 - 1,200	24	2,900	317	385
Phenol	1	55	1.82	33 - 820	150	150	307	171
Pyrene	14	56	25	240 - 1,200	45	3,100	336	420
Tetrachloroethene	1	49	2.04	5 - 15	1	1	4	1.34
Toluene	10	52	19.2	5 - 15	2	410	28.8	88.5
Trichloroethene	1	50	2	5 - 34	23	23	4.42	2.96
Xylene	1	49	2.04	5 - 15	5	5	4.09	1.26
Radionuclides (pCi/g)								
Americium-241	94	94	100	0 - 0.222	-0.013	5.06	0.166	0.537
Cesium-134	35	35	100	0.0196 - 0.3	-0.0674	0.3	0.0837	0.0793
Cesium-137	51	51	100	0.0196 - 0.2	-0.00176	0.5643	0.152	0.128
Gross Alpha	69	69	100	1.8 - 56	-9.7	320	27.7	42.1
Gross Beta	69	69	100	2.3 - 21	4.95	74.93	29.7	12.0
Plutonium-239/240	101	101	100	0 - 0.182	0	30	0.985	3.43
Radium-226	19	19	100	0.1 - 0.545	-1.897	2.19	0.833	0.899
Radium-228	20	20	100	0.04 - 0.53	0.7321	2.9	1.41	0.584
Strontium-89/90	51	51	100	0.02 - 1.12	-0.3	4.86	0.463	0.949
Uranium-233/234	85	85	100	0 - 0.272	0.23	4.775	1.27	0.807
Uranium-235	85	85	100	0 - 0.272	-0.014	0.405	0.0731	0.0712
Uranium-238	85	85	100	0 - 0.289	0.3	10.13	1.42	1.34

N/A= Not applicable.

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Table A6.17
Statistical Distribution and Comparison to Background for Surface Sediments (excluding background samples) for WC AEU

Analyte	Units	Statistical Distribution Testing Results: Background			Statistical Distribution Testing Results: WC AEU (excluding background samples)			Background Comparison Test		
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Test	1 - p	> Background?
Aluminum	mg/kg	55	GAMMA	100	71	GAMMA	100	WRS	1.61E-05	Yes
Antimony	mg/kg	47	LOGNORMAL	11	66	NONPARAMETRIC	11	N/A	N/A	N/A
Arsenic	mg/kg	55	GAMMA	89	71	NONPARAMETRIC	99	WRS	1.48E-09	Yes
Barium	mg/kg	54	GAMMA	100	71	GAMMA	99	WRS	2.81E-06	Yes
Cadmium	mg/kg	48	LOGNORMAL	10	67	NONPARAMETRIC	31	N/A	N/A	N/A
Chromium	mg/kg	55	GAMMA	85	71	GAMMA	99	WRS	1.74E-04	Yes
Copper	mg/kg	55	GAMMA	80	71	LOGNORMAL	94	WRS	1.57E-06	Yes
Fluoride	mg/kg	N/A	N/A	N/A	4	NONPARAMETRIC	25	N/A	N/A	N/A
Iron	mg/kg	55	GAMMA	100	71	NORMAL	100	WRS	5.44E-07	Yes
Lead	mg/kg	55	LOGNORMAL	100	71	GAMMA	100	WRS	4.32E-09	Yes
Manganese	mg/kg	55	GAMMA	100	71	GAMMA	100	WRS	9.63E-04	Yes
Mercury	mg/kg	46	NONPARAMETRIC	4	69	NONPARAMETRIC	25	N/A	N/A	N/A
Nickel	mg/kg	53	GAMMA	72	71	NORMAL	89	WRS	3.34E-08	Yes
Selenium	mg/kg	54	NONPARAMETRIC	28	64	LOGNORMAL	42	WRS	2.82E-05	Yes
Silver	mg/kg	48	NONPARAMETRIC	6	68	NONPARAMETRIC	16	N/A	N/A	N/A
Zinc	mg/kg	55	NONPARAMETRIC	98	71	NONPARAMETRIC	100	WRS	3.34E-07	Yes
2-Butanone	ug/kg	N/A	N/A	17	44	NONPARAMETRIC	16	N/A	N/A	N/A
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
4,4'-DDT	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
4-Methylphenol	ug/kg	N/A	N/A	16	49	NONPARAMETRIC	6	N/A	N/A	N/A
Acenaphthene	ug/kg	N/A	N/A	5	49	NONPARAMETRIC	6	N/A	N/A	N/A
Anthracene	ug/kg	N/A	N/A	9	49	NONPARAMETRIC	10	N/A	N/A	N/A
Aquatic TEQ	ug/kg	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	12	49	NONPARAMETRIC	18	N/A	N/A	N/A
Benzo(a)pyrene	ug/kg	N/A	N/A	9	49	NONPARAMETRIC	14	N/A	N/A	N/A
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	5	49	NONPARAMETRIC	8	N/A	N/A	N/A
Benzo(k)fluoranthene	ug/kg	N/A	N/A	7	49	NONPARAMETRIC	10	N/A	N/A	N/A
Chrysene	ug/kg	N/A	N/A	12	50	NONPARAMETRIC	24	N/A	N/A	N/A
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	2	49	NONPARAMETRIC	4	N/A	N/A	N/A
Fluoranthene	ug/kg	N/A	N/A	14	50	LOGNORMAL	34	N/A	N/A	N/A
Fluorene	ug/kg	N/A	N/A	5	N/A	N/A	2	N/A	N/A	N/A
gamma-BHC (Lindane)	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	5	49	NONPARAMETRIC	8	N/A	N/A	N/A
Naphthalene	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
PCB-1254	ug/kg	N/A	N/A	5	57	NONPARAMETRIC	18	N/A	N/A	N/A
Pentachlorophenol	ug/kg	N/A	N/A	N/A	49	NONPARAMETRIC	2	N/A	N/A	N/A
Phenanthrene	ug/kg	N/A	N/A	9	50	NONPARAMETRIC	28	N/A	N/A	N/A
Pyrene	ug/kg	N/A	N/A	14	50	LOGNORMAL	28	N/A	N/A	N/A
Total Dioxins	ug/kg	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Total PAHs	ug/kg	N/A	N/A	N/A	50	NONPARAMETRIC	38	N/A	N/A	N/A
Total PCBs	ug/kg	N/A	N/A	N/A	57	NONPARAMETRIC	18	N/A	N/A	N/A

Test: WRS = Wilcoxon Rank Sum, t-Test_N = Student's t-test using normal data, t-Test-LN = Student's t-test using log-transformed data, N/A = not applicable; site and/or background detection frequency less than 20%.
CRA Dataset ID: 090105_A1.

Table A6.18
Statistical Concentrations in Surface Sediments (including background samples) for WC AEU

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75th percentile	95th percentile	UCL[a]	UTL[b]	Maximum[c]
Aluminum	mg/kg	78	95% Student's-t UCL	NORMAL	10,727	9,570	13,950	23,000	11,977	21,095	31,000
Antimony	mg/kg	73	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	6.26	4.30	6.15	25.8	13.1	35.2	51.3
Arsenic	mg/kg	78	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	4.93	4.30	5.88	8.99	6.80	8.90	27.9
Barium	mg/kg	78	95% Approximate Gamma UCL	GAMMA	132	129	166	286	150	280	404
Cadmium	mg/kg	74	97.5% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.645	0.480	0.790	1.54	1.07	1.80	3.60
Chromium	mg/kg	78	95% Approximate Gamma UCL	GAMMA	12.6	11.4	15.5	25.0	14.3	25.0	70.1
Copper	mg/kg	78	95% H-UCL	LOGNORMAL	22.2	15.4	23.2	38.4	25.3	53.5	212
Fluoride	mg/kg	4	99% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	5.93	1.25	6.01	17.4	53.6	20.3	20.3
Iron	mg/kg	78	95% Student's-t UCL	NORMAL	15,487	14,950	19,750	29,105	16,925	27,413	38,800
Lead	mg/kg	78	95% Approximate Gamma UCL	GAMMA	25.6	20.9	31.0	53.1	28.7	52.7	118
Manganese	mg/kg	78	95% Approximate Gamma UCL	GAMMA	309	262	388	607	348	607	1,580
Mercury	mg/kg	76	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.156	0.060	0.085	0.650	0.394	0.650	3.80
Nickel	mg/kg	78	95% Student's-t UCL	NORMAL	13.1	12.2	18.0	25.3	14.5	24.8	33.0
Selenium	mg/kg	71	95% H-UCL	LOGNORMAL	0.622	0.415	0.720	1.60	0.725	1.49	3.80
Silver	mg/kg	74	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	0.910	0.575	0.850	2.32	1.49	2.35	7.70
Zinc	mg/kg	78	95% H-UCL	LOGNORMAL	149	70.6	134	551	163	361	2,080
2-Butanone	ug/kg	48	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	20.0	7.50	9.00	47.6	56.8	63.0	380
2-Methylnaphthalene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	316	250	328	700	356	700	1,050
4,4'-DDT	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	16.5	12.0	16.0	39.9	26.1	50.0	100
4-Methylphenol	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	311	245	333	700	353	700	1,050
Acenaphthene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	293	250	323	503	326	510	1,050
Anthracene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	296	250	328	479	329	500	1,050
Aquatic TEQ	ug/kg	1	Too Few Observations To Calculate UCLs	0	1.63E-05	1.63E-05	1.63E-05	1.63E-05	N/A	N/A	1.63E-05
Benzo(a)anthracene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	293	245	310	730	419	800	1,200
Benzo(a)pyrene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	303	250	320	730	421	800	1,050
Benzo(g,h,i)perylene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	310	250	328	700	417	700	1,050
Benzo(k)fluoranthene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	307	250	320	700	348	700	1,050
Chrysene	ug/kg	56	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	288	245	290	725	411	800	1,200
Dibenz(a,h)anthracene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	315	250	328	700	354	700	1,050
Fluoranthene	ug/kg	56	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	307	245	318	575	534	800	2,900
Fluorene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	321	260	333	700	361	700	1,050
gamma-BHC (Lindane)	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	8.68	6.00	7.75	28.6	14.2	37.0	49.5
Indeno(1,2,3-cd)pyrene	ug/kg	55	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	311	260	333	700	411	700	1,050
Naphthalene	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	319	260	328	700	359	700	1,050
PCB-1254	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	156	110	155	484	257	500	1,000
Pentachlorophenol	ug/kg	55	95% Student's-t UCL	NONPARAMETRIC	1,494	1,250	1,550	3,360	1,685	3,500	5,000
Phenanthrene	ug/kg	56	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	317	250	318	550	541	700	2,900
Pyrene	ug/kg	56	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	336	250	318	725	581	800	3,100
Total Dioxins	ug/kg	1	Too Few Observations To Calculate UCLs	0	0.054	0.054	0.054	0.054	N/A	N/A	0.054
Total PAHs	ug/kg	56	95% H-UCL	LOGNORMAL	2,754	2,210	2,936	5,903	3,060	5,381	13,440
Total PCBs	ug/kg	63	95% Chebyshev (Mean, Sd) UCL	NONPARAMETRIC	156	110	155	484	257	500	1,000

[a] UCL = 95% upper confidence limit on the mean; [b] UTL = 95% upper confidence limit on the 90th percentile value, [c] Maximum = maximum proxy result; may not be a detect.
CRA Dataset ID: 090105_A1.

Table A6.19
Summary of Adjacent Surface Soil Data in the NW AEU

Analyte	Number of Results	Detected	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration (MDC)	Arithmetic Mean[1] Concentration	Standard Deviation[1]	ESL	MDC > ESL
Inorganics (mg/kg)									
Aluminum	119	119	100%	1,450	28,000	10,781	6,038	15,900	Yes
Antimony	109	39	36%	0.31	3.5	1	2	2	Yes
Barium	119	119	100%	20	263	81	34	189	Yes
Cadmium	117	43	37%	0.075	10.6	1	1	0.99	Yes
Copper	119	117	98%	6.7	1340	54	145	31.6	Yes
Fluoride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	119	119	100%	4,790	130,000	14,732	11,632	20,000	Yes
Lead	119	119	100%	3.2	283	22	34	35.8	Yes
Manganese	116	116	100%	68.4	700	222	103	630	Yes
Mercury	118	76	64%	0.0083	1.1	0.06	0.11	0.18	Yes
Nickel	119	116	97%	3	64	12	6.9	22.7	Yes
Selenium	119	4	3%	0.3	0.75	0.34	0.10	0.95	No
Silver	119	50	42%	0.11	21.1	0.84	2.3	1	Yes
Zinc	119	119	100%	16	1,600	122	221	121	Yes
Organics (ug/kg)									
2-Methylnaphthalene	82	15	18%	36	360	285	371	20.2	Yes
4,4'-DDT	12	0	0%	N/A	N/A	9	3	4	N/A
Acenaphthene	82	41	50%	38	2,600	320	491	7	Yes
Anthracene	82	47	57%	39	3,000	376	556	57	Yes
Atrazine	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	82	68	83%	37	6,600	690	1,107	108	Yes
Benzo(a)pyrene	82	58	71%	56	7,900	724	1,143	150	Yes
Benzo(g,h,i)perylene	82	51	62%	36	2,800	440	579	13	Yes
Benzo(k)fluoranthene	81	56	69%	35	3,700	547	756	240	Yes
Carbazole	2	1	50%	500	500	340	226	25	Yes
Chrysene	82	72	88%	36	7,700	747	1,228	166	Yes
Dibenz(a,h)anthracene	82	30	37%	38	1,000	301	385	33	Yes
Fluoranthene	82	74	90%	57	23,000	1,705	3,214	423	Yes
Fluorene	82	37	45%	39	2,100	324	442	77	Yes
Indeno(1,2,3-cd)pyrene	82	52	63%	36	3,500	471	635	17	Yes
Naphthalene	96	28	29%	1	1,000	206	375	176	Yes
PCB-1254	73	23	32%	7	2,300	109	316	60	Yes
Phenanthrene	82	74	90%	39	20,000	1,412	2,781	204	Yes
Pyrene	82	74	90%	60	18,000	1,490	2,711	195	Yes

Notes:

includes soil data for all years

[1] Non-detected concentrations included in calculations at 1/2 detection limit

N/A= Not applicable.

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Table A6.20
Summary of Adjacent Surface Soil Data in the SW AEU

Analyte	Number of Results	Detected	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration (MDC)	Arithmetic Mean[b] Concentration	Standard Deviation	ESL	MDC > ESL
Inorganics (mg/kg)									
Aluminum	295	295	100%	1900	61000	10751.28814	6993.509408	15900	Yes
Antimony	282	67	24%	0.28	26.5	1.906251773	4.077619826	2	Yes
Barium	295	294	100%	12	350	80.63728814	44.89543368	189	Yes
Cadmium	295	112	38%	0.068	36	0.538267797	2.18257756	0.99	Yes
Copper	295	295	100%	3.7	270	20.22644068	21.20036209	31.6	Yes
Fluoride	9	9	100%	1.87	3.61	2.418888889	0.497328977	0.01	Yes
Lead	295	295	100%	4.4	426	23	32	35.8	Yes
Nickel	295	294	100%	2.3	280	13	19	22.7	Yes
Silver	293	87	30%	0.086	52.7	1.4	5.1	1	Yes
Zinc	295	292	99%	12	11,900	153	705	121	Yes
Organics (ug/kg)									
Acenaphthene	107	31	29%	21	1,000	200	165	6.71	Yes
Anthracene	107	36	34%	31	5,100	315	699	57	Yes
Benzo(a)anthracene	107	65	61%	38	9,400	543	1411	108	Yes
Benzo(a)pyrene	107	56	52%	39	10,000	573	1411	150	Yes
Benzo(g,h,i)perylene	107	44	41%	24	7,200	440	944	13	Yes
Benzo(k)fluoranthene	106	49	46%	39	7,500	444	986	240	Yes
Bromomethane	30	N/A	0%	N/A	N/A	3.7	2.6	3	N/A
Carbazole	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chrysene	107	68	64%	39	10,000	606	1628	166	Yes
Dibenz(a,h)anthracene	107	24	22%	28	2,800	299	402	33	Yes
Fluoranthene	107	69	64%	42	18,000	896	2482	423	Yes
Fluorene	107	21	20%	27	1,200	242	178	77	Yes
Indeno(1,2,3-cd)pyrene	107	46	43%	24	6,900	418	906	17	Yes
PCB-1254	61	9	15%	16	2,500	143	374	60	Yes
PCB-1260	61	6	10%	25	290	74	54	5	Yes
Phenanthrene	107	69	64%	41	15,000	733	1913	204	Yes
Pyrene	107	69	64%	46	17,000	953	2631	195	Yes

Notes:

Includes soil data for all years

[1] Non-detected concentrations included in calculations at 1/2 detection limit

N/A= Not applicable.

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Table A6.21
Summary of Adjacent Surface Soil Data in the WC AEU

Analyte	Number of Results	Detected	Detection Frequency (%)	Minimum Detected Concentration	Maximum Detected Concentration (MDC)	Arithmetic Mean[1] Concentration	Standard Deviation[1]	ESL	MDC > ESL
Inorganics (mg/kg)									
Aluminum	71	71	100%	1950	45000	11268	7495	15900	Yes
Antimony	70	13	19%	0.29	3.3	1.2	1.8	2	Yes
Barium	71	71	100%	31	220	80.5	39.0	189	Yes
Cadmium	69	27	39%	0.069	2.4	0.26	0.38	0.99	Yes
Copper	71	71	100%	5.1	43.8	16.3	7.1	31.6	Yes
Fluoride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	71	71	100%	4,700	29,000	13,472	5,033	20,000	Yes
Lead	71	71	100%	3	300	18	35	35.8	Yes
Mercury	70	40	57%	0.0059	0.21	0.0	0.0	0.18	Yes
Nickel	71	69	97%	2.7	68	12	9	22.7	Yes
Selenium	71	6	8%	0.35	2	0.39	0.24	0.95	Yes
Silver	71	25	35%	0.097	3	0.47	0.64	1	Yes
Zinc	71	71	100%	16	489	61	68	121	Yes
Organics (ug/kg)									
4-Methylphenol	8	0	0%	N/A	N/A	218	59	12.3	N/A
Acenaphthene	9	0	0%	N/A	N/A	196	25	7	N/A
Anthracene	10	0	0%	N/A	N/A	200	27	57	N/A
Benzo(a)anthracene	9	2	22%	37	40	165	75	108	No
Benzo(a)pyrene	10	0	0%	N/A	N/A	217	53	150	N/A
Benzo(g,h,i)perylene	10	0	0%	N/A	N/A	196	79	13	N/A
Benzo(k)fluoranthene	9	0	0%	N/A	N/A	215	56	240	N/A
Chrysene	10	1	10%	40	40	185	89	166	No
Fluoranthene	9	2	22%	69	83	191	84	423	No
Heptachlor	4	0	0%	N/A	N/A	4.1	2	0	N/A
Indeno(1,2,3-cd)pyrene	10	0	0%	N/A	N/A	195	82	17	N/A
PCB-1254	12	1	8%	8.2	8.2	104	223	60	No
Phenanthrene	10	1	10%	43	43	203	76	204	No
Pyrene	9	2	22%	76	100	193	80	195	No

Notes:

Includes soil data for all years

[1] Non-detected concentrations included in calculations at 1/2 detection limit

N/A= Not applicable.

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6.22
Sum Total PAH Values by Sample for the NW AEU

Channel of Pond	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
A-1	CR53-000	05F0792-001	2,985	205	205	120	150	180	100	100	150	415	300	415	90	140	415
A-1	CS53-000	05F0348-002	6,230	260	260	500	500	500	500	500	500	500	500	500	210	500	500
A-1	CS53-001	05F0792-002	2,940	255	255	92	110	120	77	72	110	500	200	500	62	87	500
A-1	CS53-002	05F0792-004	4,428	245	245	73	485	130	485	485	82	485	170	485	485	88	485
A-1	CS53-002	05F0792-005	3,892	250	52	190	210	260	160	120	220	500	510	500	140	280	500
A-1	CS53-003	05F0792-006	2,681	235	235	75	83	83	60	63	87	470	190	470	50	110	470
A-1	CS53-003	05F0792-007	5,590	215	215	430	430	430	430	430	430	430	430	430	430	430	430
A-1	SED60092	SD60000WC	4,999	89	310	270	310	420	210	200	350	310	790	310	200	520	710
A-1	SED60192	SD60001WC	3,952	305	88	190	190	305	305	99	210	305	590	305	150	480	430
A-1	SED60292	SD60002WC	4,208	310	68	220	240	300	150	180	270	310	600	310	310	390	550
A-1	SED60392	SD60003WC	3,650	300	300	170	190	240	150	110	220	300	510	300	140	300	420
A-2	CV54-000	05F0600-001	2,856	180	210	52	51	64	350	350	60	350	89	350	210	190	350
A-2	CW53-000	05F0599-008	11,030	415	415	850	850	850	850	850	850	850	850	850	850	850	850
A-2	CW53-000	05F0599-009	7,600	400	400	800	80	800	800	800	81	800	140	800	800	99	800
A-2	CW54-000	05F0275-001	18,800	700	700	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1450
A-2	CW54-000	05F0275-002	12,990	495	495	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1000
A-2	CW54-000	05F0275-003	19,500	750	750	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1500
A-2	CW54-002	05F0599-006	22,800	900	900	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1750
A-2	SED60692	SD60006WC	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-2	SED60792	SD60007WC	4,231	320	320	320	320	320	320	320	320	320	320	320	320	320	71
A-2	SED60892	SD60008WC	5,088	385	385	385	385	385	385	385	385	385	385	385	385	385	83
A-3	SED61092	SD60010WC	3,840	290	290	290	150	260	290	290	180	290	400	290	290	200	330
A-3	SED61192	SD60011WC	4,480	295	295	295	240	370	295	295	250	295	540	295	295	260	460
A-3	SED61292	SD60012WC	3,710	275	275	275	170	240	275	275	170	275	390	275	275	200	340
A-3	SED61392	SD60013WC	3,885	295	295	295	295	240	295	295	170	295	360	295	295	170	290
A-4	SED61592	SD60015WC	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-4	SED61692	SD60016WC	4,480	320	320	320	320	320	320	320	320	320	320	320	320	320	320
A-4	SED61792	SD60017WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
A-4	SED61892	SD60018WC	6,930	495	495	495	495	495	495	495	495	495	495	495	495	495	495
Channel	10199	99A6847-001	2,089	190	20	55	190	190	190	190	74	190	150	190	190	120	150
Channel	10199	99A6848-001	2,157	210	210	28	210	210	210	210	30	210	75	210	210	63	71
Channel	10299	99A6847-002	2,350	205	205	61	205	205	205	205	82	205	140	205	205	92	130
Channel	10299	99A6848-002	1,927	36	44	87	185	61	185	89	110	185	240	30	185	230	260
Channel	10399	99A6847-003	2,447	48	56	130	110	90	230	130	160	230	350	33	230	310	340
Channel	10399	99A6848-003	1,392	205	205	40	49	47	35	53	49	205	100	205	29	70	100
Channel	11199	99A6847-016	15,670	210	370	1,100	1,200	1,000	900	1,200	1,300	330	2,600	170	890	1,900	2500
Channel	11199	99A6848-032	10,020	420	400	580	570	420	370	530	650	160	1,700	330	390	2,000	1500
Channel	11199	99A6848-033	1,403	25	30	66	68	52	47	66	76	220	180	220	43	150	160
Channel	CG49-018	04F1603-001	4,550	175	175	350	350	350	350	350	350	350	350	350	350	350	350
Channel	CG49-018	04F1603-002	5,796	66	160	410	440	310	270	410	490	365	880	365	260	610	760
Channel	CG49-021	04F1603-003	6,540	240	240	360	360	290	240	320	410	460	990	190	240	1,100	1100
Channel	CG49-021	04F1603-004	6,835	230	250	370	410	290	270	400	440	435	1,100	180	260	1,100	1100
Channel	CH49-017	04F1373-014	8,620	395	85	290	800	800	800	800	410	800	720	800	800	460	660
Channel	CH49-017	04F1373-015	11,110	300	170	880	760	600	600	600	910	600	1,900	600	600	690	1900
Channel	CH49-018	04F1373-016	5,024	215	79	210	430	430	430	430	210	430	450	430	430	350	500
Channel	CH49-018	04F1373-017	4,356	205	61	130	410	410	410	410	160	410	330	410	410	260	340
Channel	CH49-019	04F1373-005	4,600	220	220	120	435	435	435	435	160	435	260	435	435	140	435
Channel	CH49-019	04F1373-006	5,521	86	120	240	445	445	445	445	270	445	580	445	445	520	590
Channel	CH49-025	04F1594-004	3,771	190	190	69	380	380	86	380	110	380	380	380	380	86	380
Channel	CH49-025	04F1594-005	3,783	190	53	100	380	380	380	380	130	380	220	380	380	190	240
Channel	SED008	SD00240WC	4,970	355	355	355	355	355	355	355	355	355	355	355	355	355	355
Channel	SED008	SD00284WC	5,670	405	405	405	405	405	405	405	405	405	405	405	405	405	405

Table A6.22
Sum Total PAH Values by Sample for the NW AEU

Channel or Pond	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
Channel	SED008	SD00319WC	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
Channel	SED009	SD00241WC	2,969	220	79	160	150	160	220	120	160	220	240	220	220	320	480
Channel	SED009	SD00285WC	2,660	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Channel	SED009	SD00309WC	3,220	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Channel	SED03695	SDG0284JE	4,515	235	130	300	235	650	235	235	730	235	470	235	235	130	460
Channel	SED05195	SDG0321JE	13,955	320	860	850	920	1,200	630	175	1,300	200	2,400	390	510	2,200	2000
Channel	SED05295	SDG0322JE	1,553	195	195	34	31	25	195	35	51	195	96	195	195	42	69
Channel	SED05395	SDG0244JE	2,322	45	76	160	160	150	120	160	190	41	420	50	100	300	350
Channel	SED05795	SDG0213JE	2,236	24	40	120	130	200	130	84	170	235	370	235	98	200	200
Channel	SED06095	SDG0238JE	1,150	47	185	45	62	56	47	79	74	185	150	21	40	67	92
Channel	SED06195	SDG0241JE	2,660	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Channel	SED06295	SDG0274JE	4,043	345	58	230	250	180	240	320	300	345	620	345	190	220	400
Channel	SED06695	SDG0253JE	4,477	470	81	270	290	240	230	320	310	96	670	470	210	330	490
Channel	SED06895	SDG0276JE	3,858	59	140	250	260	160	210	310	300	290	740	59	170	450	460
Channel	SED06995	SDG0291JE	1,068	180	180	26	33	26	37	36	37	180	56	180	23	26	48
Channel	SED07095	SDG0268JE	8,815	240	420	530	610	790	320	235	800	130	1,300	240	300	1,500	1400
Channel	SED07495	SDG0258JE	3,487	500	500	100	120	110	98	120	130	500	290	500	79	200	240
Channel	SED07595	SDG0293JE	1,693	26	33	88	91	82	110	85	110	205	210	205	88	170	190
Channel	SED07695	SDG0294JE	3,731	64	70	190	240	210	240	220	360	240	680	57	240	390	530
Channel	SED07995	SDG0277JE	2,429	275	48	120	140	130	96	110	160	275	330	275	90	170	210
Channel	SED09195	SDG0319JE	1,759	180	24	57	96	70	180	62	110	180	170	180	180	110	160
Channel	SED09295	SDG0278JE	2,132	250	30	71	71	130	250	250	79	250	170	250	61	120	150
Channel	SED09395	SDG0279JE	3,056	50	93	170	170	280	170	230	190	230	460	53	130	450	380
Channel	SED09495	SDG0280JE	1,842	205	205	205	23	36	205	205	22	205	44	205	205	40	37
Channel	SED09595	SDG0281JE	2,678	34	50	160	180	310	170	220	200	220	360	24	140	260	350
Channel	SED117	SD00262WC	9,085	250	350	690	570	510	210	660	650	245	1,500	220	230	1,300	1700
Channel	SED117	SD00287WC	5,425	110	170	410	360	350	180	340	400	265	880	100	170	730	960
Channel	SED117	SD00311WC	20,555	620	970	1,400	1,300	1,500	480	1,100	1,500	245	3,100	650	490	3,300	3900
Channel	SED118	SD00263WC	2,406	240	240	49	240	61	240	240	51	240	110	240	240	95	120
Channel	SED118	SD00286WC	3,076	245	245	245	245	245	245	245	245	245	68	245	245	245	68
Channel	SED118	SD00310WC	2,850	325	325	78	76	82	325	96	88	325	170	325	325	120	190
Channel	SED120	SD00264WC	3,264	56	68	190	210	230	185	250	210	185	440	185	185	360	510
Channel	SED60492	SD60004WC	3,603	295	295	295	295	295	295	295	73	295	240	295	295	170	170
Channel	SED60592	SD60005WC	2,854	280	280	58	75	280	280	280	71	280	160	280	280	120	130
Channel	SED60992	SD60009WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
Channel	SED61492	SD60014WC	3,137	250	250	250	250	250	250	250	77	250	170	250	250	250	140
Channel	SED61992	SD60019WC	3,220	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Channel	SED65092	SD60050WC	3,457	275	275	275	275	275	275	275	275	275	93	275	275	275	64
Channel	SED65192	SD60051WC	3,383	280	280	280	280	280	280	280	280	280	130	280	280	81	92
Channel	SED65292	SD60052WC	3,990	285	285	285	285	285	285	285	285	285	285	285	285	285	285
Channel	SED65392	SD60053WC	3,442	260	260	260	260	260	260	260	260	260	62	260	260	260	260
Channel	SED65492	SD60054WC	2,399	220	220	51	220	110	220	220	74	220	190	220	220	94	120
Channel	SED65592	SD60055WC	3,670	245	245	190	260	400	110	170	230	245	560	245	110	290	370
Channel	SED65692	SD60056WC	3,150	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Channel	SED65792	SD60057WC	3,050	230	230	230	230	230	230	230	230	230	230	230	230	230	60
Channel	SED68192	SD60081WC	3,220	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Channel	SED68492	SD60084WC	2,640	230	230	230	110	140	230	230	100	230	180	230	230	110	160
Channel	SED68592	SD60085WC	2,580	195	195	195	195	195	195	195	195	195	45	195	195	195	195
Channel	SED68692	SD60086WC	3,207	240	240	240	240	240	240	240	240	240	87	240	240	240	240
Channel	SED68792	SD60087WC	2,870	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Channel	SED69492	SD60094WC	2,638	245	245	78	79	245	245	245	91	245	160	245	245	110	160
Channel	SED69692	SD60096WC	3,005	275	65	170	160	200	275	74	180	275	380	275	66	260	350

Non-detected concentrations reported at one-half detection limits and included in the total PAH concentration.

Table A6.23

Total Maximum Detected PAH Values for the NW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz (a,h) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Phenanthrene	Pyrene
A-1	CR53-000	05F0792-001	1,330	ND	ND	120	150	180	100	100	150	ND	300	ND	90	140	ND
A-1	CS53-000	05F0348-002	210	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	210	ND	ND
A-1	CS53-001	05F0792-002	930	ND	ND	92	110	120	77	72	110	ND	200	ND	62	87	ND
A-1	CS53-002	05F0792-004	543	ND	ND	73	ND	130	ND	ND	82	ND	170	ND	ND	88	ND
A-1	CS53-002	05F0792-005	2,142	ND	52	190	210	260	160	120	220	ND	510	ND	140	280	ND
A-1	CS53-003	05F0792-006	801	ND	ND	75	83	83	60	63	87	ND	190	ND	50	110	ND
A-1	SED60092	SD60000WC	4,069	89	ND	270	310	420	210	200	350	ND	790	ND	200	520	710
A-1	SED60192	SD60001WC	2,427	ND	88	190	190	ND	ND	99	210	ND	590	ND	150	480	430
A-1	SED60292	SD60002WC	2,968	ND	68	220	240	300	150	180	270	ND	600	ND	ND	390	550
A-1	SED60392	SD60003WC	2,450	ND	ND	170	190	240	150	110	220	ND	510	ND	140	300	420
A-2	CV54-000	05F0600-001	1,106	180	210	52	51	64	ND	ND	60	ND	89	ND	210	190	ND
A-2	CW53-000	05F0599-009	400	ND	ND	ND	80	ND	ND	ND	81	ND	140	ND	ND	99	ND
A-2	SED60792	SD60007WC	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	71
A-2	SED60892	SD60008WC	83	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	83
A-3	SED61092	SD60010WC	1,520	ND	ND	ND	150	260	ND	ND	180	ND	400	ND	ND	200	330
A-3	SED61192	SD60011WC	2,120	ND	ND	ND	240	370	ND	ND	250	ND	540	ND	ND	260	460
A-3	SED61292	SD60012WC	1,510	ND	ND	ND	170	240	ND	ND	170	ND	390	ND	ND	200	340
A-3	SED61392	SD60013WC	1,230	ND	ND	ND	ND	240	ND	ND	170	ND	360	ND	ND	170	290
Channel	10199	99A6847-001	569	ND	20	55	ND	ND	ND	ND	74	ND	150	ND	ND	120	150
Channel	10199	99A6848-001	267	ND	ND	28	ND	ND	ND	ND	30	ND	75	ND	ND	63	71
Channel	10299	99A6847-002	505	ND	ND	61	ND	ND	ND	ND	82	ND	140	ND	ND	92	130
Channel	10299	99A6848-002	1,187	36	44	87	ND	61	ND	89	110	ND	240	30	ND	230	260
Channel	10399	99A6847-003	1,757	48	56	130	110	90	ND	130	160	ND	350	33	ND	310	340
Channel	10399	99A6848-003	572	ND	ND	40	49	47	35	53	49	ND	100	ND	29	70	100
Channel	11199	99A6847-016	15,670	210	370	1,100	1,200	1,000	900	1,200	1,300	330	2,600	170	890	1,900	2,500
Channel	11199	99A6848-032	10,020	420	400	580	570	420	370	530	650	160	1,700	330	390	2,000	1,500
Channel	11199	99A6848-033	963	25	30	66	68	52	47	66	76	ND	180	ND	43	150	160
Channel	CG49-018	04F1603-002	5,066	66	160	410	440	310	270	410	490	ND	880	ND	260	610	760
Channel	CG49-021	04F1603-003	6,080	240	240	360	360	290	240	320	410	ND	990	190	240	1,100	1,100
Channel	CG49-021	04F1603-004	6,400	230	250	370	410	290	270	400	440	ND	1,100	180	260	1,100	1,100
Channel	CH49-017	04F1373-014	2,625	ND	85	290	ND	ND	ND	ND	410	ND	720	ND	ND	460	660
Channel	CH49-017	04F1373-015	7,210	ND	170	880	760	ND	ND	ND	910	ND	1,900	ND	ND	690	1,900
Channel	CH49-018	04F1373-016	1,799	ND	79	210	ND	ND	ND	ND	210	ND	450	ND	ND	350	500
Channel	CH49-018	04F1373-017	1,281	ND	61	130	ND	ND	ND	ND	160	ND	330	ND	ND	260	340
Channel	CH49-019	04F1373-005	680	ND	ND	120	ND	ND	ND	ND	160	ND	260	ND	ND	140	ND
Channel	CH49-019	04F1373-006	2,406	86	120	240	ND	ND	ND	ND	270	ND	580	ND	ND	520	590
Channel	CH49-025	04F1594-004	351	ND	ND	69	ND	ND	86	ND	110	ND	ND	ND	ND	86	ND
Channel	CH49-025	04F1594-005	933	ND	53	100	ND	ND	ND	ND	130	ND	220	ND	ND	190	240
Channel	SED009	SD00241WC	1,869	ND	79	160	150	160	ND	120	160	ND	240	ND	ND	320	480
Channel	SED03695	SDG0284JE	2,870	ND	130	300	ND	650	ND	ND	730	ND	470	ND	ND	130	460
Channel	SED05195	SDG0321JE	13,780	320	860	850	920	1,200	630	ND	1,300	200	2,400	390	510	2,200	2,000
Channel	SED05295	SDG0322JE	383	ND	ND	34	31	25	ND	35	51	ND	96	ND	ND	42	69
Channel	SED05395	SDG0244JE	2,322	45	76	160	160	150	120	160	190	41	420	50	100	300	350
Channel	SED05795	SDG0213JE	1,766	24	40	120	130	200	130	84	170	ND	370	ND	98	200	200
Channel	SED06095	SDG0238JE	780	47	ND	45	62	56	47	79	74	ND	150	21	40	67	92
Channel	SED06295	SDG0274JE	3,008	ND	58	230	250	180	240	320	300	ND	620	ND	190	220	400
Channel	SED06695	SDG0253JE	3,537	ND	81	270	290	240	230	320	310	96	670	ND	210	330	490
Channel	SED06895	SDG0276JE	3,568	59	140	250	260	160	210	310	300	ND	740	59	170	450	460
Channel	SED06995	SDG0291JE	348	ND	ND	26	33	26	37	36	37	ND	56	ND	23	26	48
Channel	SED07095	SDG0268JE	8,580	240	420	530	610	790	320	ND	800	130	1,300	240	300	1,500	1,400

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Total Maximum Detected PAH Values for the NW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz (a,h) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd) pyrene	Phenanthrene	Pyrene
Channel	SED07495	SDG0258JE	1,487	ND	ND	100	120	110	98	120	130	ND	290	ND	79	200	240
Channel	SED07595	SDG0293JE	1,283	26	33	88	91	82	110	85	110	ND	210	ND	88	170	190
Channel	SED07695	SDG0294JE	2,771	64	70	190	ND	210	ND	220	360	ND	680	57	ND	390	530
Channel	SED07995	SDG0277JE	1,604	ND	48	120	140	130	96	110	160	ND	330	ND	90	170	210
Channel	SED09195	SDG0319JE	859	ND	24	57	96	70	ND	62	110	ND	170	ND	ND	110	160
Channel	SED09295	SDG0278JE	882	ND	30	71	71	130	ND	ND	79	ND	170	ND	61	120	150
Channel	SED09395	SDG0279JE	2,596	50	93	170	170	280	170	ND	190	ND	460	53	130	450	380
Channel	SED09495	SDG0280JE	202	ND	ND	ND	23	36	ND	ND	22	ND	44	ND	ND	40	37
Channel	SED09595	SDG0281JE	2,238	34	50	160	180	310	170	ND	200	ND	360	24	140	260	350
Channel	SED117	SD00262WC	8,840	250	350	690	570	510	210	660	650	ND	1,500	220	230	1,300	1,700
Channel	SED117	SD00287WC	5,160	110	170	410	360	350	180	340	400	ND	880	100	170	730	960
Channel	SED117	SD00311WC	20,310	620	970	1,400	1,300	1,500	480	1,100	1,500	ND	3,100	650	490	3,300	3,900
Channel	SED118	SD00263WC	486	ND	ND	49	ND	61	ND	ND	51	ND	110	ND	ND	95	120
Channel	SED118	SD00286WC	136	ND	ND	ND	ND	ND	ND	ND	ND	ND	68	ND	ND	ND	68
Channel	SED118	SD00310WC	900	ND	ND	78	76	82	ND	96	88	ND	170	ND	ND	120	190
Channel	SED120	SD00264WC	2,524	56	68	190	210	230	ND	250	210	ND	440	ND	ND	360	510
Channel	SED60492	SD60004WC	653	ND	ND	ND	ND	ND	ND	ND	73	ND	240	ND	ND	170	170
Channel	SED60592	SD60005WC	614	ND	ND	58	75	ND	ND	ND	71	ND	160	ND	ND	120	130
Channel	SED61492	SD60014WC	387	ND	ND	ND	ND	ND	ND	ND	77	ND	170	ND	ND	ND	140
Channel	SED65092	SD60050WC	157	ND	ND	ND	ND	ND	ND	ND	ND	ND	93	ND	ND	ND	64
Channel	SED65192	SD60051WC	303	ND	ND	ND	ND	ND	ND	ND	ND	ND	130	ND	ND	81	92
Channel	SED65392	SD60053WC	62	ND	ND	ND	ND	ND	ND	ND	ND	ND	62	ND	ND	ND	ND
Channel	SED65492	SD60054WC	639	ND	ND	51	ND	110	ND	ND	74	ND	190	ND	ND	94	120
Channel	SED65592	SD60055WC	2,690	ND	ND	190	260	400	110	170	230	ND	560	ND	ND	290	370
Channel	SED65792	SD60057WC	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60
Channel	SED68492	SD60084WC	800	ND	ND	ND	110	140	ND	ND	100	ND	180	ND	ND	110	160
Channel	SED68592	SD60085WC	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	45	ND	ND	ND	ND
Channel	SED68692	SD60086WC	87	ND	ND	ND	ND	ND	ND	ND	ND	ND	87	ND	ND	ND	ND
Channel	SED69492	SD60094WC	678	ND	ND	78	79	ND	ND	ND	91	ND	160	ND	ND	110	160
Channel	SED69692	SD60096WC	1,905	ND	65	170	160	200	ND	74	180	ND	380	ND	ND	260	350

ND = Not detected.

N/A = Not analyzed for.

Non-detected concentrations and individual PAHs detected in fewer than 5% of samples in the AEU were excluded from the Total-PAH calculation.

Table A6.24
Sum Total PAH Values by Sample for the SW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
A-5	SED64592	SD60045WC	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64692	SD60046WC	3,570	255	255	255	255	255	255	255	255	255	255	255	255	255	255
A-5	SED64792	SD60047WC	4,200	300	300	300	300	300	300	300	300	300	300	300	300	300	300
A-5	SED64892	SD60048WC	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64992	SD60049WC	3,570	255	255	255	255	255	255	255	255	255	255	255	255	255	255
B-4	DB47-000	05F0618-001	15,600	600	600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
B-4	DB47-001	05F0597-001	23,400	900	900	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
B-4	DB47-001	05F0597-002	6,415	225	60	330	430	810	310	450	470	450	880	450	250	430	870
B-4	DB47-001	05F0597-003	12,350	700	420	330	450	630	1,400	1,400	480	1,400	1,000	1,400	1,400	420	920
B-4	DB47-002	05F0599-001	4,328	310	73	240	290	270	200	270	330	65	580	600	150	370	580
B-4	DB47-002	05F0599-002	6,915	270	75	360	490	560	320	540	610	110	1,200	550	280	550	1,000
B-4	DB47-002	05F0599-003	3,457	260	260	98	150	180	95	200	210	500	450	500	84	160	310
B-4	DB47-002	05F0599-004	5,270	205	205	405	405	405	405	405	405	405	405	405	405	405	405
B-4	DB47-002	05F0599-005	5,200	200	200	400	400	400	400	400	400	400	400	400	400	400	400
B-4	DB47-003	05F0618-003	3,744	275	275	100	100	180	90	550	110	550	230	550	74	110	550
B-4	DB47-004	05F0618-005	6,734	350	350	80	700	700	700	700	74	700	170	700	700	110	700
B-4	DB47-004	05F0618-006	5,380	270	270	200	270	530	230	550	340	550	690	550	190	290	450
B-4	DB47-004	05F0618-007	7,830	440	440	220	300	720	290	900	460	900	1,100	900	260	370	530
B-4	DB47-005	05F0597-004	4,496	110	140	300	320	230	270	310	350	92	750	94	200	630	700
B-4	SED63592	SD60035WC	5,989	235	79	350	420	660	200	280	490	235	1,100	235	235	580	890
B-4	SED63592	SD60111WC	6,690	245	100	370	460	740	245	350	530	245	1,200	245	200	760	1,000
B-4	SED63692	SD60036WC	4,660	235	235	240	290	440	235	200	330	235	750	235	235	420	580
B-4	SED63792	SD60037WC	6,745	330	85	340	420	1,000	330	290	500	330	1,100	330	330	500	860
B-4	SED63792	SD60114WC	8,329	295	84	430	570	1,500	270	350	650	295	1,400	295	300	690	1,200
B-4	SED63892	SD60038WC	6,145	315	315	315	370	660	315	220	470	315	950	315	315	450	820
B-4	SED63892	SD60110WC	6,945	315	315	315	400	770	315	360	520	315	1,100	315	315	590	1,000
B-4	SED63992	SD60039WC	6,279	250	99	350	440	710	250	290	490	250	1,100	250	250	580	970
B-5	SED64092	SD60040WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
B-5	SED64192	SD60041WC	3,640	260	260	260	260	260	260	260	260	260	260	260	260	260	260
B-5	SED64292	SD60042WC	3,789	285	285	285	285	285	285	285	285	285	84	285	285	285	285
B-5	SED64392	SD60043WC	5,030	390	390	390	390	390	390	390	390	390	190	390	390	390	160
B-5	SED64492	SD60044WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	CJ41-004	04F2195-001	4,216	200	200	405	405	56	405	405	68	405	47	405	405	405	405
Channel	CJ42-006	04F2195-002	5,173	200	67	300	370	350	250	340	410	71	1,000	395	220	520	680
Channel	CJ42-007	04F2195-003	2,350	195	195	63	79	75	55	66	94	390	190	390	48	120	390
Channel	CJ42-008	04F2195-004	3,149	205	57	120	120	140	415	110	190	415	380	415	72	250	260
Channel	CJ43-009	04F2195-005	3,024	205	50	150	190	180	130	180	210	44	510	405	100	320	350
Channel	CJ43-010	04F2195-006	4,148	190	78	240	260	250	140	230	310	55	850	375	130	510	530
Channel	CJ43-011	04F2128-001	2,676	215	215	89	110	120	120	110	160	425	260	425	87	120	220
Channel	CP46-000	03F0049-013	2,903	190	190	89	110	110	375	84	120	375	200	375	375	110	200
Channel	DC45-000	02E0055-003	2,258	175	175	62	175	175	175	175	86	175	190	175	175	175	170
Channel	SED001900	00D1513-001	2,174	35	50	150	170	150	140	130	170	185	340	24	110	220	300
Channel	SED002900	00D1513-002	2,383	195	195	195	195	195	195	195	23	195	195	195	195	195	20
Channel	SED003900	00D1513-003	5,587	34	160	530	450	430	330	280	500	160	810	43	280	620	960
Channel	SED004900	00D1513-004	1,301	190	190	47	56	52	43	31	52	190	77	190	35	57	91
Channel	SED005900	00D1513-005	1,217	190	190	42	41	46	44	32	59	190	58	190	30	35	70
Channel	SED00795	SDG0203JE	12,574	69	320	1,100	1,000	1,400	730	660	1,200	250	2,300	95	650	1,400	1,400
Channel	SED01095	SDG0206JE	2,693	26	45	190	210	210	170	210	230	51	590	21	160	240	340
Channel	SED011	SD00242WC	2,288	56	250	92	95	110	250	67	94	250	220	250	74	240	240
Channel	SED011	SD00282WC	2,730	195	195	195	195	195	195	195	195	195	195	195	195	195	195

Table A6.24
Sum Total PAH Values by Sample for the SW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
Channel	SED011	SD00306WC	3,179	270	270	270	270	270	270	270	270	270	61	270	270	53	95
Channel	SED011	SD00331WC	2,389	220	220	95	220	66	220	97	120	220	240	220	61	190	200
Channel	SED011	SD00537WC	3,080	220	220	220	220	220	220	220	220	220	220	220	220	220	220
Channel	SED01195	SDG0207JE	9,685	51	250	820	810	1,000	670	590	850	230	1,800	74	550	990	1,000
Channel	SED01295	SDG0208JE	15,880	180	430	1,400	1,300	1,500	1,100	920	1,400	360	2,700	180	910	1,800	1,700
Channel	SED02495	SDG0301JE	1,881	175	175	175	175	37	175	175	34	175	33	175	175	175	27
Channel	SED02595	SDG0302JE	2,870	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Channel	SED02695	SDG0237JE	2,800	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Channel	SED02795	SDG0303JE	2,303	200	200	200	200	200	200	200	200	200	34	200	200	38	31
Channel	SED03295	SDG0215JE	1,679	210	210	65	60	79	55	50	95	210	190	210	39	96	110
Channel	SED03495	SDG0311JE	1,938	180	180	25	180	180	180	180	69	180	100	180	180	45	79
Channel	SED04395	SDG0209JE	1,948	205	25	110	120	110	99	130	150	21	320	205	93	160	200
Channel	SED04495	SDG0267JE	5,679	205	59	350	420	450	380	460	490	150	1,100	205	330	450	630
Channel	SED04795	SDG0256JE	3,005	245	245	245	245	245	245	245	245	245	33	245	245	245	32
Channel	SED04895	SDG0287JE	2,091	225	29	96	130	120	140	91	130	225	220	225	110	150	200
Channel	SED05095	SDG0242JE	4,049	345	345	345	345	345	345	345	345	345	99	345	345	60	95
Channel	SED07295	SDG0318JE	2,324	175	19	120	170	120	170	180	180	175	330	175	120	140	250
Channel	SED65992	SD60059WC	3,713	93	230	180	230	280	230	100	210	230	560	230	230	510	400
Channel	SED66492	SD60064WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED66592	SD60065WC	4,820	110	130	280	380	500	150	180	350	240	900	80	190	720	610
Channel	SED66692	SD60066WC	2,800	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Channel	SED66792	SD60067WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED68892	SD60088WC	2,800	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Channel	SED69292	SD60092WC	3,010	215	215	215	215	215	215	215	215	215	215	215	215	215	215
Channel	SED69392	SD60093WC	2,800	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Channel	SED69792	SD60097WC	3,010	215	215	215	215	215	215	215	215	215	215	215	215	215	215
Channel	SED69892	SD60098WC	5,240	230	110	360	410	550	120	190	430	230	870	230	150	600	760
Channel	SED69992	SD60099WC	2,660	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Channel	SED70092	SD60100WC	5,894	130	150	430	480	650	160	230	510	175	1,000	89	180	750	960
Channel	SED80093	SDG0002JE	2,590	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Channel	SED80193	SDG0003JE	1,971	210	210	94	100	140	79	50	110	210	200	210	83	85	190
Channel	SS9040400	00A1133-004	2,887	360	360	78	100	86	360	100	130	360	180	360	73	140	200
Channel	SW022	SW70213JE	6,885	96	120	590	580	870	260	250	600	160	1,000	69	250	740	1,300

Non-detected concentrations and individual PAHs detected in fewer than 5% of samples in the AEU were excluded from the Total-PAH calculation.

A6.25

Total Maximum Detected PAH Values for the SW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,I) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
B-4	DB47-001	05F0597-002	4,840	ND	60	330	430	810	310	ND	470	ND	880	ND	250	430	870
B-4	DB47-001	05F0597-003	4,650	ND	420	330	450	630	ND	ND	480	ND	1,000	ND	ND	420	920
B-4	DB47-002	05F0599-001	3,418	ND	73	240	290	270	200	270	330	65	580	ND	150	370	580
B-4	DB47-002	05F0599-002	6,095	ND	75	360	490	560	320	540	610	110	1,200	ND	280	550	1,000
B-4	DB47-002	05F0599-003	1,937	ND	ND	98	150	180	95	200	210	ND	450	ND	84	160	310
B-4	DB47-003	05F0618-003	994	ND	ND	100	100	180	90	ND	110	ND	230	ND	74	110	ND
B-4	DB47-004	05F0618-005	434	ND	ND	80	ND	ND	ND	ND	74	ND	170	ND	ND	110	ND
B-4	DB47-004	05F0618-006	3,190	ND	ND	200	270	530	230	ND	340	ND	690	ND	190	290	450
B-4	DB47-004	05F0618-007	4,250	ND	ND	220	300	720	290	ND	460	ND	1,100	ND	260	370	530
B-4	DB47-005	05F0597-004	4,496	110	140	300	320	230	270	310	350	92	750	94	200	630	700
B-4	SED63592	SD60035WC	5,049	ND	79	350	420	660	200	280	490	ND	1,100	ND	ND	580	890
B-4	SED63592	SD60111WC	5,710	ND	100	370	460	740	ND	350	530	ND	1,200	ND	200	760	1,000
B-4	SED63692	SD60036WC	3,250	ND	ND	240	290	440	ND	200	330	ND	750	ND	ND	420	580
B-4	SED63792	SD60037WC	5,095	ND	85	340	420	1,000	ND	290	500	ND	1,100	ND	ND	500	860
B-4	SED63792	SD60114WC	7,444	ND	84	430	570	1,500	270	350	650	ND	1,400	ND	300	690	1,200
B-4	SED63892	SD60038WC	3,940	ND	ND	ND	370	660	ND	220	470	ND	950	ND	ND	450	820
B-4	SED63892	SD60110WC	4,740	ND	ND	ND	400	770	ND	360	520	ND	1,100	ND	ND	590	1,000
B-4	SED63992	SD60039WC	5,029	ND	99	350	440	710	ND	290	490	ND	1,100	ND	ND	580	970
B-5	SED64292	SD60042WC	84	ND	ND	ND	ND	ND	ND	ND	ND	ND	84	ND	ND	ND	ND
B-5	SED64392	SD60043WC	350	ND	ND	ND	ND	ND	ND	ND	ND	ND	190	ND	ND	ND	160
Channel	CJ41-004	04F2195-001	171	ND	ND	ND	ND	56	ND	ND	68	ND	47	ND	ND	ND	ND
Channel	CJ42-006	04F2195-002	4,578	ND	67	300	370	350	250	340	410	71	1,000	ND	220	520	680
Channel	CJ42-007	04F2195-003	790	ND	ND	63	79	75	55	66	94	ND	190	ND	48	120	ND
Channel	CJ42-008	04F2195-004	1,699	ND	57	120	120	140	ND	110	190	ND	380	ND	72	250	260
Channel	CJ43-009	04F2195-005	2,414	ND	50	150	190	180	130	180	210	44	510	ND	100	320	350
Channel	CJ43-010	04F2195-006	3,583	ND	78	240	260	250	140	230	310	55	850	ND	130	510	530
Channel	CJ43-011	04F2128-001	1,396	ND	ND	89	110	120	120	110	160	ND	260	ND	87	120	220
Channel	CP46-000	03F0049-013	1,023	ND	ND	89	110	110	ND	84	120	ND	200	ND	ND	110	200
Channel	DC45-000	02E0055-003	508	ND	ND	62	ND	ND	ND	ND	86	ND	190	ND	ND	ND	170
Channel	SED001900	00D1513-001	1,989	35	50	150	170	150	140	130	170	ND	340	24	110	220	300
Channel	SED002900	00D1513-002	43	ND	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	ND	ND	20
Channel	SED003900	00D1513-003	5,587	34	160	530	450	430	330	280	500	160	810	43	280	620	960
Channel	SED004900	00D1513-004	541	ND	ND	47	56	52	43	31	52	ND	77	ND	35	57	91
Channel	SED005900	00D1513-005	457	ND	ND	42	41	46	44	32	59	ND	58	ND	30	35	70
Channel	SED00795	SDG0203JE	12,574	69	320	1,100	1,000	1,400	730	660	1,200	250	2,300	95	650	1,400	1,400
Channel	SED01095	SDG0206JE	2,693	26	45	190	210	210	170	210	230	51	590	21	160	240	340
Channel	SED011	SD00242WC	1,288	56	ND	92	95	110	ND	67	94	ND	220	ND	74	240	240
Channel	SED011	SD00306WC	209	ND	ND	ND	ND	ND	ND	ND	ND	ND	61	ND	ND	53	95
Channel	SED011	SD00331WC	1,069	ND	ND	95	ND	66	ND	97	120	ND	240	ND	61	190	200
Channel	SED01195	SDG0207JE	9,685	51	250	820	810	1,000	670	590	850	230	1,800	74	550	990	1,000
Channel	SED01295	SDG0208JE	15,880	180	430	1,400	1,300	1,500	1,100	920	1,400	360	2,700	180	910	1,800	1,700
Channel	SED02495	SDG0301JE	131	ND	ND	ND	ND	37	ND	ND	34	ND	33	ND	ND	ND	27
Channel	SED02795	SDG0303JE	103	ND	ND	ND	ND	ND	ND	ND	ND	ND	34	ND	ND	38	31
Channel	SED03295	SDG0215JE	839	ND	ND	65	60	79	55	50	95	ND	190	ND	39	96	110
Channel	SED03495	SDG0311JE	318	ND	ND	25	ND	ND	ND	ND	69	ND	100	ND	ND	45	79
Channel	SED04395	SDG0209JE	1,538	ND	25	110	120	110	99	130	150	21	320	ND	93	160	200
Channel	SED04495	SDG0267JE	5,269	ND	59	350	420	450	380	460	490	150	1,100	ND	330	450	630
Channel	SED04795	SDG0256JE	65	ND	ND	ND	ND	ND	ND	ND	ND	ND	33	ND	ND	ND	32
Channel	SED04895	SDG0287JE	1,416	ND	29	96	130	120	140	91	130	ND	220	ND	110	150	200
Channel	SED05095	SDG0242JE	254	ND	ND	ND	ND	ND	ND	ND	ND	ND	99	ND	ND	60	95
Channel	SED07295	SDG0318JE	1,799	ND	19	120	170	120	170	180	180	ND	330	ND	120	140	250
Channel	SED65992	SD60059WC	2,333	93	ND	180	ND	280	ND	100	210	ND	560	ND	ND	510	400
Channel	SED66592	SD60065WC	4,580	110	130	280	380	500	150	180	350	ND	900	80	190	720	610

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A6.25

Total Maximum Detected PAH Values for the SW AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,I) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
Channel	SED69892	SD60098WC	4,550	ND	110	360	410	550	120	190	430	ND	870	ND	150	600	760
Channel	SED70092	SD60100WC	5,719	130	150	430	480	650	160	230	510	ND	1,000	89	180	750	960
Channel	SED80193	SDG0003JE	1,131	ND	ND	94	100	140	79	50	110	ND	200	ND	83	85	190
Channel	SS9040400	00A1133-004	1,087	ND	ND	78	100	86	ND	100	130	ND	180	ND	73	140	200
Channel	SW022	SW70213JE	6,885	96	120	590	580	870	260	250	600	160	1,000	69	250	740	1,300

ND = Not detected.

Non-detected concentrations reported and individual PAHs detected in fewer than 5% of samples in the AEU were excluded from the Total-PAH calculation.

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Ta[illegible].26
Sum Total PAH Values by Sample for the WC AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
C-1	CR31-005	05F0600-002	4,710	360	440	190	170	170	150	150	190	530	120	700	500	340	700
C-1	CR31-006	05F0600-003	9,985	395	450	800	800	800	800	800	800	800	800	800	800	340	800
C-1	CR31-006	05F0600-004	6,093	360	410	83	79	700	700	700	81	700	130	700	400	350	700
C-1	CR31-007	05F0600-006	5,240	320	350	69	66	600	600	600	65	600	120	600	340	310	600
C-1	CR31-008	05F0630-001	5,814	74	90	140	700	180	700	700	130	700	330	700	700	360	310
C-1	CR31-008	05F0630-002	4,013	205	205	59	410	410	410	410	60	410	120	410	410	84	410
C-1	SED510	SD50017WC	6,500	500	500	500	500	500	500	500	500	ND	500	500	500	500	500
C-2	SED511	SD50023WC	9,240	700	700	700	700	700	700	700	700	700	140	700	700	700	700
C-2	SED512	SD50024WC	14,700	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
Channel	CR32-001	02E0267-001	2,870	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Channel	SED001	SD00275WC	3,080	220	220	220	220	220	220	220	220	220	220	220	220	220	220
Channel	SED001	SD00324WC	3,500	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Channel	SED002	SD00236WC	2,450	175	175	175	175	175	175	175	175	175	175	175	175	175	175
Channel	SED002	SD00276WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
Channel	SED002	SD00300WC	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
Channel	SED002	SD00325WC	2,800	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Channel	SED016	SD00005JE	3,920	280	280	280	280	280	280	280	280	280	280	280	280	280	280
Channel	SED016	SD00243WC	3,220	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Channel	SED016	SD00305WC	5,390	385	385	385	385	385	385	385	385	385	385	385	385	385	385
Channel	SED016	SD00330WC	3,010	215	215	215	215	215	215	215	215	215	215	215	215	215	215
Channel	SED016	SD00536WC	4,410	315	315	315	315	315	315	315	315	315	315	315	315	315	315
Channel	SED017	SD00244WC	7,000	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Channel	SED024	SD00250WC	2,870	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Channel	SED024	SD00277WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED024	SD00326WC	4,620	330	330	330	330	330	330	330	330	330	330	330	330	330	330
Channel	SED025	SD00251WC	5,740	410	410	410	410	410	410	410	410	410	410	410	410	410	410
Channel	SED026	SD00252WC	4,690	335	335	335	335	335	335	335	335	335	335	335	335	335	335
Channel	SED027	SD00253WC	4,270	305	305	305	305	305	305	305	305	305	305	305	305	305	305
Channel	SED027	SD00278WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED027	SD00302WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED027	SD00327WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
Channel	SED028	SD00254WC	3,246	245	245	245	245	245	245	245	245	245	245	245	245	245	61
Channel	SED029	SD00255WC	1,957	190	190	64	110	120	190	110	87	190	120	190	190	66	140
Channel	SED029	SD00271WC	5,250	375	375	375	375	375	375	375	375	375	375	375	375	375	375
Channel	SED029	SD00320WC	3,990	285	285	285	285	285	285	285	285	285	285	285	285	285	285
Channel	SED029	SD00531WC	4,550	325	325	325	325	325	325	325	325	325	325	325	325	325	325
Channel	SED030	SD00256WC	3,990	285	285	285	285	285	285	285	285	285	285	285	285	285	285
Channel	SED031	SD00257WC	2,590	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Channel	SED037	SD00274WC	3,500	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Channel	SED037	SD00323WC	3,640	285	285	285	285	285	285	285	285	285	120	285	285	285	100
Channel	SED038	SD00272WC	3,397	270	270	270	270	270	270	270	270	270	70	270	270	270	87
Channel	SED039	SD00273WC	3,613	285	285	285	285	285	285	285	63	285	130	285	285	285	285
Channel	SED039	SD00322WC	4,850	435	435	435	435	190	435	110	190	435	380	435	435	190	310
Channel	SED039	SD00532WC	3,920	280	280	280	280	280	280	280	280	280	280	280	280	280	280
Channel	SED040	SW70254WC	3,920	280	280	280	280	280	280	280	280	280	280	280	280	280	280
Channel	SED041	SW70255WC	2,870	205	205	205	205	205	205	205	205	205	205	205	205	205	205
Channel	SED08295	SDG0324JE	1,210	ND	ND	ND	ND	ND	ND	ND	280	ND	400	ND	ND	220	310
Channel	SED08395	SDG0227JE	1,542	190	190	33	39	190	45	190	55	190	88	190	24	51	67
Channel	SED08495	SDG0229JE	1,780	200	200	22	37	200	50	200	140	200	50	200	200	28	53
Channel	SED08895	SDG0325JE	2,740	240	240	240	240	240	240	240	240	240	31	240	240	24	45
Channel	SED125	SD00266WC	17,130	510	470	1,200	970	1,500	630	690	1,200	220	2,900	400	440	2,900	3,100

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[illegible]6.26
Sum Total PAH Values by Sample for the WC AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
Channel	SED126	SD00267WC	1,738	180	180	53	57	84	180	72	73	180	95	180	180	94	130
Channel	SED127	SD00006JE	3,150	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Channel	SED127	SD00551WC	6,230	445	445	445	445	445	445	445	445	445	445	445	445	445	445
Channel	SED508	SD50014WC	12,600	900	900	900	900	900	900	900	900	900	900	900	900	900	900
Channel	SED51593	SD50000AS	2,366	190	190	190	190	190	190	190	190	190	97	190	190	82	97
Channel	SED51693	SD50001AS	1,989	185	185	38	185	185	185	185	41	185	96	185	185	76	73
Channel	SED51793	SD50002AS	2,660	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Channel	SED51893	SD50003AS	2,520	180	180	180	180	180	180	180	180	180	180	180	180	180	180
Channel	SW01793	SW70169JE	3,010	215	215	215	215	215	215	215	215	215	215	215	215	215	215
Channel	SW030	SW70168JE	5,460	390	390	390	390	390	390	390	390	390	390	390	390	390	390
Channel	SW036	SW70167JE	3,640	260	260	260	260	260	260	260	260	260	260	260	260	260	260

ND = Not detected.

Non-detected concentrations reported at one-half detection limits and included in the Total-PAH concentration.

[illegible] A6.27
Total Maximum Detected PAH Values for the WC AEU

Pond or Channel	Location	Sample Number	Total PAH	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
C-1	CR31-005	05F0600-002	2,950	ND	440	190	170	170	150	150	190	530	120	ND	500	340	ND
C-1	CR31-006	05F0600-003	790	ND	450	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	340	ND
C-1	CR31-006	05F0600-004	1,893	360	410	83	79	ND	ND	ND	81	ND	130	ND	400	350	ND
C-1	CR31-007	05F0600-006	1,640	320	350	69	66	ND	ND	ND	65	ND	120	ND	340	310	ND
C-1	CR31-008	05F0630-001	1,614	74	90	140	ND	180	ND	ND	130	ND	330	ND	ND	360	310
C-1	CR31-008	05F0630-002	323	ND	ND	59	ND	ND	ND	ND	60	ND	120	ND	ND	84	ND
C-2	SED511	SD50023WC	140	ND	ND	ND	ND	ND	ND	ND	ND	ND	140	ND	ND	ND	ND
Channel	SED028	SD00254WC	61	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	61
Channel	SED029	SD00255WC	817	ND	ND	64	110	120	ND	110	87	ND	120	ND	ND	66	140
Channel	SED037	SD00323WC	220	ND	ND	ND	ND	ND	ND	ND	ND	ND	120	ND	ND	ND	100
Channel	SED038	SD00272WC	157	ND	ND	ND	ND	ND	ND	ND	ND	ND	70	ND	ND	ND	87
Channel	SED039	SD00273WC	193	ND	ND	ND	ND	ND	ND	ND	63	ND	130	ND	ND	ND	ND
Channel	SED039	SD00322WC	1,370	ND	ND	ND	ND	190	ND	110	190	ND	380	ND	ND	190	310
Channel	SED08295	SDG0324JE	1,210	ND	ND	ND	ND	ND	ND	ND	280	ND	400	ND	ND	220	310
Channel	SED08395	SDG0227JE	402	ND	ND	33	39	ND	45	ND	55	ND	88	ND	24	51	67
Channel	SED08495	SDG0229JE	380	ND	ND	22	37	ND	50	ND	140	ND	50	ND	ND	28	53
Channel	SED08895	SDG0325JE	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	31	ND	ND	24	45
Channel	SED125	SD00266WC	17,130	510	470	1,200	970	1,500	630	690	1,200	220	2,900	400	440	2,900	3,100
Channel	SED126	SD00267WC	658	ND	ND	53	57	84	ND	72	73	ND	95	ND	ND	94	130
Channel	SED51593	SD50000AS	276	ND	ND	ND	ND	ND	ND	ND	ND	ND	97	ND	ND	82	97
Channel	SED51693	SD50001AS	324	ND	ND	38	ND	ND	ND	ND	41	ND	96	ND	ND	76	73

Non-detected concentrations and individual PAHs detected in fewer than 5% of samples in the AEU were excluded from the Total-PAH calculation.

COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

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Other Lines of Evidence in Support of the Risk Characterization

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ACRONYMS AND ABBREVIATIONS

µg/kg	microgram per kilogram
AEU	Aquatic Exposure Unit
bgs	below ground surface
BSF	biota to sediment factor
CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy
ECOC	ecological chemical of concern
ECOPC	ecological contaminant of potential concern
EE	Environmental Evaluation
EEC	effective exposure concentration
EPC	exposure point concentration
ERA	Ecological Risk Assessment
HI	hazard index
HQ	hazard quotient
IA	Industrial Area
IBI	index of biotic integrity
IMP	Integrated Monitoring Plan
MK	McKay Ditch
N/A	not applicable
NN	No Name
NPDES	National Pollutant Discharge Elimination System
NW	North Walnut

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OU	Operable Unit
PCB	polychlorinated biphenyl
PCOC	potential contaminant of concern
PMJM	Preble's meadow jumping mouse
ppb	part per billion
RBP	Rapid Bioassessment Protocol
RC	Rock Creek
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	Remedial Feasibility Investigation/Remedial Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SE	Southeast
SW	Southwest
TSS	total suspended solids
WC	Woman Creek

1.0 INTRODUCTION

Previous research studies have been completed within the Rocky Flats Environmental Technology Site (RFETS) that help define the current ecological condition of the site. Many of these studies were focused within the Aquatic Exposure Units (AEUs) specifically. For the purposes of the Comprehensive Risk Assessment (CRA), a review of the studies that focused on ecological effects within the AEUs was completed. Each study provides a "line of evidence" that describes the ecological risk setting of RFETS. These lines of evidence help to determine if a chemical effect is occurring to the aquatic population within a given AEU.

The information available in these previous studies includes tissue analyses, aquatic population studies, bioassay analyses, waterfowl/wading bird studies, and chemical loading analyses. Only those portions of each study that fell within these categories were reviewed and relied upon. Information that was not used includes hazard quotient (HQ) analyses, wildlife studies, vegetation studies, and studies not focused upon the AEU areas. The types of line of evidence studies available from the reviewed literature are summarized in Table A7.1.

Only studies completed since 1991 were reviewed. These studies, in essence, captured a moment in time that was encompassed by the CRA AEU comprehensive databases. Therefore, the results have a direct application to the CRA because they co-occur in time and location.

Several studies provided multiple lines of evidence. For instance, the U.S. Department of Energy (DOE) (1996) evaluation was a baseline Ecological Risk Assessment (ERA) of Operable Units (OUs) 5 and 6 (Woman Creek and Walnut Creek) using a multi-tiered approach. This study included tissue analyses, bioassay analyses, and food chain modeling for waterfowl species, thereby providing three different lines of evidence for the CRA.

Studies with common goals were combined into a single subsection (i.e., aquatic ecological characterization studies, tissue analyses, etc.). The types of studies reviewed fall into a general set of lines of evidence categories that have ecological endpoints (i.e., impacts to populations of aquatic species), with one exception. Studies that describe chemical loading within a watershed were also reviewed as a line of evidence for surface water and/or sediment ecological contaminants of potential concern (ECOPCs) requiring further spatial extent analysis. These loading studies were not designed to address an ecological endpoint, but rather serve to define a chemical behavior within a watershed system. The categories of studies that were compiled are described below.

1.1 Tissue Analyses

The measure of chemical body burden in an aquatic receptor is a direct measure of bioaccumulation/concentration processes. These measures are useful in determining whether a given surface water or sediment ECOPC is bioavailable and, thus, potentially

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harmful. Studies reviewed and used for their tissue analysis evaluations included the following:

- Stiger, 1994a. OU 3 Final RFI/RI – Appendix K. PCB Study: "Results of PCB Sediment and Tissue Sampling For Walnut and Woman Creek Drainages and Offsite Reservoirs – SGS-576-94."

- DOE, 1996. Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

1.2 Aquatic Population Studies

The study of a given aquatic species population is a direct measure of surface water and/or sediment chemical effects. Sessile organisms such as benthic macroinvertebrates can be highly susceptible to habitat disturbance, including chemical releases. The measure of species and population indicators (biometrics) such as species richness, density, diversity, etc., is often a useful tool to determine chemical effects so long as a habitat reference condition is understood. Biometrics are influenced by chemical, physical, and biological factors, all of which need to be understood in order to isolate a single factor's effect on a given population. Numerous biological inventory studies have been completed within RFETS. A number of these were designed to define the aquatic health condition within a potentially affected watershed component (i.e., Woman Creek) as compared to a background or reference watershed component (i.e., Rock Creek). The endpoint of most of these studies was to determine the causative factor controlling the ecology, whether physical (habitat), biological (species inter- or intra-actions), or chemical (RFETS chemical release). Many of these studies evaluated both biological and abiotic (physical and chemical) features of a watershed within RFETS at once. Some were focused on particular segments, or streams for a defined purpose (for example, ammonia spatial extent within Big Dry Creek). Aquatic population studies reviewed and integrated into the CRA included the following:

- Aquatics Associates Inc., 1998. Interim Report: Results of the Aquatic Monitoring Program in Big Dry Creek, 1997. Prepared for Cities of Broomfield, Northglenn and Westminster, Colorado.

- Aquatics Associates Inc., 2003. Results of the Aquatic Monitoring Program in Streams at the Rocky Flats Site, Golden, Colorado 2001-2002. Prepared for U.S. Department of Energy, Rocky Flats Field Office Golden, Colorado.

- Ebasco Environmental Consultants Inc., 1992. Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at Rocky Flats Plant. Prepared for U.S. DOE, Rocky Flats Field Office. Golden, Colorado.

- Exponent, 1998. Final Report: Lower Walnut Creek Aquatic Sampling, Spring 1998. Prepared for Kaiser-Hill Company, LLC, Rocky Flats Environmental Technology Site. Golden, Colorado.

- Wright Water Engineers, Inc. 2003. Supplemental Biological and Selected Water Quality Data Exploration 1997-2001. Provided to Big Dry Creek Watershed Association Steering Committee. April 8, 2003.

1.3 Bioassay Analyses

Bioassays test the toxicity attributable to potentially contaminated media and provide a direct measure of chemical risk. Only one study was identified as having completed a bioassay analysis:

- DOE, 1996. Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

1.4 Waterfowl/Wading Bird Studies

Waterfowl, wading birds, and higher trophic organisms were not identified as target receptors for the AEU CRA. However, the CRA methodology (DOE 2004a) suggests that studies of these organisms may be useful lines of evidence within the CRA. For that purpose, these studies were evaluated and included:

- DOE, 1996. Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.
- Stiger, 1994a. OU 3 Final RFI/RI – Appendix K. PCB Study: "Results of PCB Sediment and Tissue Sampling For Walnut and Woman Creek Drainages and Offsite Reservoirs – SGS-576-94."

1.5 Chemical Loading Analyses

The spatial extent of a particular surface water and/or sediment ECOPC can be determined with a synoptic sampling that follows the course of a "slug" of water as it travels through a drainage. Measures of chemical concentration are synchronized with flow in order to determine load. Load is then compared from location to location as the slug of water progresses downgradient. Where a dramatic increase in load is observed, a potential source area may be the cause. Loading analyses therefore help describe the spatial distribution of a chemical and determine if it is gaining in concentration, losing in concentration, typical of the drainage, or potentially related to source areas. The following study describes such efforts and was used as a line of evidence for the CRA:

- DOE, 2004b. Rocky Flats Environmental Technology Site Automated Surface-Water Monitoring. Water Year 2003 Annual Report and Water Year 2004 Source Evaluations for Points of Evaluation GS10, SW027, and SW093. RF/EMM/WP-04-SWMANLRPT03.UN. Final.

2.0 TISSUE ANALYSES

2.1 Stiger, 1994a

OU 3 Final RFI/RI – Appendix K. PCB Study: "Results of PCB Sediment and Tissue Sampling For Walnut and Woman Creek Drainages and Offsite Reservoirs – SGS-576-94."

Review

This study was completed in response to preliminary results of sediment and tissue samples collected during the OU 6 Remedial Investigation (RI) between August 1992 and June 1993, which indicated elevated polychlorinated biphenyl (PCB) concentrations occur for some of the A- and B-series ponds. Because the potential exists for sediment and/or specific biota in Great Western Reservoir and Standley Lake Reservoir to have been affected by PCB contaminants from RFETS prior to 1989 (prior to the diversion canal being constructed that routes flow coming from Walnut Creek around Great Western Reservoir and back into Walnut Creek below the dam), a sediment and tissue PCB sampling project was undertaken as part of the Environmental Evaluation (EE) portion of the OU 6 RI.

The effort entailed sampling of sediment and fish tissue from the A- and B-series ponds. Fish samples also were collected from the Walnut Creek terminal pond at Indiana Street (OU 6) and Great Western Reservoir to determine if any PCBs had migrated downstream of the terminal ponds, Mower Reservoir, Standley Lake Reservoir, and the C- and D-series ponds.

An attempt was made to collect three of each species of fish for whole body analysis. When additional numbers of the same species were sacrificed, they were used for filet or liver analysis. Results were compared to literature-derived values to determine potential effects. The following values were used to compare tissue results:

- Reproductive impairment in rainbow trout may occur at concentrations above 400 micrograms per kilogram (µg/kg) fresh weight (EPA 1980, as reported in Eisler 1986).
- The recommended maximum body burden for trout is 400 µg/kg fresh weight (Eisler 1986).
- A reported value of 5,000 µg/kg is protective of human health consumption (Hoeting 1983, as reported in Eisler 1986).
- An observed typical body burden concentration for fish is 1,000 µg/kg (Schnitt, et al. 1983, as reported in Eisler 1986).

- Food concentration thresholds recommended by DOE (1994) for fish-eating birds are 667 parts per billion (ppb) for the belted kingfisher and 768 ppb for the great blue heron.

In addition, a sampling effort was undertaken to evaluate whether the Preble's meadow jumping mouse (PMJM) might be impacted by the presence of PCBs in the RFETS buffer zone. Because the PMJM has a diet similar to deer mice, 13 deer mice were collected adjacent to Ponds A-1, A-3, B-1, and B-4 for whole body tissue analysis to evaluate possible PCB contamination in PMJM. In addition, 12 voles were collected from the same locations to determine if they represent a pathway of PCBs to predatory birds, which include voles in their diet.

Results from the sediment sampling program (collected at depths of 0 to 6 inches below ground surface [bgs]) in both the A- and B-series ponds show a decreasing concentration of PCBs, primarily Aroclor-1254, with distance downstream. The mean values of Aroclor-1254 and Aroclor-1248 in the A and B ponds are summarized in Table A7.2. Conclusions drawn from the sediment analysis are as follows:

- Sediments collected from Pond B-2 have a considerably higher mean Aroclor-1254 concentration than those collected from either Pond B-1 or B-3. It was speculated that this was due to the presence of an outfall that historically entered directly into Pond B-2, bypassing Pond B-1.

- Ponds B-1 and B-2 contain the only sediment sampling locations where Aroclor-1248 was detected.

- No PCBs were detected in terminal Ponds A-4 or B-5.

- No PCBs were detected in sediment collected from the C-1 and C-2 ponds.

PCB concentrations in both the A- and B-series ponds decrease with distance downstream to the point where no PCBs were detected in terminal Ponds A-4 or B-5. In addition, no PCBs were detected in sediment samples collected from Ponds C-1 and C-2. Therefore, it is highly unlikely that sediments derived from RFETS would be currently contributing PCBs to any of the offsite reservoirs.

In the A and B ponds, four types of whole body tissues were analyzed: largemouth bass (40-58 μg/kg), fathead minnows (14-479 μg/kg), tiger salamanders (26 – 134 μg/kg), and crayfish (BDL – 9.5 μg/kg). Summary conclusions are as follows:

- For the A-series ponds, no consistent trends could be observed. Species were either present and collected in one pond only or the PCB concentrations were below detection limits.

- For the B-series ponds, the PCB concentrations increased in tiger salamanders from the B-1 to B-2 ponds with no further specimens being found downstream, increased in plants from B-1 to B-4, and decreased in fathead minnows from B-4

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to B-5. PCBs were detected in fathead minnows collected from the Walnut Creek terminal pond at Indiana Street in even lower concentrations than in Pond B-5.

- Only one fish species was collected from Great Western Reservoir. Of the six carp specimens collected, only one contained detected quantities of PCBs (52.4 μg/kg).

- Fish tissue samples collected from Ponds C-1 and C-2 contained only low levels of PCBs (<100 μg/kg), and no PCBs were detected in fish tissues collected from Ponds D-1 and D-2 or Mower reservoir.

- The highest concentration of PCBs found in any animal tissue during this study was in a carp (1,000 μg/kg) collected from Standley Lake Reservoir. Historically, less than 5 percent of the water flowing into Standley Lake Reservoir has come from RFETS. In addition, all of the Woman Creek drainage above the divide on Woman Creek below the C-2 dam has been diverted to Mower Reservoir since 1989, and currently no surface water enters this reservoir. Therefore, it is highly unlikely that the PCBs found in the fish tissue samples collected from Standley Lake were derived from RFETS. Furthermore, the scarcity of detected PCBs in fish tissues collected from Great Western Reservoir supports the hypothesis that RFETS is not contributing PCBs to any of the offsite reservoirs.

- The only tissue samples collected on RFETS to exceed Eisler's (1986) recommended maximum body burden for trout (400 μg/kg fresh weight) were three fathead minnow specimens (464 – 498 μg/kg for whole body) collected from the B-4 pond.

Application to the CRA and Uncertainties

This study encapsulated several lines of evidence within its design. The A-, B-, and C-series ponds were sampled specifically to assess PCB transfer between abiotic (sediment) and biotic (fish tissue) media. The absence of PCB accumulation in excess of tissue threshold concentrations in almost all fish at the site indicates there is a low potential for risk to fish in the pond habitat within NW AEU, SW AEU, WC AEU, and SE AEU. Results of sediment samples did not yield any detectable levels of PCBs in terminal Ponds A-4 and B-5.

The only tissue samples collected on RFETS to exceed Eisler's (1986) body burden for trout (400 μg/kg flesh weight) were three fathead minnow specimens collected from the B-4 pond that had an average Aroclor-1254 content of 498 μg/kg. The results from the SW AEU sediment were compared to this value to determine if a potential bioaccumulation pathway may exist.

This study also evaluated the potential effects of PCBs in sediment on predatory birds that may feed on organisms that are exposed to the sediment. Results from this study revealed that there is no risk to predatory birds (i.e., higher trophic organisms) as a result of ingesting prey within the pond areas that may have accumulated PCBs from the sediment. The absence of PCB accumulation exceeding tissue threshold concentrations in prey species indicates that there is a low potential for risk to these organisms within North Walnut (NW) AEU, Southwest (SW) AEU, Woman Creek (WC) AEUs, and Southeast (SE) AEU.

The time period in which this study was completed represents an historic condition for RFETS. A significant number of accelerated action efforts have been completed since this time. The sediments from certain ponds (B-1, B-2, and B-3) have been removed, and the food web components that were initially sampled from each pond may no longer be present. Therefore, the study likely represents conservative conditions and over-estimates PCB risks when compared to current conditions at RFETS.

2.2 DOE, 1996

Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

Review

The ERA for OUs 5 and 6 used a multi-tiered approach to evaluate risks to aquatic and terrestrial receptors. The first tier represented a conservative screening approach that served to recommend additional steps of refinement for more baseline-level ERA evaluations. One additional step was the evaluation of PCBs, which initially indicated negligible risk to aquatic-feeding birds (as per the screening-level findings). However, DOE (1996) recommended further analysis because 1) data on biological tissues were not available for all ponds in which PCBs were detected in sediments, and 2) development of the aquatic community in ponds could result in increased biological transport of sediment contaminants and increased exposure to aquatic-feeding birds.

During the Remedial Feasibility Investigation/Remedial Investigation (/RFI/RI) field sampling at OU 6, sediments were collected from multiple locations within each of the A- and B-series ponds and analyzed for several PCB congeners. Only Aroclor-1254 and Aroclor-1260 were detected in these samples, and concentrations varied considerably between ponds. The highest concentrations were in the most upstream ponds in each watershed, with progressively lower concentrations down-gradient. In general, concentrations in sediments from the B-series ponds averaged ten times those in the A-series ponds, reflecting the fact that the South Walnut Creek watershed includes most of the industrialized area of RFETS and receives discharge from the wastewater treatment plant. PCBs were detected in 100 percent of the samples from Ponds A-1, B-1, B-2, B-3, and B-4; in three of four samples from Pond A-2; and in none of the samples from Ponds A-3, A-4, and B-5. These data were generated from samples collected from the surface as well as at depth. Aquatic organisms typically are not exposed to sediments below the upper 15 cm. Data generated during the RFI/RI field program, which included collection of sediment samples below this depth, did not permit evaluation of biological exposures.

Consequently, sediments and biota in the ponds were re-sampled and re-analyzed to obtain data more appropriate for assessing ecological risk. Samples were taken from the upper 15 cm of sediment at the same sites sampled during the earlier investigation. Where available, tissue samples also were collected for fish, salamanders, crayfish, and benthic macroinvertebrates. Sampling was conducted in June and July 1994. A preliminary report on the results of this follow-up sampling and analysis was submitted to DOE by EG&G (Stiger, 1994a). This exposure and analysis were based on results of the 1994 sampling.

Biota was sampled in all ponds. However, some of the ponds did not produce samples sufficient for analysis. Adequate samples were obtained only for Ponds A-2, A-3, A-4, B-1, B-2, B-4, and B-5. Largemouth bass were obtained from Pond A-2; fathead minnows from Ponds A-4, B-4, and B-5; tiger salamander larvae from Ponds B-1 and B-2; and crayfish from Ponds A-2, A-3, A-4, and B-5. A single sample of benthic macroinvertebrates was collected from Pond A-2.

As with the earlier sampling, the PCB concentrations were higher in the B ponds than in the A ponds, with the highest concentrations in Pond B-2. The maximum concentrations were generally lower than in the earlier (RFI/RI) samples. The sediments within the upper 15 cm had generally lower PCB concentrations than did the deeper sediments, suggesting a lower risk to aquatic life than indicated by the earlier data.

Aroclor-1254 was the only PCB congener consistently detected in biota and sediments. Aroclor-1260 was detected in only one biota sample from Pond B-3, and was not detected in sediment samples. The highest concentrations in tissues were not detected in samples from the ponds with the highest sediment concentrations. Aroclor-1254 was not detected in any of the crayfish samples. However, with the exception of Pond A-2, crayfish were captured in ponds with one (Pond A-3) or no sediment samples having detectable PCBs in sediment. Results of the sample analysis are provided in Table A7.3.

The ratio of Aroclor-1254 content in biota to that in sediments was calculated for ponds in which Aroclor-1254 was detected in both sediments and biological samples (Table A7.4). The variability of biota types available, and the lack of PCB detections in some ponds with biota, limited comparison of biota-to-sediment factor (BSF) values among ponds. BSF ratios varied among biota types, ranging from 0.1 in salamander neonates from Pond B-1 to 3.3 in fathead minnows from Pond B-4. Largemouth bass, which were found only in Pond A-2, had a BSF of 0.6. These values were comparable to BSFs estimated for aquatic biota in other studies (Rassmussen, et al. 1990; Macdonald, et al. 1993).

Application to the CRA and Uncertainties

This study encapsulated several lines of evidence within its design. A-, B-, and C-series ponds were sampled specifically to assess PCB transfer between abiotic (sediment) and biotic (fish tissue) media. The results from the A-series ponds, B-4, and B-5 were compared to the results for SW AEU PCB in sediment to determine to what extent bioaccumulation may occur. The absence of bioaccumulation of PCBs in Ponds A-1 and A-2 indicates a low risk to higher trophic organisms, as well as the receptors directly exposed to pond sediments. The measured tissue concentrations in specimens collected from Pond B-4 are just above tissue thresholds protective of fish (Stiger 1994b). This moderate level of bioaccumulation indicates a possible risk from PCBs.

The time period in which this study was completed represents an historic condition for RFETS. A significant number of accelerated action efforts have been completed since this time. The sediments from certain ponds (B-1, B-2, and B-3) have been removed, and the food web components that were initially sampled from each pond may no longer be present. Therefore, the results of this study are not directly applicable to the current conditions represented in the CRA.

3.0 AQUATIC POPULATION STUDIES

3.1 DOE, 1996

Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

Review

This study was completed as a part of the ecological risk evaluation of aquatic life for OUs 5 and 6. Risks to aquatic life from chemical concentrations in sediments were evaluated by a weight-of-evidence approach. HQs and hazard indices (HIs) were generated as a screening tool and indicated a relatively high potential for toxic effects in sediments. As a next step in the ERA tiered process, characteristics of benthic community structure and results of sediment bioassay tests were used to check predictions of toxic stress as indicated by the screening results. Community characteristics are described here; results of the bioassay analyses are presented in Section 4.1. This multi-tiered approach is similar to the Sediment Quality Triad procedure (Chapman 1986; EPA 1992), which uses toxicity, chemistry, and benthic community data to investigate the biological impact of sediment pollution and identify mechanisms of effects-based sediment studies (Chapman, et al. 1992; Power and Chapman 1992; Canfield, et al. 1994).

Benthos samples were collected from all of the A-, B-, C-, and D-series ponds during May through July 1994. Five replicate multi-core composite samples were obtained from different water depths and submerged habitat types to ensure complete representation of the pond biota. Samples were analyzed for taxonomic composition and abundance. Taxa were recorded at the lowest practical taxonomic level for the sample period.

Conventional interpretation of benthic community structure suggests that communities with low densities of organisms or reduced richness and diversity are subject to physical or chemical stress. Under sustained chemical stress, the benthic community may also contain high densities of pollution-tolerant species, which in turn may result in low

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richness and low diversity. Benthic communities for Ponds D-1 and D-2 were sampled to represent locations with no known contaminant input from RFETS.

Descriptive data were developed for community parameters including richness, density, Simpson and Shannon-Wiener diversity measures, number of dominant taxa, and abundance-based relationships for oligochaetes and dipterans. The data represent pond-level characteristics for a composite of data from the five different habitat samples.

A total of 81 different taxa representing all the major orders of aquatic organisms were identified in the pond benthos samples. A composite listing of identified taxa and mean abundance for each pond was compiled. Community description measures generated for each pond are summarized in Table A7.5. Oligochaete worms and dipterans dominated the benthos samples from all locations. General conclusions drawn from the study include the following:

- The B-series ponds contained the highest abundance of all taxa except pelecypoda (snails), which were most abundant in the A-series ponds.
- The C-series ponds did not support a wide variety of organisms other than oligochaetes and dipterans.
- Ponds A-1 and A-3 had the least pollution-tolerant communities of all ponds, including the D-series reference ponds. Ponds A-2 and B-2 had the most pollution-tolerant communities.
- Ponds D-1 and D-2 exhibited a wide range of community characteristics, including the second lowest (Pond D-1) and highest (Pond D-2) diversity values.
- A cursory review of the benthic community data indicates that Ponds A-4, B-3, and C-1 may have been under the most persistent chemical or physical stress. In each of these ponds, oligochaetes and dipterans were the dominant taxa. These organisms are considered good colonizers and frequently are the dominant taxa from habitats with high physical variability. The highly variable environmental (physicochemical) conditions at RFETS may account for the dominance of colonizers.

The data were analyzed to identify sites with benthic communities that were similar in composition and structure to sites with no known exposure to contaminants (Ponds D-1 and D-2). However, although the sediments from Pond D-1 were considered to be uncontaminated, the low richness and diversity and the high abundance of a single taxon at this site appear to reflect some type of environmental stress.

Cluster analysis techniques were used to determine the relationship between the HI estimate and community structure for each pond. Results from the analysis indicate that none of the community structure parameters mirror the HI site patterns. This result suggests a lack of correlation between the magnitude of the HIs and pond benthic community structure. Further analysis involving regression methods were used to estimate whether the proportion of variation in community structure could be explained by differences in HIs. Results indicate that predicted toxicity accounts for some of the variation in community composition, but other factors are clearly important. Factors such as pond size, fluctuating water levels, and the presence or absence of upper trophic levels also are important.

Applications to the CRA and Uncertainties

This study evaluated benthos samples collected from all of the A-, B-, C- and D-series ponds during May through July 1994, which encapsulates a portion of the surface water and sediment data set time period used for this CRA. Therefore, the results represent a snapshot in time of the aquatic ecology within the time-frame of the data collected for the CRA analysis. Results indicate that the pond populations at the time of the study were comparable to reference conditions. In addition, there was little correlation of population biometrics to chemical indices, indicating that there was minimal correlation between possible chemical stressors and population conditions. The results provided no evidence for chemical risk conditions during the sampling period in 1994.

Sampling captures aquatic population conditions during certain periods. Because the monitoring was completed over a short duration, it may not represent the year-round condition. In addition, the sampling took place prior to accelerated action efforts and likely represents worst-case conditions as compared to current conditions. Instead, the pond community studies indicated the general AEU conditions and influence of hydrologic conditions as compared to chemical exposure.

3.2 Ebasco Environmental Consultants Inc., 1992

Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at Rocky Flats Plant.

Review

This study provided an inventory and cursory assessment of the ecological health of the aquatic habitats within the RFETS buffer zone. A variety of methods were used to collect and observe aquatic species. Fish sampling employed gill nets, minnow traps, and limited electro-shock sampling. Benthic macroinvertebrate sampling used grab sampling techniques to collect field samples and repeatable laboratory methods to quantify the occurrence and abundance of benthic samples.

The occurrence of taxa within the benthic communities of streams and ponds was assessed, and generalizations about aquatic community health were made based on the presence or absence of various taxon, including those that may indicate tolerance or intolerance to pollutants.

The aquatic habitats were found to have high species richness, an indication of a healthy ecosystem. The report documents that aquatic habitats at RFETS have a high density of

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benthic macroinvertebrates. Fish species diversity is naturally low in the semiarid climate characterized by intermittent streams and small pools and ponds that are inadequate to support large fish populations. Nine species of fish were collected at RFETS, most in the minnow family *Cyprinidae* (six species). Most species were found in pools or impoundments that offer refuge from annual drought conditions. Several ponds had very high populations of golden shiners and fathead minnows.

The authors report that the most disruptive environmental factor to aquatic communities at RFETS is the naturally semiarid climate. All streams have sections that are intermittent, while the perennial sections are fed by groundwater seeps. Aquatic communities on RFETS thrive despite the environmental limitations. Many aquatic organisms present are adapted to low stream flow conditions. These organisms are often classified as "tolerant" considering general water quality.

Benthic macroinvertebrate samples from Walnut Creek contained 59 taxa during fall sampling. *Diptera* had the highest species richness with 24 species. One species of fish, fathead minnows, was collected from the B-series ponds. Two species of fish were collected from the A-series ponds, fathead minnow and golden shiner. No predatory fish were found.

The East Landfill Pond supports no fish and only a depauperate benthic macroinvertebrate community. Macrobenthic sampling documented eight taxa of macrobenthic organisms present in the pond, including organisms in the groups *Gastropoda, Pelecypoda, Oligochaeta, Hydracarina, Amphipoda,* and *Diptera.*

In Woman Creek, the benthic macroinvertebrate community was relatively rich and diverse. The most abundant and widespread groups overall in stream communities were the larvae of true flies (*Diptera*) and mayflies (*Ephemoptera*). The most common dipteran taxa are blackflies (*Simulidae*) and midges (*Chironomidae*). Both caenid and baetid mayflies also are common. Species richness for mayflies and caddisflies increased from headwater segments to the area east of Pond C-2, where flow in Woman Creek decreases (apparently due to loss to groundwater). Communities within the ponds are strongly dominated by midges and aquatic earthworms (*Oligochaeta*). Pond C-1 had a more developed aquatic plant community along the edge, supporting a more diverse assemblage of nektonic forms, including water striders (*Hemiptera: Gerridae*) and water boatmen (*Hemiptera: Corixidae*). Predatory dragonfly nymphs (*Odonota*) were present in the C ponds, as were crayfish (*Astacidae*).

Fish species within the streams of Woman Creek included the creek chub, stoneroller, fathead minnow, and green sunfish. Fish communities in the C ponds are influenced by the presence of suitable substrates, vegetation, and persistent water. The most common species included the golden shiner, white sucker, and largemouth bass found in Pond C-1; however, creek chubs and stonerollers were observed frequently throughout the upper sections of Woman Creek. Golden shiners feed on a variety of small prey and algae and may themselves be important prey for larger fish or piscivorous birds because of the large populations they attain and their relatively large size. Aquatic vertebrates in Pond C-2 comprise fathead minnows and the aquatic form of tiger salamanders (*Ambystoma tigrinum*).

Application to the CRA and Uncertainties

This study documented the baseline conditions of aquatic organisms present at RFETS in 1991. It investigated streams, ponds, and wetlands in Walnut Creek and Woman Creek. The results of the population studies provide line of evidence for NW AEU, SW AUE, WC AEU, and NN AEU in regard to populations and overall ecosystem health. The results indicate that the aquatic populations are at equilibrium with their environment and do not appear to be negatively affected by chemical stressors. The species composition is a reflection of the habitat condition. There does not appear to be any chemical stressor affecting the populations sampled from the ponds or stream channels.

The time period in which this study was completed represents an historic condition associated with RFETS. A significant number of accelerated action efforts have been completed since this time period. The food web components that were initially sampled from certain ponds may no longer be present, and the flows of water into and out of some ponds have been altered. Pond C-1 was modified to have a lower depth, the B-series ponds receive less water, and the upper B ponds have been remediated by having sediments removed. Therefore, current conditions are likely different from those described in this study. However, general hydrology is essentially unchanged while chemical exposure has improved. This supports the concept that the aquatic communities of these environments reflect the local climate and hydrology but are not significantly affected by contaminant exposure.

3.3 Exponent, 1998

Final Report: Lower Walnut Creek Aquatic Sampling for the Rocky Flats Environmental Technology Site.

Review

The objectives of this study of lower Walnut Creek were to determine the quality of aquatic habitat and richness and abundance of benthic macroinvertebrates; identify the fish species present; determine the condition of the benthic macroinvertebrate and fish populations; and compare these results to downstream areas. One site within RFETS and five sites located east (downstream) of RFETS were investigated. EPA-approved Rapid Bioassessment Protocols (RBP) were used to measure physical habitat characteristics, and habitat was then rated as optimal, suboptimal, marginal, or poor. Substrate composition and relative amounts of micro-habitats also were measured. Fish sampling was conducted during spring using seines and minnow traps. Macroinvertebrate sampling occurred in spring using kick nets to sample riffle, run, pool, and bank habitats. In addition, a Hess sampler was used in appropriate habitat.

The study concluded that aquatic life in Walnut Creek was limited by stream flow, which has been modified from natural flow conditions. However, the assessment presented findings of good habitat and a relatively healthy macroinvertebrate community, which typically equates to good water quality. Compared to an earlier study (WWE 1994), habitat scores in 1998 improved at one site below Great Western Reservoir. Habitat scores at the remaining sites declined. Real estate development may have affected water quality offsite by creating increased siltation. The RFETS site had more tolerant and hardy macroinvertebrate taxa compared to the downstream sites. This may have been an indication of the water management at RFETS, which often alternates from conditions of no flow to moderate flow and back to no flow within a short period.

Application to the CRA and Uncertainties

The study concluded that the water quality in Walnut Creek was good and there were no indications that pollution was limiting aquatic life. The observed species were controlled/affected by the intermittent flows in the creek. This study provides more evidence that RFETS aquatic communities in lower Walnut Creek are limited by the physical conditions of the streams and ponds due to very limited or manipulated flows. On-site water management and the general arid conditions limit the types of aquatic communities that are possible at RFETS. The findings that the aquatic communities are healthy downstream and are not impacted by chemical stressors were used as a line of evidence for NW AEU, SW AEU, and NN AEU.

The findings of this study describe the aquatic condition within the lower portions of the Walnut Creek watershed. They do not reflect conditions within RFETS, but rather the conditions just inside the boundary to off-site down-gradient areas. The findings of this study must be viewed with caution because there was only one sampling event in the spring of 1998 and, thus, it is a "snapshot" of the creek condition. The authors recognized the limitations of the study and recommended that further studies be completed. Habitat conditions of a stream can change rapidly over a season and can vary from year to year. The trend in the fluctuation of habitat and aquatic communities should be known in order to determine if conditions at RFETS are improving or declining.

3.4 Aquatics Associates Inc., 1998

Interim Report: Results of the Aquatic Monitoring Program in Big Dry Creek, 1997.

Review

An aquatic monitoring program was initiated in 1997 for the Cities of Broomfield, Northglenn, and Westminster to document the abundance and distribution of fish and aquatic macroinvertebrate populations in Big Dry Creek. The study was needed to establish a database of aquatic conditions and to help determine appropriate surface water standards for Segment 1 of Big Dry Creek.

Fish sampling was performed by the Colorado Division of Wildlife using electroshocking equipment. Fish population data collected in the spring and fall of 1997 were analyzed and summarized. A list of species collected, including mean lengths, mean weights, and relative abundance, was developed for each station and sampling occasion.

Aquatic macroinvertebrates were collected at locations corresponding to fish sampling sites. Methods included Hess sampling in shallow riffle areas and kick net sampling in riffle, run, pool, and bank microhabitats. Samples were processed and preserved by City of Northglenn staff. Identification, enumeration, and analysis of aquatic macroinvertebrate samples were performed by Aquatic Associates Inc.

Seven study sites were selected for this investigation, three upstream of city wastewater treatment plants and four at or below the effluent for the treatment plants. Big Dry Creek was characterized as a transition zone foothills-plains stream in areas upstream of the treatment plants. The reach below the treatment plants was characterized as a plains stream type.

A total of 17 species of fish were collected over the two sampling seasons. Nine of the fish species collected in the Big Dry Creek in March and October 1997 are native to streams in the South Platte River Basin. Native species collected included longnose dace (*Rhinichthys cataractae*), creek chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales promelas*), sand shiner (*Notropis stramineus*), white sucker (*Catostomus commersoni*), longnose sucker (*Catostomus catostomus*), brook stickleback (*Culaea inconstans*), green sunfish (*Lepomis cyanellus*), and Johnny darter (*Etheostoma nigrum*). Of the nine native species observed in Big Dry Creek, five species (longnose dace, creek chub, white sucker, longnose sucker, and Johnny darter) are common to cool water environments in transitional foothills-plains stream types. Most of the native fish collected in Big Dry Creek were classified as either abundant or common in a recent inventory of streams in the Front Range and eastern plains conducted by the Colorado Division of Wildlife. Conclusions from the biological assessment portion of this study suggested a relatively low risk of imperilment for most native fish species.

The aquatic community of Big Dry Creek was represented by 18 orders of macroinvertebrates, including a total of 113 taxa. *Diptera* (midges and flies) were predominant at all sites in March. *Diptera* and *Ologochaeta* (aquatic earthworms) were abundant at all sites in October. Essentially, the fauna present upstream of the Broomfield Treatment Plant was representative of a transitional foothills-plains stream, while in downsteam areas the aquatic community was more representative of plains stream habitats. Physical habitat and fluctuating stream flows most likely limit the macroinvertebrate community in Big Dry Creek, particularly in the low-gradient areas downstream from the Broomfield Treatment Plant, where riffle habitats with cobble substrate are sparse and much of the streambed is channelized.

Application to the CRA and Uncertainties

Streams at RFETS are the same type, transitional foothills-plains streams, as those in the upper portion of Big Dry Creek. Conclusions from this study indicate a low risk to most native fish species within Big Dry Creek. These results suggest that flows from RFETS via Walnut and Woman Creeks are not causing a risk to aquatic life downgradient. This will be used as a line of evidence for the Walnut Creek and Woman Creek AEUs.

The study of Big Dry Creek represents only one year of aquatic community data, presenting uncertainty of the overall health of the streams and year-to-year fluctuations in fish and macroinvertebrate populations. Additionally, Big Dry Creek is influenced by adjacent real estate development and changing stormwater conditions that are not present at RFETS.

3.5 Kaiser-Hill, 1999, 2000, and 2001

Annual Wildlife Survey for the Rocky Flats Environmental Technology Site.

Review

Fish surveys were preformed using minnow traps in streams and ponds over three consecutive years. The purpose of these surveys was to determine whether previously recorded fish species (Ebasco 1992) were still present within RFETS streams. Streams were systematically surveyed in each drainage during May 1998. Ten stream locations within each drainage (40 over the entire site) were selected based on water availability. Ponds were not surveyed. In early summer 1999, ponds and impoundments were surveyed. In summer 2000, Rock Creek was surveyed again. Nine stream locations were selected based on the availability of water in this ephemeral stream. Traps remained at each location for a minimum of 2 days and were checked by afternoon of each day. Any aquatic or semi-aquatic vertebrates captured in the traps were identified and enumerated before being released.

Selection of sampling locations was limited by water availability. In 1998, locations in Rock Creek were clustered because large sections of the creek were dry. It was determined that surveys in Rock Creek should be conducted during another year when conditions were better. Therefore, Rock Creek was surveyed again in 2000.

During the 1998 surveys, fathead minnow (*Pimephales promelas*) were captured in all major drainages at RFETS. This included locations in Rock Creek, Lower Walnut Creek, Upper Woman Creek, and Lower Smart Ditch. Additionally, creek chub (*Semotilus atromaculatus*) and stoneroller (*Campostoma anomalum*) were captured in Upper Woman Creek. The greater variety of fish species in Woman Creek was attributed to the relatively large seep-wetland complexes that discharge into the Woman Creek drainage. Due to these conditions, a greater portion of Upper Woman Creek has sustained water flows. Not all survey locations had fish observations. Notably, McKay ditch had no fish present, and Walnut Creek above the A-series ponds had no fish.

Pond and impoundment surveys in 1999 revealed fathead minnows in all locations, though it is unclear if all ponds and impoundments were surveyed. In Pond C-1, fathead minnows, smallmouth bass (*Micropterus dolomieui*), and creek chub were captured. It is noteworthy that largemouth bass were collected just below Pond C-1 during the baseline study (Ebasco 1992). This suggests that the bass observed in 1999 may have been misidentified. This study, along with the earlier stream surveys, demonstrates the higher species richness in Woman Creek compared to other RFETS drainages. In Rock Creek, largemouth bass (*Micropterus salmoides*) were captured in the Lindsay Pond.

When Rock Creek was surveyed again in 2000, sites were located in a more systematic fashion and better represented stream habitats throughout the drainage. Fathead minnows were the only species captured at eight of the nine survey locations. Only the location furthest downstream did not have fish. Higher numbers of fathead minnows corresponded to the upper reaches of the stream.

With the exception of the bass observations, all fish species observed during the baseline study (Ebasco 1992) were observed again over this 3-year survey and found in the same general locations as they were in 1992. Other animal taxa also were recorded over the 3 years. Leeches, crayfish, garter snakes, and leopard frogs were observed.

Application to the CRA and Uncertainties

These studies indicate that all the RFETS streams are intermittent and that perennial flows and better aquatic habitats occur in the upper reaches of these streams. It is unrealistic to expect that vibrant diverse aquatic communities, especially fish communities, can occur in the lower reaches. Overall, fish species richness is very low at RFETS.

The studies also confirm that fish species are present with the same richness and in the same general locations as they were nearly a decade earlier. No analysis is presented on the abundance of fish over time, however.

The years 1998 through 2000 were very dry in terms of precipitation, and it is interesting to note that drought conditions presented a problem in finding enough sites to sample. This reinforces the point that habitat, especially water availability, limits fish communities at RFETS. This information was used as a line of evidence for NW AEU, SW AEU, WC AEU, and Rock Creek (RC) AEU that aquatic life does not appear to be impacted by chemical stressors but rather is controlled by physical habitat limitations such as flow.

3.6 Aquatics Associates Inc., 2003

Results of the Aquatic Monitoring Program in Streams at the Rocky Flats Site, Golden, Colorado, 2001-2002.

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Review

The purpose of this study was to characterize the existing aquatic communities (fish and macroinvertebrates) and physical habitat conditions in streams within the Walnut, Woman, and Rock Creek drainages in order to provide a baseline for monitoring the potential influences of site closure activities. Sampling in ponds did not occur. RBPs were used to measure physical habitat characteristics, and habitat was rated as optimal, suboptimal, marginal, or poor. Substrate composition and relative amounts of micro-habitats were measured to supplement the RBP habitat analysis. Fish sampling was conducted during summer and/or fall using backpack electroshocking equipment. Macroinvertebrate sampling occurred in spring, summer, and fall using kick nets to sample riffle, run, pool, and bank habitats.

Findings from the study indicated that all of the streams at Rocky Flats are flow limited. Perennial flows are typical in the upper reaches of all three drainages, and flows diminish considerably in downstream reaches where the streams become largely intermittent. In the upper reaches where flows are perennial, habitat assessment scores were generally highest, indicating overall better habitat quality.

Woman Creek has more natural flows in the upper reaches. Below the C-2 pond, flows are greatly reduced and heavily influenced by pond releases and water management. The natural flows in the upper reaches are seep-fed and also influenced by seasonal precipitation. Rock Creek has natural seep-fed flows.

In the effluent-dominated reach of Upper Walnut Creek and the discharge-dependent Lower Walnut Creek, bank erosion results in poor bank stability and sediment inputs to the stream, which negatively affects physical habitat and aquatic life. Stream bank erosion was further aggravated by the periodic discharges from the terminal ponds.

Fish abundance and distribution in these streams is severely limited due to the lack of permanent water. Fish were collected at only seven of the twelve study sites, and only three species were collected. Fathead minnows were found in every drainage. Naturally self-sustaining populations of fathead minnows were found at site WC3 in South Walnut Creek between Ponds B-4 and B-5 and at site RC2 below the Lindsey Pond. A stable and healthy creek chub population was found at the upper two sites in Woman Creek. A single specimen of longnose dace also was collected in Woman Creek.

The macroinvertebrate community was observed to be rich and diverse across all drainages, and comprised mainly of hardy and tolerant species. The dominant organisms were similar in each drainage, with oligochaetes most abundant in Woman Creek and dipterans most abundant in Walnut Creek. *Ephemeroptera* were relatively abundant throughout the drainages and included moderate to tolerant taxa. *Trichoptera* (caddisflies) in Walnut Creek were generally present in higher numbers compared to other RFETS drainages, likely due to the effluent-dominated flows. Amphipods are also found in higher numbers in Walnut Creek, thriving in the slower moving or standing water environments provided by the ponds.

A comparison of study results to other, earlier studies of Rocky Flats streams showed that community structure and abundance were somewhat similar to those found in Walnut, Woman, and Rock Creeks during the 2001- 2002 study and are similar to other transitional foothills-plains and plains type streams.

Application to the CRA and Uncertainties

This study concluded that, within the aquatic habitats present in Walnut and Woman Creeks, whether perennial or intermittent, aquatic communities persist over time and are comparable to communities found at other locations at RFETS and within the region. While only one fish species is prevalent (fathead minnows), the manipulated nature of the ponds and streams precludes the establishment of large or diverse fish populations. Macroinvertebrate populations do not appear as affected, likely due to their ability to re-colonize newly inundated habitats and their comparatively shorter life cycles. Macroinvertebrate communities in Walnut Creek and Woman Creek are similar to those found in Rock Creek. This supports the line of evidence that Walnut Creek and Woman Creek aquatic communities are healthy, albeit limited, and these creeks are capable of sustaining rich and diverse aquatic life that comprise hardy and tolerant species adapted to the limiting environmental conditions. The results provide no evidence for effects of chemical stressors impacting the ecological setting within these streams. The study was used as a line of evidence for NN AEU, NW AEU, SW AUE, and WC AEU with regard to populations and overall ecosystem health.

The detention ponds were not sampled in this study. The RBP methods are not intended to sample large ponds. Therefore, conclusions about the aquatic health of the ponds cannot be made without some uncertainty. Only one sampling location was established in North Walnut Creek, and it was located above the A-series ponds. Because the ponds represent a significant habitat portion of the aquatic areas within RFETS, the lack of pond sampling presents uncertainty in the use of this study as a line of evidence.

3.7 Wright Water Engineers, Inc. 2003

Supplemental Biological and Selected Water Quality Data Exploration, 1997-2001.

Review

This study was summarized as a technical memorandum to the steering committee evaluating water quality conditions within Big Dry Creek. Information in the memorandum was taken from a Wright Water Engineers report entitled, "Integrated Analysis of Habitat, Macroinvertebrate, Fish, Flow and Selected Water Quality Parameters in the Main Stem of Big Dry Creek" (WWE 1994). The memorandum provides a supplemental evaluation to the Wright Water Engineers report.

The study used RBPs to sample macroinvertebrate communities, periphyton, and fish in streams and rivers. Results from the sampling conducted from 1997 to 1999 were incorporated and compared to a 5-year expanded database for Big Dry Creek.

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The purpose of the assessment was to develop an understanding of the factors influencing aquatic life in the creek and to determine whether a more stringent unionized ammonia standard was necessary to protect the Johnny darter (*Etheostoma nigrum*). The levels of unionized ammonia in the creek did not appear to be affecting the fish or macroinvertebrate communities, based on concentrations present in the creek during the last 5 years. Unionized ammonia levels in the creek are generally below the stream water quality standard.

Overall, upper reaches of Big Dry Creek have higher quality fish and benthic communities than downstream locations. Upstream locations also generally have higher habitat scores, better water quality, and lower flows. This is expected for a stream such as Big Dry Creek as it transitions from a foothills to a plains stream with an associated increase in sediment load and reduction in riffle quality and habitat diversity.

Although iron periodically exceeds the stream water quality standard, it does not appear to be affecting the fish and benthic communities. Dissolved selenium concentrations do not appear to be adversely affecting the fish and benthic communities based on the limited sample size reviewed. Selenium testing has just been added to the program over the last few years. Lead is not included in the study because concentrations of lead prior to initial assessments had not exceeded the water quality standards.

Habitat appears to be the most consistent influence on benthic communities, whereas fish communities do not seem to be influenced by any of the variables explored. Fish index of biotic integrity (IBI) scores in Big Dry Creek are improving over time. However, habitat alone does not fully explain benthic community health. Artificial substrate samples showed stronger relationships to flow, total suspended solids (TSS), and location than did other benthic samples taken from natural conditions.

Application to the CRA and Uncertainties

This technical memorandum and review of data from areas downstream of RFETS in Big Dry Creek illustrate many of the conditions seen at RFETS. Stream habitat quality is higher and corresponding benthic and fish communities are healthier in the upper reaches of streams compared to lower sections. Water entering into the Big Dry Creek drainage via Walnut and Woman Creeks is of good quality albeit influenced by the large buffering affect of Standley Lake Reservoir and Great Western Reservoir. The negative affects of flows, including increased TSS, are not observed until greater flows occur and runoff is received form surrounding urban land uses. This study provides a line of evidence that NW AEU, SW AEU, and WC AEU are providing good water quality to off-site areas.

4.0 BIOASSAY ANALYSES

4.1 DOE, 1996

Final Phase I RFI/RI Report. Woman Creek Priority Drainage, Operable Unit 5. Appendix N. Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

Review

This study was completed as part of the ecological risk evaluation of aquatic life for OUs 5 and 6. Risks to aquatic life from chemical concentrations in sediments were evaluated by a weight-of-evidence approach. HQs and HIs were generated as a screening tool, and indicated a relatively high potential for toxic effects in sediments. As a next step in the multi-tiered ERA process, characteristics of benthic community structure and results of sediment bioassay tests were used to check predictions of toxic stress as indicated by the screening results. The results of the community characteristics were summarized in Section 3.1; the results of the bioassay analysis are presented here.

Laboratory sediment toxicity tests were conducted on composite sediment samples collected from each pond during October and November 1992. Whole sediment tests following protocols outlined in Nelson et al. (1990) were used for 28-day exposure of the amphipod *Hyalella azteca* and for 10-day exposure of the dipteran *Chironomus tentans*. Fine sands were used as controls. Sediments from the A-, B-, and C-series ponds were tested with *Hyalella azteca*. Toxicity tests using *Chironomus tentans* were limited to Ponds A-3, A-4, B-3, B-4, and B-5 due to reduced availability of acceptable test organisms. Toxicity test results reported by DOE (2004b) were based on information provided to the RFETS Surface Water Division in documents submitted by The Seacrest Group of Broomfield, Colorado. The DOE report (2004b) acknowledged the possible need for further review of the test results in order to evaluate test validity and statistical results.

Bioassay results for Pond B-2 sediments indicated that survival of *Hyalella azteca* after 28 days of exposure (64 percent) was significantly lower than in controls (85 percent) ($t=3.72$, $t0.05=2.18$). No toxic effects were observed for *Hyalella azteca* or *Chironomus tentans* in any other sediment exposures. Table A7.6 presents a summary of the bioassay test results.

Sediment bioassays indicated toxicity only in sediments from Pond B-2. These results are not consistent with the high levels of toxicity indicated by HQs and HIs, especially in Ponds A-1 and B-1.

Application to the CRA

This study determined that, despite predictive risk analysis of chemicals using HQs and HIs, the actual toxicity conditions were low. It appears that the chemicals present within

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the sediment were not bioavailable and did not yield a toxic response. This points to the uncertainty inherent in using HQ and HI tools in determining realistic risk conditions. HQs and HIs may occur in orders of magnitude that indicate a potential concern, whereas the risk in the real environment is low.

Sediments from the A-, B-, and C-series ponds were tested with *Hyalella azteca*. Toxicity tests using *Chironomus tentans* were limited to Ponds A-3, A-4, B-3, B-4, and B-5 due to reduced availability of acceptable test organisms. The results will be used as a line of evidence for the ponds tested, as a direct measure of sediment toxicity. The study was completed during the timeframe from which the CRA data sets were derived. Therefore, the results represent a snapshot in time that is relevant to the CRA findings.

The period in which this study was completed represents an historic condition at RFETS. A significant number of accelerated action efforts have been completed since this time. The samples tested are a small set of the collected media samples and may not represent the entire drainage system. Therefore, these results may be over- or under-conservative. In addition, the sampling represents a single event in time and likely does not represent year-round conditions or current conditions. Although these are historical results, they indicate that earlier, pre-remediation conditions did not demonstrate toxicity. It is likely that current pond and stream conditions are comparably nontoxic.

5.0 WATERFOWL/WADING BIRD STUDIES

5.1 DOE, 1996

Final Phase I RFI/RI Report: Woman Creek Priority Drainage, Operable Unit 5. Volume 5. Appendix N Ecological Risk Assessment for Woman Creek and Walnut Creek Watersheds at the Rocky Flats Environmental Technology Site.

Review

As part of the multi-tiered ERA provided in this study, an evaluation of potential risk to waterfowl and wading birds was completed using standard screening-level risk methods. The mallard and great blue heron were selected to represent aquatic-feeding wildlife because they are common species and known to occur at RFETS. In addition, birds are more sensitive than mammals to organic contaminants because they lack the same capacity for detoxification and therefore represent a more limiting exposure and risk scenario. Exposure of these two receptors was assessed by using measured concentrations of contaminants in biota or by estimating the transfer of contaminants from sediments to prey species. The purpose of this study was to:

> *Determine whether ecological contaminants of concern (ECOC) concentrations in surface water and sediments of the detention ponds could result in exposures that reduce the survivorship or reproductive capacity of aquatic feeding birds.*

The primary exposure pathway for both birds would be through ingestion of aquatic organisms that have become contaminated. Herons feed primarily on fish. Amphibians and invertebrates are usually minor components of their diets but can be important in localized areas. Herons have relatively little direct contact with sediments during feeding. Mallards have more contact with sediments because they may feed by filtering plant material and invertebrates. However, the amount of sediment ingested by mallards does not greatly exceed that of other more selective feeders (EPA 1993). Thus, the primary pathway for exposure of both birds to ecological chemicals of concern (ECOCs) in sediments is through ingestion of aquatic organisms that have become contaminated. The birds could also be exposed to surface water contaminants.

The document provides the detailed methods used for the evaluation of exposure for the Heron and mallard. Assumed exposure rates, area use factors etc., are all thoroughly described within the original document and not revisited here. The exposure point concentrations derived from various source media are also summarized.

The risk characterization was based on exposure and risk to individual birds because both great blue herons and mallards are protected under the Migratory Bird Treaty Act. The exposure and risk evaluation was conducted under two exposure scenarios: 1) current aquatic community structure and contaminant distribution; and 2) more complex aquatic communities that could result in increased biological transport of sediment contaminants and increased PCB concentrations in prey.

Two methods were used to determine the potential risk to the mallard and great blue heron. The first relied on available, current tissue data. The second used a modeling approach to extrapolate and determine potential prey tissue burdens for aquatic areas that did not have measured values due the lack of prey species at the time of the study.

Chemicals identified as ECOCs for aquatic feeding birds included di-n-butylphthalate, PCBs, mercury, and antimony.

Preliminary investigations indicate that current concentrations of ECOCs in sediment and biota are probably nontoxic (Stiger 1994a). However, ponds with the highest PCB concentrations apparently do not support significant fish or amphibian populations. More extensive colonization of the ponds could result in more complex food webs, increased biological transport of sediment contaminants, and exposure of birds or mammals to higher concentrations in biota. The risk characterization includes evaluation of potential exposures as well as those based on existing conditions.

Sitewide results of the exposure estimation indicated potentially significant risk in all source areas that might be used by great blue herons, including the Old Landfill in Woman Creek and ponds in Woman Creek and Walnut Creek. Based on the HIs calculated for all source areas, the ECOPCs that contributed substantially to the risk estimate were mercury, antimony, and di-n-butylphthalate. HIs for source areas are provided in Table A7.7. Receptor-specific HQs by source area are provided in Tables A7.8 and A7.9.

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Unfortunately, no HIs or HQs are reported from individual ponds for aquatic-feeding birds. Because the ECOCs bioaccumulate, their concentrations in sediments and in aquatic life forms (e.g., macroinvertebrates) are relatively low. ECOCs that presented potential risk tended to be different for aquatic life than for aquatic-feeding birds. Therefore, knowing what ECOCs in ponds contribute the most risk to aquatic organisms does not translate to the risk to aquatic-feeding birds.

The A-series ponds HI for aquatic-feeding birds was primarily from di-n-butylphthalate in fish tissue eaten by great blue herons that spend 100 percent of their time foraging on site. Di-n-butylphthalate and mercury were the only ECOCs for the B-series ponds relevant to the great blue heron. Mercury was the only ECOC in the C-series ponds and the Old Landfill (upstream from the C-1 pond). Other exposure point concentrations (EPCs) came from estimated prey tissue values from 903 Pad (PCBs), with portions in both watersheds; 881 Hillside Area (magnesium) in the Woman Creek watershed; and the Ash Pits (cadmium) in the Woman Creek watershed.

Based on screening estimates, the A-, B-, and C-series ponds represent the highest risk of potential exposure to di-n-butylphthalate, with the A-series ponds presenting the greatest risk. However, all HIs were less than 5. Di-n-butylphthalate in surface water (EPC = 0.002, Intake = 4.79E-05) in the A-series ponds was the only potential contaminant of concern (PCOC) with an HQ greater than 1 and was identified as an ECOC. Di-n-butylphthalate risk to mallards was due to ingestion of benthic macroinvertebrates. Risk characterization for the mallard, therefore, focused on characterizing the potential for di-n-butylphthalate bioconcentration in the aquatic prey species in each of the A-series ponds. Unfortunately, sediment concentrations for individual ponds were not reported.

PCBs in pond sediments were a concern, and Table A7.10 presents a summary of the findings included in the report. The table includes total PCB concentrations in each pond and the Aroclor-1254 concentrations when reported. PCBs were included as an ECOC due to their potential bioconcentration in aquatic prey.

Aroclor-1254 effective exposure concentrations (EECs) were compared to current concentrations of Aroclor-1254 in sediments at RFETS for the following:

- Great blue herons feeding in ponds with piscivorous fish present (i.e., long food chain);
- Great blue herons feeding in ponds without piscivorous fish present (i.e., short food chain); and
- Mallard feeding in ponds 100 percent of the time.

Risk was identified only for the first scenario, great blue herons feeding in ponds with piscivorous fish present. The long food chain resulted in the greatest amount of bioconcentration and the longest exposure period. The remaining two scenarios resulted in maximum concentrations of Aroclor-1254 below benchmark criteria. Because the first scenario is very unlikely to occur, the authors concluded that risk in Woman Creek did not exceed criteria developed for sediment at RFETS. Walnut Creek Aroclor-1254 concentrations in sediment exceeded the criteria for Ponds B-1, B-2, and B-3 only if the top aquatic predators were present. These ponds did not support this type of community at the time.

In Woman Creek, mercury was detected in two of 24 fish taken from Pond C-1. Fish from other areas (i.e., streams) had no mercury detections. Therefore, the risk to aquatic birds is significant only if all food is obtained exclusively from Pond C-1. Although mercury was detected in 75 percent of the fish in the B-series ponds, the source of mercury in fish was unclear. Mercury does not appear to represent risk to herons as HQs from the ponds are low (maximum of 2). Mercury was not an ECOC for North Walnut Creek.

Other ECOCs include antimony in Woman Creek and di-n-butylphthalate in Walnut Creek. These chemicals were determined not to present risk to the great blue heron or the mallard.

Application to the CRA and Uncertainties

This study documented the potential risk to great blue heron and mallard from ponds and streams of Walnut Creek and Woman Creek. It provides a risk characterization specific to aquatic-feeding birds. This risk characterization was used as a line of evidence for NN AEU, NW AEU, SW AUE, and WC AEU in regards to populations and overall ecosystem health. The conclusions indicate that higher trophic organisms that rely on the AEUs for food items would not be at risk unless individual ponds represented their entire dietary intake, which is highly unlikely.

The time period in which this study was completed represents an historic condition at RFETS. A significant number of accelerated action efforts, especially in the B-series ponds, have been completed since this time. The food web components that were initially sampled in the ponds may no longer be present. Also, the flows of water into and out of certain ponds have been altered. Pond C-1 was modified to have a lower depth, the B-series ponds receive less water, and the upper B-series ponds have been remediated by having sediments removed. Therefore, current conditions are likely different from those described in the study.

As described previously, two methods were used to determine the potential risk to the mallard and great blue heron. The first relied upon available, current tissue data. The second used a modeling approach to extrapolate and determine potential prey tissue burdens for aquatic areas that did not have measured values due to the lack of prey species. There is uncertainty in the first method because it represents site conditions from an historic perspective and may not represent current conditions. There is uncertainty with the second method due to the extrapolation necessary for modeling approaches. This uncertainty can result in either over- or under-conservative estimates of tissue burden.

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5.2 Stiger, 1994

OU3 Final RFI/RI – Appendix K. PCB Study: "Results of PCB Sediment and Tissue Sampling For Walnut and Woman Creek Drainages and Offsite Reservoirs – SGS-576-94."

Review

This study was completed in response to preliminary results of sediment and tissue samples collected during the OU 6 RI (August 1992 to June 1993), which indicated elevated PCB concentrations occur for some of the A- and B-series ponds. Because the potential exists for sediment and/or specific biota in Great Western Reservoir and Standley Lake Reservoir to have been impacted by PCB contaminants from RFETS prior to 1989 (prior to the construction of the diversion canal that routes flow coming from Walnut Creek around Great Western Reservoir and back into Walnut Creek below the dam), a sediment and tissue PCB sampling project was undertaken as part of the EE portion of the OU 6 RI.

This effort entailed collecting sediment, fish, and small mammal tissue samples from the A- and B-series ponds to evaluate whether PMJM might be impacted by the presence of PCBs in the RFETS buffer zone. Because PMJM have a diet similar to deer mice, 13 deer mice were collected adjacent to Ponds A-1, A-3, B-1, and B-4 for whole body tissue analysis to evaluate possible PCB contamination in Prebles. In addition, 12 voles were collected from the same locations to determine if they represent a pathway of PCBs to predatory birds, which include voles in their diet.

Results of the deer mice and vole tissue analysis revealed that no PCBs were detected in any of the small mammal tissue samples (whole body) collected from around Ponds A-1, A-3, B-1, and B-4. Comparison to PCB food threshold values for birds revealed that PCB levels in fish do not exceed food concentration threshold values prescribed by DOE (1994). These results suggest that PCBs have not bioaccumulated up the food chain further than the fish species collected at RFETS and that neither the PMJM nor predatory birds are threatened with PCB contamination from RFETS.

Application to the CRA and Uncertainties

This study encapsulated several lines of evidence within its design. The sediment and tissue analysis will be used as a line of evidence for NW AEU, SW AUE, and WC AEU with regard to pond bioaccumulation processes. The study evaluated the A-, B-, and C-series ponds specifically for PCB transfer between abiotic (sediment) and biotic (fish tissue) media. The absence of PCB accumulation at concentrations exceeding tissue threshold concentrations in almost all fish at the site indicates that there is a low potential for risk to fish in the pond habitat within NW AEU, SW AEU, WC AEU, and SE AEU.

This study also evaluated the potential effects of PCBs in sediment to predatory birds that may feed on organisms that are exposed to PCB-contaminated sediment. Results from this study were obtained for the A- and B-series ponds, and were used as a line of evidence for the NW AEU and SW AEU risk characterization of PCB ECOPCs in pond sediments.

The time period in which this study was completed represents an historic condition at RFETS. A significant number of accelerated action efforts have been completed since this time. The food web components that were initially sampled from each pond may no longer be present. Similarly, the sediments from certain ponds (i.e., B-1, B-2, and B-3) have been removed. Therefore, current conditions are different from those described in the study. The study likely represents conservative conditions because the sampling took place closer in time to historic events that lead to the initial release of the PCBs to the AEUs.

6.0 CHEMICAL LOADING ANALYSES

6.1 DOE, 2004b

RFETS Automated Surface-Water Monitoring. Water Year 2003 Annual Report and Water Year 2004 Source Evaluations for Points of Evaluation GS10, SW027, and SW093. Final.

DOE completes an annual automated surface-water monitoring evaluation as part of the Integrated Monitoring Plan (IMP). The RFETS automated surface-water monitoring network is designed to meet the requirements documented in the Site IMP, which groups all site surface-water monitoring objectives into five primary categories: Sitewide, Industrial Area, Industrial Area Discharges to Ponds, Water Leaving the Site, and Off-Site. The most recent reports for water years 2003 and 2004 were reviewed as lines of evidence for the purpose of describing chemical loading within the AEUs. The methods, conclusions, and application to the CRA for water year 2003 are provided here.

The automated monitoring program is intended to provide a number of objectives. Those that pertain to building lines of evidence for the AEU CRA include the following:

- Monitoring of flows and contaminant levels in subdrainages to allow for the location of contaminant sources;
- Routine monitoring of point-source discharges and reporting of results in compliance with the National Pollutant Discharge Elimination System (NPDES) permit program to control the release of pollutants into the waters of the United States; and
- Detection of statistically significant increases of contaminants in runoff from within the Industrial Area (IA) in general.

The automated program is designed to obtain a loading analysis of constituents of interest. Therefore, the amount of a given chemical is traced through the course of a

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drainage path, and additional load is identified over distance. This tool helps determine if the drainage is gaining or losing chemical over the course of its path, allowing the identification of source areas as well as chemicals that may be source-related and not a natural phenomenon.

During the water year 2003 effort, the site monitoring network included 62 monitoring locations. The automated network successfully fulfilled the targeted monitoring objectives as required by the Site IMP. Four new monitoring locations were installed to provide increased monitoring resolution as RFETS moves toward closure. From the 62 monitoring locations, 441 composite samples composed of 23,455 individual grabs were collected.

Application to the CRA and Uncertainties

Detected metals and radionuclides were evaluated as part of the professional judgment process. The results from this study helped to determine if certain constituents had site-related source areas or demonstrated a pattern of increased or decreased load through the site. The results were constituent- and AEU-specific and are provided in Section 2.0 of Volume 15B1.

The automated surface-water sampling program was developed with specific RFETS objectives in mind, specifically, to evaluate chemical transport within surface water and sediment throughout the site. These objectives do not necessary focus on ecological risk-based concerns. The locations and the hydrologic setting of all the site studies do not necessarily coincide with aquatic ecological habitat settings. Only those chemicals with a point of compliance understanding, or a site source relation, were evaluated further. Chemicals of potential interest from a toxicological standpoint from historic site activities that do not behave in a loading type hydrologic model (i.e., PCBs) were not evaluated. These studies prove useful, yet are limited to the understanding of inorganic and radionuclide chemical spatial extent at RFETS.

7.0 SUMMARY OF FINDINGS

This attachment provides a summary of the methods, results, conclusions, uncertainties, and applications of individual studies conducted within RFETS that provide supporting lines of evidence for the AEU risk characterizations. Numerous studies were available for the larger drainages such as the NW AEU, and few studies were available for smaller drainage components such as the MK AEU. These lines of evidence, coupled with the ECOPC evaluation form the weight-of-evidence risk characterization of the chemical stressors.

A summary of the conclusions drawn from each study, and their application to each AEU, are provided in Section 5 of this report. As described here, the aquatic ecosystems are clearly limited by stressors other than chemicals related to RFETS activities. Habitat conditions of flow appear to be the most significant controlling factor to the aquatic ecology. The aquatic ecology of RFETS is comparable to reference or background sites and does not exhibit signs of chemical stress. Given the fact that numerous accelerated action activities have occurred, a number of which will impact the receiving drainages that make up the AEUs, it is likely that future conditions within these drainages will improve further, re-establish as habitat over time, and equilibrate. The anticipated ecology will appear much as it has in the past, with opportunistic assemblages of aquatic invertebrates, plants, and fish. It will retain its warm-water ecology character and perhaps will provide sustainable wetted habitat of sufficient size to support smaller species of fish over time.

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TABLES

Table A7.1
Summary of Other/Drainage Lines of Evidence Available for each AEU

AEU	Line of Evidence Category and Source				
	Tissue Analysis	Aquatic Population Studies	Bioassay Analysis	Waterfowl/Wading Bird Evaluations	Chemical Loading Analysis
NW AEU	Stiger, 1994	Ebasco, 1992	DOE, 1996	Stiger, 1994	DOE, 2004
	DOE, 1996	DOE, 1996		DOE, 1996	
		Exponent, 1998			
		Aquatic Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
		WWE Inc., 2003			
SW AEU	Stiger, 1994	Ebasco, 1992	DOE, 1996	Stiger, 1994	DOE, 2004
	DOE, 1996	DOE, 1996		DOE, 1996	
		Exponent, 1998			
		Aquatic Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
		WWE Inc., 2003			
WC AEU	Stiger, 1994	Ebasco, 1992	DOE, 1996	DOE, 1996	DOE, 2004
		DOE, 1996			
		Aquatic Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
NN AEU	N/A	Ebasco, 1992	N/A	DOE, 1996	DOE, 2004
		DOE, 1996			
		Exponent, 1998			
		Kaiser-Hill, 1999, 2000 and 2001			

N/A = Not available.

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Table A7.2
Unvalidated Sediment Sampling Results (units ug/kg)

A Ponds	Mean* A-1254	Mean A-1248	B Ponds	Mean* A-1254	Mean* A-1248
A 1	75.9	ND	B 1	868	253.6
A 2	83.8	ND	B 2	2,073	589
A 3	25	ND	B 3	572	ND
A 4	ND	ND	B 4	188	ND
			B 5	ND	ND

(*Calculated using 20 ug/kg, one-half of the instrument detection limits of 40 ug/kg, for nondetects where averaged with detects; n = 5. ND indicates that PCB was not detected in sediment samples of the pond).

Table A7.3
Aroclor-1254 in Aquatic Biota Collected from A- and B-Series Detention Ponds

Pond	Biota Type	Number of Samples	Detection Frequency	Mean[a] (ug/kg)	Standard Deviation1 (ug/kg)
A-1	None	N/A	N/A	N/A	N/A
A-2	Benthos	1	1/1	20	N/A
A-2	Crayfish	4	0/4	N/A	N/A
A-2	Largemouth bass	3	3/3	48	9.1
A-3	Crayfish	4	0/4	N/A	N/A
A-4	Crayfish	3	0/3	N/A	N/A
A-4	Fathead minnow	3	3/3	17	5.8
A-5	Crayfish	3	0/3	N/A	N/A
A-5	Fathead minnow	5	3/5	73	41
B-1	Salamander larvae	2	2/2	33	9.9
B-2	Salamander larvae	2	2/2	120	21
B-3	None	N/A	N/A	N/A	N/A
B-4	Fathead minnow	6	3/6	480	17
B-5	Crayfish	3	0/3	N/A	N/A
B-5	Fathead minnow	3	3/3	160	17

[a] Mean and standard deviation values were calculated using the values reported for the "real" Aroclor-1254 detections.

N/A = Not applicable.

Source: DOE 1996.

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Table A7.4
Aroclor-1254 Concentration Ratios in Sediment and Biological Tissues[a]

Pond[b] (species)	Concentration in Sediments		Concentration in Biological Tissues		Aroclor-1254 Concentration Ratios	
	Bulk Sediment (ug/kg)	Organic Carbon (ug/kg C)	Whole Body (ug/kg)	Lipids[c] (ug/kg lipid)	Whole Body/Bulk Sediment	Lipid/Organic Carbon (BSF)
Pond A-2 (largemouth bass)	215	8,270	48	4,800	0.2	0.6
Pond A-2 (benthos)	215	8,270	20	2,000	0.1	0.2
Pond B-1 (tiger salamander)	868	37,700	40	4,000	0	0.1
Pond B-2 (tiger salamander)	2,050	89,000	134	13,000	0.1	0.2
Pond B-4 (fathead minnow)	188	14,500	480	48,000	2.6	3.3

[a] Mean for pond.

[b] Data presented only for ponds in which Aroclor-1254 was detected in both sediment and biota.

[c] Assume 1% lipids.

Source: DOE 1996.

Table A7.5
Pond Benthos Community Structure Summary

Characteristic	Pond A-1	Pond A-2	Pond A-3	Pond A-4	Pond A-5	Pond B-1	Pond B-2	Pond B-3	Pond B-4	Pond B-5	Pond C-1	Pond C-2	Pond D-1	Pond D-2
Total Richness	48	24	27	7	19	36	35	12	20	17	6	18	13	31
Mean Density	25,256.6	10,354.7	30,557.4	8,509.8	4,960.0	17,591.3	11,145.2	55,047.4	32,415.2	26,919.6	66.4	117.6	24,762.9	4,962.0
Simpson's Diversity	0.65	0.43	0.75	0.57	0.19	0.16	0.16	0.84	0.44	0.44	0.44	0.22	0.75	0.1
Shannon-Weiner Diversity	1.07	1.39	0.53	0.81	2.1	2.35	2.22	0.32	1.04	1.16	1.11	1.95	0.51	2.73
Shannon-Weiner Max.[a]	3.87	3.17	3.29	1.94	2.94	3.58	3.55	2.48	2.99	2.83	1.79	2.89	2.56	3.43
Percent Max. Diversity	27.7	43.85	16.11	41.75	71.43	65.64	62.54	12.9	34.78	40.99	62.01	67.47	19.92	79.59
Number Dominant Taxa	2.9	4	1.7	2.2	7.5	10.5	9.2	1.4	2.8	3.2	3	7	1.7	15.4
Dominant Taxa Density	21,917.7	9,120.4	29,790.8	7,951.2	4,544.0	15,863.4	10,172.9	49,538.8	31,388.8	21,592.8	61.6	105.4	24,204.2	4,482.1
% Density Dominant Taxa	86.7	88.1	97.5	93.4	91.6	90.1	91.3	89.9	96.8	80.2	92.7	89.6	97.7	90.3
Oligochaeta Density	20,241.7	1,676.0	26,257.0	6,145.3	1,720.0	5,014.9	194.9	4,586.2	17,455.0	16,837.7	41.6	42.0	21,255.0	39.0
% Density Oligochaeta	80.1	16.2	85.9	72.2	34.6	28.5	1.8	8.3	55.3	62.5	62.6	35.7	85.8	8
Diptera Density	3,167.8	8,367.1	4,066.5	1,974.9	2,552.0	1,232.5	3,339.0	571.7	12,263.6	5,105.9	24.8	68.4	3,422.1	3,001.1
% Density Diptera	12.5	80.8	13.3	23.2	51.4	7	30	1	37.8	19	37.4	58.1	13.8	60.4

[a] Maximum Shannon-Weiner Diversity based on richness.
Source: DOE 1996.

Table A7.6
Sediment Bioassay Test Results

Test Media	Sample Date	*Hyalella azteca*							*Chironomus tentans*			
		Control % Survival	Test % Survival	Survival T Statistic	Survival $T_{0.05}$ Value	Control Mean Wt.[a]	Test Mean Wt.	Mean Wt. T Statistic	Control % Survival	Test % Survival	Survival T Statistic	Survival $T_{0.05}$ Value
Pond A-1	10/29/92	74[g]	95	N/A	N/A	0.06	0.11	N/A	N/A[d]	N/A	N/A	N/A
Pond A-2	11/12/92	74[g]	89	N/A	N/A	0.06	0.15	N/A	N/A	N/A	N/A	N/A
Pond A-3	10/21/92	89	76	0.971	2.46	0.13	0.10	N/A	82	103[e]	-2.618[f]	2.46
Pond A-4	10/19/92	89	99	-0.777	2.46	0.13	0.17	N/A	82	73	1.007	2.46
Pond A-5	11/19/92	38g	89	N/A	N/A	0.06	0.33	N/A	N/A	N/A	N/A	N/A
Pond B-1	11/16/92	85	91	-1.094	2.18	0.05	0.16	N/A	N/A	N/A	N/A	N/A
Pond B-2	11/18/92	85	64	3.72[h]	2.18	0.05	0.14	N/A	N/A	N/A	N/A	N/A
Pond B-3	10/27/92	89	84	0.388	2.46	0.13	0.11	N/A	82	88	-0.805	2.46
Pond B-4	10/22/92	89	91	-0.194	2.46	0.13	0.19	N/A	82	62	2.416	2.46
Pond B-5	10/20/92	89	60	2.233	2.46	0.13	0.12	N/A	82	72	1.208	2.46
Pond C-1[b]	11/9/92	74[g]	80	N/A	N/A	0.06	0.14	N/A	N/A	N/A	N/A	N/A
Pond C-1[c]	11/9/92	74[g]	94	N/A	N/A	0.06	0.10	N/A	N/A	N/A	N/A	N/A
Pond C-2	11/10/92	74[g]	96	N/A	N/A	0.06	0.16	N/A	N/A	N/A	N/A	N/A

[a] Mean Weight in grams.

[b] Sediment material from.

[c] Sediment material from

[d] Tests not conducted.

[e] Sample showed evidence of reproduction.

[f] Statistically higher than control; attributed to resident *Chironomus* in test sediments.

[g] Control treatment below acceptable test limit of 80 percent survival.

[h] Statistically lower than control treatment.

N/A = Data not available.

Source: DOE 1996.

Table A7.7
Source Area Hazard Index for Mallard and Great Blue Heron

Source Area	Watershed	Mallard HI	GB Heron HI
OU6 A-Ponds	Walnut	4.55	23.5
OU6 B-Ponds	Walnut	1.61	18.7
OU2 903 Pad	Walnut/Woman	0.5	7.84
OU5 C-Ponds	Woman	1.65	17.19
OU1 881 Hillside	Woman	0.26	8.91
OU5 Old Landfill	Woman	0.7	41.23
OU5 Ash Pits	Woman	0.04	8.05

Table A7.8
Hazard Quotients Contributing to Risk in Great Blue Heron

Source Area	ECOC	GB Heron HQ (% if HI)	Prey Est. Value Intake (mg/kg)	Sediment Concentration (mg/kg)	Total Intake Concentration[a] (mg/kg)
OU6 A-Ponds	DBP	16.56 (70.45%)	0.744	ND	0.745
OU6 B-Ponds	DBP	8.27 (44.21%)	0.372	ND	0.372
OU6 B-Ponds	Hg	2.40 (12.83%)	0.0110	0.00100	0.0120
OU2 903 Pad	Aroclor-1254	5.78 (73.66%)	0.780	0	0.780
OU5 C-Ponds	Hg	6.40 (37.24%)	0.0310	0.00200	0.0320
OU1 881 Hillside	Mg	1.95 (21.95%)	No BCF	22.7	23.3
OU5 Old Landfill	Hg	28.80 (69.85%)	0.132	0.0130	0.144
OU5 Ash Pits	Cd	2.98 (37.03%)	3.47	0.00500	3.47

[a] Total intake may be larger due to surface water contaminant intake, usually small portion.
ND = Not detected in laboratory samples.

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Table A7.9
Hazard Quotients Contributing to Risk in Mallard

Source Area	ECOC	Mallard HQ (% if HI)	Prey Est. Value Intake (mg/kg)	Sediment Concentration (mg/kg)	Total Intake Concentration[a] (mg/kg)
OU6 A-Ponds	DBP	2.00 (43.92%)	0.114	ND	0.114
OU6 B-Ponds	DBP	0.47 (29.66%)	0.027	ND	0.027
OU6 B-Ponds	Hg	0.25 (15.65%)	0.006	6.93E-05	0.006
OU2 903 Pad	Aroclor-1254	0.31 (61.27%)	0.053	3.64E-06	0.053
OU5 C-Ponds	Zn	1.00 (53.90%)	2.613	0.016	2.718
OU1 881 Hillside	Phenanthrene	0.06 (21.33%)	ND	6.08E-06	0.002
OU5 Old Landfill	Zn	0.26 (37.27%)	0.692	0.051	0.791
OU5 Ash Pits	Al	0.01 (21.67%)	0.005	0.06	0.533

[a] Total intake may be larger due to vegetation, soil or surface water contaminant intake, usually small portion.
ND = Not detected in laboratory samples.

Table A7.10

PCB Concentrations in Sediments, 1996[a]

Pond	PCB Conc.[b] (mg/kg)	Aroclor-1254 Conc.[c] (ug/kg)	TRV[d]	HQ
A-1	0.48	350	270	1.3
A-2	0.3	270	518	0.5
A-3	0.17	NR	-------	-------
A-4	0.17	NR	-------	-------
B-1	1.7	4,100	460	8.9
B-2	2.3	NP	-------	-------
B-3	1.5	NP	-------	-------
B-4	0.2	430	258	1.7
B-5	0.1	NP	-------	-------

[a] Information taken from Figure N5-11 (Sediment PCB's) and Attachment 4 –Table 1 Summary of Sediment ECOC Screen).

[b] Concentrations are estimated from the figure and not used in the HQ calculation.

[c] Exposure Point Concentration.

[d] Pond-specific TRVs for sediment.

NR = not reported, noted that PCOCs with records less than TRV were not shown.

NP = not presented; a table was not presented for this pond.

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COMPREHENSIVE RISK ASSESSMENT

NORTH WALNUT CREEK AQUATIC EXPOSURE UNIT, SOUTH WALNUT CREEK AQUATIC EXPOSURE UNIT, WOMAN CREEK AQUATIC EXPOSURE UNIT

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Pond-Specific Ecological Screening Summary

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ACRONYMS AND ABBREVIATIONS

µg	micrograms
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ac-ft	acre-feet
AET	apparent effects threshold
AEU	Aquatic Exposure Unit
AT	alternative toxicity
AWQC	ambient water quality standard
bgs	below ground surface
BZ	Buffer Zone
CAD/ROD	Corrective Action Decision/Record of Decision
CB-PEC	consensus-based probable effects concentration
CB-TEC	consensus-based threshold effect concentration
CCME	Canadian Council of Ministers of the Environment
CD	compact disc
CDH	Colorado Department of Health
CDPHE	Colorado Department of Public Health and Environment
cfs	cubic feet per second
CMC	criterion maximum concentration
CNHP	Colorado Natural Heritage Program
CRA	Comprehensive Risk Assessment
DOE	U.S. Department of Energy

DQA	data quality assessment
DQO	Data Quality Objective
ECOC	Ecological Contaminant of Concern
ECOI	ecological contaminant of interest
ECOPC	ecological contaminant of potential concern
EE	Environmental Evaluation
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EqP	equilibrium partitioning
ERA	Ecological Risk Assessment
ERL	effects range low
ERM	effects range median
ESL	ecological screening level
EU	Exposure Unit
foc	fraction of organic carbon
HI	hazard index
HQ	hazard quotient
HRR	Historical Release Report
IA	Industrial Area
IAEU	Industrial Area Exposure Unit
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
ISQG	interim sediment quality guideline
K-H	Kaiser-Hill Company, L.L.C.

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Koc	organic carbon partitioning coefficient
LEL	lowest effects level
LOAEL	lowest observed adverse effect level
MDC	maximum detected concentration
MENVIQ/EC	Ministere de l'Environnement du Quebec et Environnement Canada
m	meter
mg	milligrams
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MDC	maximum detected concentration
MIDEQ	Michigan Department of Environmental Quality
MK AEU	McKay Ditch Aquatic Exposure Unit
N/L	nitrogen per liter
NA	not applicable
NAWQC	National Ambient Water Quality Criteria
ND	Not detected (or nondetect)
NEC	no-effects concentration
NFAA	No Further Accelerated Action
ng/kg	nanogram per kilogram
NIPHEP	National Institute of Public Health and Environmental Protection
NN AEU	No Name Gulch Aquatic Exposure Unit
NOAEL	no observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
NW AEU	North Walnut Creek Aquatic Exposure Unit

NYSDEC	New York State Department of Environmental Conservation
OMOE	Ontario Ministry of the Environment
OU	Operable Unit
PAC	Potential Area of Concern
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
pCi/kg	picocuries per kilogram
pCi/L	picocuries per liter
PCOC	potential contaminant of concern
PEC	probable effects concentration
PEL	probable effects level
PMJM	Preble's meadow jumping mouse
ppm	parts per million
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QAPjP	Quality Assurance Project Plan
RC AEU	Rock Creek Aquatic Exposure Unit
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan

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SCM	site conceptual model
SCV	secondary chronic value
sd	Standard deviation
SE AEU	Southeast Aquatic Exposure Unit
SEC	sediment effect concentration
SEV	severity of ill effect
SID	South Interceptor Ditch
SQG	sediment quality guideline
SW AEU	South Walnut Creek Aquatic Exposure Unit
SW ESL	surface water ecological screening level
TCDD	tetrachlorodibenzo-para-dioxin
TEC	threshold effect concentration
TEF	toxicity equivalency factor
TEL	toxic effects level
TEL	threshold effects level
TEQ	toxic equivalency quotient
TET	toxic effect threshold
TNRCC	Texas Natural Resource Conservation Commission
UBC	Under Building Contamination
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UTL	upper tolerance limit
WC AEU	Woman Creek Aquatic Exposure Unit

WHO	World Health Organization
WQCC	Water Quality Control Commission
WRS	Wilcoxon Rank Sum
WS SQS	Washington State Sediment Quality Standard

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EXECUTIVE SUMMARY

This attachment presents the ecological screening summary for the sediment data collected from the A-series, B-series, and C-series ponds that are included in the Data Summary Report for Individual Hazardous Substance Site (IHSS) Group NE-1 (i.e., Ponds A-1, A-2, A-3, A-4, A-5, B-4, B-5, C-1, and C-2) (DOE 2005). The purpose of the ecological screening summary is to provide information for risk managers at Rocky Flats Environmental Technology Site (RFETS) to determine if accelerated actions are warranted for the ponds based on protection of ecological receptors.

This assessment focuses on sediment evaluation because sediment is the most likely media impacted by site activities. The surface water evaluation is presented in the Aquatic Exposure Unit (AEU) screening assessments (Volume 15B(2) of the Comprehensive Risk Assessment [CRA], for the North Walnut AEU [NW AEU], South Walnut AEU [SW AEU], and Woman Creek AEU [WC AEU]), which contain information on the ecological risk associated with surface water.

The ecological screening summary follows the Comprehensive Risk Assessment Work Plan and Methodology (CRA Methodology) (DOE 2004a). The steps of the ecological risk assessment process outlined in the CRA Methodology are included in this attachment, namely, identification of ecological contaminants of potential concern (ECOPCs) and risk characterization.

The ECOPC identification process was completed using all sediment sample results available within the pond areas regardless of depth fraction. Results are summarized in Table A8.1 for the A-series ponds, Table A8.2 for the B-series ponds, and Table A8.3 for the C-series ponds. The following ecological contaminants of concern (ECOIs) were identified as ECOPCs and carried forward for further evaluation in the risk characterization:

- Pond A-1: aluminum, antimony, barium, cadmium, copper, iron, lead, mercury, nickel, selenium, silver, zinc, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, Aroclor-1260, total polynuclear aromatic hydrocarbons (PAHs), and total polychlorinated biphenyls (PCBs);
- Pond A-2: aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, zinc, acenaphthene, anthracene, bis(2-ethylhexyl)-phthalate, indeno(1,2,3-cd)pyrene, and Aroclor-1254, total PAHs and total PCBs;
- Pond A-3: aluminum, antimony, barium, iron, nickel, selenium, zinc, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, pyrene, total PAHs, and total PCBs;
- Pond A-4: aluminum, antimony, arsenic, barium, cadmium, copper, iron, nickel, selenium, zinc, atrazine, and total PAHs;
- Pond A-5: aluminum, barium, iron, silver, and zinc;

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- Pond B-4: aluminum, antimony, barium, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)-phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, gamma-BHC, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, total PAHs, and total PCBs;
- Pond B-5: aluminum, barium, iron, lead, nickel, selenium, silver, zinc, and total PAHs;
- Pond C-1: aluminum, barium, iron, lead, manganese, mercury, nickel, selenium, zinc, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, Aroclor-1254, total PAHs, and total PCBs; and
- Pond C-2: aluminum, arsenic, barium, copper, iron, mercury, selenium, zinc, and total PAHs.

Sediment samples were collected from a variety of depths (0 to 8 feet). However, because typical aquatic life activity occurs within the top 0.5 feet of the sediment profile, potential risks associated with the deeper sediments were not evaluated. As a conservative measure, surface sediment was defined as 1 foot in depth for this evaluation. Pond-specific risks to isolated aquatic populations is evaluated, while subsurface sediment risks are presented in the CRA AEU screening assessments (Volume 15B(2); NW AEU, SW AEU, and WC AEU).

The first step in the risk characterization process was to calculate surface sediment hazard quotients (HQs) using the maximum detected concentrations (MDCs) and ecological screening levels (ESLs). Those ECOPCs found to have surface sediment MDC HQs (using ESLs) of 1 or less, or those that were not detected in surface sediment, were eliminated from further consideration (HQs were rounded to one significant figure). Upon completion of this decision process, the list of ECOPCs requiring further risk characterization included the following:

- Pond A-1: aluminum, selenium, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs;
- Pond A-2: aluminum, manganese, acenaphthene, anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs;
- Pond A-3: aluminum, antimony, selenium, zinc, pyrene, and total PCBs;
- Pond A-4: aluminum, antimony, cadmium, and selenium;
- Pond A-5: no ECOPCs were identified for further evaluation;
- Pond B-4: aluminum, cadmium, selenium, silver, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, total PAHs, Aroclor-1254, and total PCBs;

- Pond B-5: selenium and zinc;
- Pond C-1: aluminum, barium, iron, manganese, mercury, selenium, acenaphthene, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, total PAHs, Aroclor-1254, and total PCBs; and
- Pond C-2: mercury and zinc.

The risk characterization process for these remaining chemicals involved multiple lines of evidence, each of which evaluated the potential for risk to aquatic receptors from individual ECOPCs, and together provided an overall risk conclusion for each ECOPC. Chemical lines of evidence included a HQ assessment using the exposure point concentration (EPC) for each ECOPC, as compared to the ESL, and literature-derived alternative toxicity (AT) values. These AT values represent "upper bound" toxicity values that have variable endpoints (i.e., effects-range median, lowest observed effect level, or toxicity threshold, etc. depending on the chemical). The HQ evaluation included assessments of the MDC from surface sediments, the MDC from all sediments, the 95 percent upper confidence limit (UCL) from all sediments, and the pond-series mean as compared to ESL and AT values. In addition, the frequency of detection was evaluated and the spatial extent of contamination was depicted to determine the extent of ECOPC occurrence within the ponds. For certain chemicals, these statistical measures were not available because of limited datasets. In instances where the UCL or upper tolerance limit (UTL) was greater than the MDC, the MDC was not used. In instances where a UCL of UTL could not be calculated, the HQ was not derived. The final chemical line of evidence was the comparison of the ECOPC MDC to the range of background concentrations in order to determine if the chemical risk is within the range of background risk.

The risk characterization continued by reviewing pond-specific conclusions from previous studies at RFETS. These additional lines of evidence included studies of tissue analyses, aquatic population studies, toxicity bioassays, and waterfowl and wading bird exposure studies (Attachment 7). The combination of findings from the chemical risk characterization and drainage-specific lines of evidence constitute the weight-of-evidence approach to this ecological screening summary.

Findings for specific ponds were as follows:

- Pond A-1: Sediment ECOPCs requiring further evaluation included two metals (aluminum and selenium) and four organic chemicals (benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs). Aroclor-1254 was eliminated because the surface sediment MDC was less than the Aroclor-1254 ESL. Results of further chemical risk evaluation determined that the surface sediment ESL HQs for these chemicals were low (less than 10) for each ECOPC. Other chemical lines of evidence found selenium to occur within the range of risk attributable to background. The spatial extent of these chemicals within surface sediment was often limited to a few locations with detected concentrations greater than the ESL, while the remaining locations had chemical concentrations less than the ESL or below detection. Based on a culmination of chemical risk lines of

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evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from several studies conducted by others have demonstrated that the aquatic life within Pond A-1 is typical of pond systems within the region (Attachment 7). There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond A-1 as measured by bioassay analysis and population studies. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond A-1.

- Pond A-2: Sediment ECOPCs requiring further evaluation included two metals (aluminum and manganese) and five organic chemicals (acenaphthene, anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs). Further chemical risk evaluation determined that the surface sediment ESL HQs for aluminum, manganese, anthracene, Aroclor-1254, and total PCBs were less than 10. Acenaphthene had an HQ of 27; however, it was detected in only one of ten samples, indicating a limited spatial extent. Similarly, indeno(1,2,3-cd)pyrene had an HQ of 12, but it was detected in only one of ten samples. Other chemical lines of evidence found manganese occurred within the range of risk attributable to background. The spatial extent of these chemicals within surface sediment was often limited to a few locations with detected concentrations greater than the ESL, while the remaining locations had chemical concentrations less than the ESL or below detection. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from studies conducted by others have demonstrated that the aquatic life within A-2 is typical of pond systems within the region (Attachment 7). There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond A-2 as measured by bioassay analysis and population studies. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within pond A-2.
- Pond A-3: Sediment ECOPCs requiring further evaluation included four metals (aluminum, antimony, selenium, and zinc) and two organic chemicals (pyrene and total PCBs). Further chemical risk evaluation determined that the surface sediment ESL HQs for these chemicals were all less than 10. The only PCB congener detected was Aroclor-1254, which was detected in only one of eight samples collected. Other chemical lines of evidence found zinc occurred within the range of risk attributable to background. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from studies conducted by others have demonstrated that the aquatic life within A-3 is typical of pond systems within the region (Attachment 7). There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond A-3 as measured by bioassay analysis and population studies. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond A-3.

- Pond A-4: Sediment ECOPCs requiring further evaluation included four metals (aluminum, antimony, cadmium, and selenium). Further chemical risk evaluation determined that the surface sediment ESL HQs for aluminum, cadmium, and selenium were less than 10. Antimony had an HQ of 21; however, it was detected in only four of twelve samples, indicating a minimal spatial extent. Other chemical lines of evidence found selenium occurred within the range of risk attributable to background. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from studies conducted by others have demonstrated that the aquatic life within A-4 is typical of pond systems within the region (Attachment 7). There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond A-4. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond A-4.
- Pond A-5: No sediment ECOPCs were evaluated within the risk characterization. Those ECOPCs identified from the entire sediment data set were found to have surface sediment MDC values less than the ESL. Therefore, these chemicals do not pose a risk to aquatic populations within Pond A-5.
- Pond B-4: Sediment ECOPCs requiring further evaluation included five metals (aluminum, cadmium, selenium, silver, and zinc) and thirteen organic chemicals (anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, total PAHs, and total PCBs). Further chemical risk evaluation determined that the surface sediment ESL HQs for these chemicals with the exceptions of benzo(g,h,i)perylene and indeno(1,2,3-cd)pyrene were less than 10. Benzo(g,h,i)perylene had an HQ of 21; however, it was detected in only 10 of 22 samples. Similarly, indeno(1,2,3-cd)pyrene had an HQ of 12 but it was detected in only 10 of 22 samples. While these two PAH constituents yielded large HQ values, the MDCs for these chemicals fell below the AT values and were limited in their spatial extent of exceedance as compared to the ESLs (both had three measured values greater than the ESL, while the remaining three sample locations within the Pond B-4 were at concentrations below detection). The overall risk attributable to these chemicals is expected to be low. Other chemical lines of evidence found that zinc occurred within the range of risk attributable to background. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond B-4 as measured by bioassay analysis and population studies. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond B-4.
- Pond B-5: Sediment ECOPCs requiring further evaluation included three metals (aluminum, selenium, and zinc) and one organic chemical (total PAHs). Surface sediment ESL HQs for these chemicals were less than 10. Further evaluation

indicated that the risk attributable to these metals was within the range of background conditions. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. The results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond B-5.

- Pond C-1: Sediment ECOPCs requiring further evaluation included six metals (aluminum, barium, iron, manganese, mercury, and selenium) and twelve organic chemicals (acenaphthene, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, Aroclor-1254, total PCBs, and total PAHs). Further chemical risk evaluation determined that the surface sediment ESL HQs for these chemicals with the exceptions of acenaphthene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were less than 10. Six organic chemicals yielded large HQ values: acenaphthene HQ = 48, anthracene HQ = 8, benzo(g,h,i)-peryelene HQ = 12, dibenz(a,h)anthracene HQ = 16, indeno(1,2,3-cd)pyrene HQ = 29, and pentachlorophenol HQ = 4. However, the MDCs for anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene were comparable to the AT values. In addition, dibenz(a,h)anthracene, benzo(g,h,i)perylene, and pentachlorophenol were infrequently detected above their respective ESLs. The remaining chemicals with uncertain toxicity potential were acenaphthene and indeno(1,2,3-cd)pyrene because they were frequently detected (50 percent of total samples) yet had minimal spatial exceedances as compared to their ESLs. Results of sediment bioassay analysis indicate that Pond C-1 sediment is comparable to controls. There were no chemical stressors measured as a result of the bioassay analysis. In addition, previous studies did not identify PAHs as creating a risk to aquatic life or other receptors (wildlife and waterfowl) associated with Pond C-1 (Attachment 7). Other chemical lines of evidence found iron, manganese, and selenium occurred within the range of risk attributable to background. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from studies conducted by others have demonstrated that the aquatic life within Pond C-1 is very limited, yet typical of pond systems within the region. There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond C-1. Results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond C-1.
- Pond C-2: Sediment ECOPCs requiring further evaluation included two metals (mercury and zinc) and one organic chemical (total PAHs). Further chemical risk evaluation determined that the surface sediment ESL HQs for these chemicals were less than 10. Other chemical lines of evidence found zinc to occur within the range of risk attributable to background. Based on a culmination of chemical risk lines of evidence, these ECOPCs were found to be of low risk to aquatic populations. Results from studies conducted by others have demonstrated that the aquatic life within Pond C-2 is typical of pond systems within the region

(Attachment 7). There has not been a measurable impact attributable to a chemical stressor in relation to the aquatic ecology within Pond C-2. Results of the chemical risk characterization in combination with other lines of evidence indicate there are low risk concerns to aquatic populations within Pond C-2.

Results of this ecological screening may indicate that there are no continuing, significant risks to aquatic life in the ponds addressed in this report as a result of residual ECOPCs from RFETS-related operations. Any potential risk to these receptors is expected to be within the range of background risks. No additional risks above what is expected to be encountered in the natural environment in the vicinity of the ponds within the Aquatic Exposure Units (AEUs) are predicted for the aquatic life receptors evaluated in this Ecological Screen. Overall, the aquatic communities in RFETS AEUs are limited by natural environmental conditions (i.e., low flows and poor habitat) characteristic of this area along the Colorado Front Range. Therefore, aquatic receptor exposure pathways are often incomplete when discharge is low in these ephemeral streams.

1.0 INTRODUCTION AND SITE SETTING

An evaluation of the potential risk to aquatic populations within individual ponds at the Rocky Flats Environmental Technology Site (RFETS) was completed as part of this Aquatic Exposure Unit (AEU) risk assessment and the Data Summary Report for Individual Hazardous Substance Site (IHSS) Group NE-1. This process involved the following two components: 1) the identification of Ecological Contaminants of Potential Concern (ECOPCs) based on all sediment sample results gathered (regardless of depth fraction); and 2) risk characterization. The ECOPC selection process followed the Comprehensive Risk Assessment Work Plan and Methodology (hereafter referred to as the CRA Methodology) (DOE 2004a) and was completed for each pond. The risk characterization process addressed those ECOPCs carried forward. There are three components to the risk characterization: 1) a chemical risk characterization; 2) other lines of evidence gathered from previous studies focused specifically on tissue analyses, aquatic population studies, bioassay analyses, and waterfowl/wading bird studies (Attachment 7); and 3) a weight-of-evidence conclusion where the chemical risk and other lines of evidence are combined to form a risk conclusion.

The lines of evidence used within the chemical risk characterization included a Hazard Quotient (HQ) evaluation of the ECOPCs using surface sediment results, a frequency of detection and spatial extent evaluation, a comparison to the range of background conditions, and additional chemical lines of evidence as appropriate. Other lines of evidence gathered from previous studies (Attachment 7) were compiled in order to more fully understand the potential risk conditions associated with the ponds (Attachment 7). Several previous studies focused specifically on the ponds, and these studies also are summarized in Attachment 7. The combination of chemical risk assessment and other lines of evidence formulates the weight-of-evidence summary risk conclusions. Each pond was evaluated independently. In addition, each pond's contribution to the pond-series is described.

Aquatic habitats at RFETS have been highly modified by diversion and impoundment of water, which occurred historically for agricultural use and, more recently, for control of potential off-site transport of contaminants in water and sediments. Prior to agricultural development, Walnut Creek and Woman Creek were seasonally intermittent streams fed primarily by snowmelt and runoff. Aquatic communities were limited by both the periodic lack of flows and the generally low flows. Reliable surface flows occurred only near seeps and springs (DOE 1996).

Construction of detention ponds in both watersheds severely altered the natural hydrologic conditions. Creation of the ponds resulted in permanent lentic (standing water) habitats in areas where water previously was present only seasonally. In Walnut Creek, batch-release of water from the terminal ponds (Pond A-4 and Pond B-5) has caused stream segments immediately downstream to be dry most of the time. Establishment of aquatic life in these stream segments is limited because batch-releases are of short duration and occur at irregular intervals. Much of the water in Woman Creek has historically been diverted to Mower Ditch, leaving the segment below Pond C-2 dry much of the year. Flow in portions of Woman Creek upstream of Pond C-2 is relatively

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natural, although some groundwater sources may have been interrupted by installation of the South Interceptor Ditch (SID) and French drain in Operable Unit (OU) 1 and OU 5 (DOE 1996).

Stream communities at RFETS are composed of species that are typical of limited-flow or seasonal-flow environments. Under these conditions, assessment of impacts due to contaminant input is difficult because of natural variability (DOE 1996). Physical conditions in the ponds also hinder assessment of toxic impacts. Water levels in historic Ponds A-3, A- 4, B-2, B-3, and B-5 were manipulated for site water management. Ponds A-1, A-2, B-1, and B-2 were relatively shallow (less than 1 meter [m]), had no regular input besides local runoff, and had no regular output besides evaporation. As a result, the ponds historically have had abundant aquatic plant life. However, faunal communities are limited, probably because of high daytime temperatures in summer and low dissolved oxygen at night.

The most common aquatic macroinvertebrates (aquatic insects) are the larvae of the blackfly (Order *Diptera, Simulidae* sp.), midge (Order *Diptera, Chironomidae* sp), mayfly (Order *Ephemeroptera*), and scuds (*Hyalella azteca*). Other species include caddisflies (Order *Trichoptera*), craneflies (*Tipulidae* sp.), and damselfly larvae (Order *Odonata*), as well as snails (Class *Gastropoda*) and other amphipods (Order *Amphipoda*). Large macroinvertebrates such as crayfish (Order *Decapoda*, Family *Astacidae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

Each of the primary drainages at RFETS contains a variety of pond and stream habitats, varying amounts of habitat modification, and seasonal water flows. The Walnut Creek drainage has been highly modified as part of site development. The upper section of the drainage was filled and the lower section modified into a series of small reservoirs that can retain water released from the Industrial Area (IA). A variety of non-native fish species such as rainbow trout (*Salmo gairdneri),* carp (*Cyprinus carpio),* and bass (Order *Centrarchidae, Micropterus* sp.*),* were introduced into the Walnut Creek reservoirs. Although all introductions did not establish reproducing fish populations, carp, goldfish *(Carassius auratus),* and fathead minnows *(Pimephales promelas)* are present in these reservoirs. Woman Creek retains a significant amount of stream habitat and holds the majority of RFETS fish species. Native fish species that reproduce within Woman Creek include white suckers *(Catostomus commersoni),* fathead minnows, green sunfish *(Lepomis cyanellus*), stonerollers *(Campostoma anomalum*), and creek chubs *(Semotilus atromaculatus*). Two non-native fish species, golden shiners *(Notemigonus crysoleucas)* and largemouth bass *(Micropterus salmoides),* also are found in the drainage.

The A- and B-series ponds are down-gradient of the historic IHSSs in the Walnut Creek watershed and may contain contaminants transported from primary source areas. Contaminants that have accumulated in water and sediments could affect the aquatic populations within these ponds.

Most of the historic IHSSs in the Woman Creek watershed are located on the south-facing slopes of this drainage. These IHSSs were used primarily for storage and disposal of hazardous materials. In some of the IHSSs, most notably the 903 Pad, hazardous wastes leaked from drums into surrounding soil. The drums and contaminated soil underneath have since been removed. Exposure to aquatic receptors is most likely through contact with contaminated sediment and surface water.

Ponds C-1 and C-2 are downgradient of historic IHSSs and therefore may contain contaminants originating from these sites. Pond C-1 is probably the most "natural" pond in terms of associated vegetation and persistent water levels. Pond C-2 supports a population of fathead minnows.

Details of the history and uses of the ponds are provided in the following sections.

2.0 IDENTIFICATION OF ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN

This Section provides a summary of the methods and findings of the pond ECOPC process. A summary of the ECOPCs identified for each pond are provided in Table A8.1 for the A-series ponds, Table A8.2 for the B-series ponds, and Table A8.3 for the C-series ponds.

2.1 Data Used in the Evaluation

The ECOPC screen was conducted using the complete sediment data set available for each individual pond (all samples regardless of depth fraction collected after June 23, 1991, including the recently collected July 2005 samples). Therefore, all sediment samples comprised of all depth fractions within a given pond were compiled for the screening process. Summary statistics for detected chemicals within all sediment samples collected for each pond are provided in Tables A8.4 through A8.12. The spatial extent of each identified ECOPC are provided in Figures A8.1 through A8.82.

Polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) tend to act in an additive manner because of similar modes of toxic action. To account for this interactive toxicity, a total concentration was calculated for PCBs and PAHs within each sample.

The total maximum PAH concentrations were determined using the following steps:

1. PAH compounds detected in greater than 5 percent of the samples were included in the total calculations.
2. A sum of PAHs was determined for each sample, using half the detection limit for nondetected chemicals.
3. The total maximum detected value was compared to the total PAH ecological screening level (ESL) for the ECOPC screen.
4. The total detected maximum sum for each sample location was calculated for surface sediment and compared to the ESL for the risk characterization screen.

The total maximum PCB concentration was determined using the following steps:

1. Aroclors detected in greater than 5 percent of the samples were included in the total calculations.

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2. A total maximum sum of PCBs was determined for each sample, using half the detection limit for nondetected PCBs.
3. The total maximum sum was compared to the total PCB ESL for the ECOPC screen.
4. The total maximum sum in surface sediment was compared to the ESL for the risk characterization screen.

Additional sampling for dioxin/furan congeners was completed after the CRA Methodology was put in place. The toxicity evaluation of these chemicals requires the use of toxicity equivalency factors (TEFs) as related to 2,3,7,8-TCDD. The methods are more thoroughly described in Attachment 5. For dioxins/furans, the following steps were taken:

1. Detected dioxin/furan concentrations were summed, using half the detection limit for nondetected concentrations, to develop a conservative total dioxin concentration.
2. The total dioxin concentration was compared to the total dioxin ESL for the ECOPC screen.
3. If the total dioxin concentration exceeded the ESL and was retained for risk characterization, then a toxicity equivalent quotient (TEQ) was calculated using dioxin/furan-specific TEFs (WHO 1998).

The results of these analyses were compared to available toxicity benchmarks protective of aquatic life. Values of 0.85 nanogram per kilogram (ng/kg) no observed effects level (NOAEL) and 21.5 ng/kg lowest observed effects level (LOAEL) were used for the comparison (WHO 1998).

2.2 Identification of Sediment ECOPCs

The pond ECOPC identification process examined ecological contaminants of interest (ECOIs) (i.e., analytes detected at least once in sediment samples) that were present in sediment through the sequential, multi-step process described in the CRA Methodology. In the interest of being conservative, the professional judgment step was eliminated from the process used to select ECOPCs for the ponds. A summary of the process and the specific application to the pond ECOPC selection process is described below.

As the first step in the decision process, the maximum detected concentrations (MDCs) of ECOIs were screened against ESLs. ECOIs without ESLs were considered to be chemicals of uncertain potential for risk and are discussed further in the uncertainty section of the CRA (Volume 2).

The ECOPC selection process continued with the exclusion of chemicals with a detection frequency less than 5 percent and, subsequently, with concentrations not significantly different from background. Infrequently detected ECOIs and those with concentrations not greater than background are assumed not to pose a potential for risk to aquatic receptors. Because each pond has a small and concentrated data set, it was found that this screening step did not eliminate any ECOIs from further consideration.

The third step of the ECOPC selection process compared the exposure point concentration (EPC), represented by the 95th upper tolerance limit (UTL) (95th upper confidence limit [UCL] of the 90th percentile), to the ESL. Because of the size of the data sets, it was often found that the UTL was greater than the MDC. Therefore, no ECOIs were eliminated from further consideration within the ECOPC process as a result of this step.

The final ECOPC selection step outlined in the CRA Methodology involves a professional judgment evaluation of each remaining ECOI to determine if the ECOI was related to site activities and if there was a realistic potential for risk to aquatic communities that required a thorough risk characterization. As noted above, this step was not applied for the ecological screening summary.

2.3 Summary of ECOPCs by Pond

All ECOIs with MDCs greater than the ESL were ultimately retained as an ECOPC. The decision steps involving a frequency of detection screen, a statistical comparison to background, and the comparison of the UTL to the ESL, did not eliminate any ECOIs from further consideration.

Statistical background results and summary statistics from which the ECOI UTLs were developed are provided in Attachment 3.

Results of each ECOPC step are shown in Tables A8.13 through A8.21 by pond. A summary of the total PCB evaluations for all sediment sample results and for surface sediment sample results are shown in Tables A8.22 and A8.23, respectively. Total PAH values for all sediment by sample are provided in Table A8.24, and total PAHs for surface sediment by location are shown in Table A8.25. Dioxin TEQ calculations for all sediment sample results and surface sediment results are provided in Tables A8.26 and A8.27, respectively. The values provided in Tables A8.22 through A8.27 represent measured values plus half the reported value for the nondetect sample results. For instance, values presented for locations and samples within Ponds A-4 and A-5 were all nondetect, thus half the reporting limit values are presented for each chemical.

The total PCB MDC was used for the ECOPC evaluation step. In general, Aroclor-1254 was the only PCB detected in the ponds (with the exception of Pond A-1). Therefore, the MDC for Aroclor-1254 was the equivalent of the total maximum PCB concentration. Total PCBs were identified as an ECOPC for Ponds A-1, A-2, A-3, B-4, and C-1. Further analysis of the total PCB results identified Aroclor-1254 as an ECOPC for Ponds A-1, A-2, A-3, B-4, and C-1, while Aroclor-1260 was an ECOPC for Pond A-1.

Calculated total PAHs were compared to the total PAH ESL. Total PAHs were identified as an ECOPC for all of the ponds except A-4 and A-5, where data analysis indicated that all sample results from the comprehensive sediment data set were below detection limits.

Dioxin was evaluated by summing the products of detected dioxin/furan concentrations and TEFs. The resulting total dioxin equivalent (TEQ) concentration was compared to available toxicity benchmarks protective of aquatic life. A no observed adverse effect level (NOAEL) of 0.85 nanogram per kilogram (ng/kg) and a lowest observed adverse

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effect level (LOAEL) of 21.5 ng/kg were used for the comparison (WHO 1998). The summed values provided in Table A8.26 are below the LOAEL level.

The ECOPCs identified for each pond are as follows:

- Pond A-1 (Table A8.13): aluminum, antimony, barium, cadmium, copper, iron, lead, mercury, nickel, selenium, silver, zinc, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, Aroclor-1260, total PAHs, and total PCBs;
- Pond A-2 (Table A8.14): aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, zinc, acenaphthene, anthracene, bis(2-ethylhexyl)phthalate, indeno(1,2,3-cd)pyrene, Aroclor-1254, total PAHs, and total PCBs;
- Pond A-3 (Table A8.15): aluminum, antimony, barium, iron, nickel, selenium, zinc, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, pyrene, total PAHs, and total PCBs;
- Pond A-4 (Table A8.16): aluminum, antimony, arsenic, barium, cadmium, copper, iron, nickel, selenium, zinc, and atrazine;
- Pond A-5 (Table A8.17): aluminum, barium, iron, silver, and zinc;
- Pond B-4 (Table A8.18): aluminum, antimony, barium, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium, silver, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene bis(2-ethylhexyl)phthalate, chrysene, dibenz(a,h)anthracene, fluoranthene, gamma-BHC, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, total PAHs, and total PCBs;
- Pond B-5 (Table A8.19): aluminum, barium, iron, lead, nickel, selenium, silver, zinc, and total PAHs.
- Pond C-1 (Table A8.20): aluminum, barium, iron, lead, manganese, mercury, nickel, selenium, zinc, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, Aroclor-1254, total PAHs, and total PCBs; and
- Pond C-2 (Table A8.21): aluminum, arsenic, barium, copper, iron, mercury, selenium, zinc, and total PAHs.

3.0 ECOLOGICAL EXPOSURE ASSESSMENT

An exposure pathway describes a specific environmental route by which an individual receptor could be exposed to contaminants present at or originating from a site. A complete exposure pathway includes five elements: source, mechanism of release, transport medium, exposure point, and intake route. If any of these elements are missing, the pathway is considered incomplete. For the purposes of the pond evaluations, it is assumed that aquatic life may be exposed to sediment-related ECOPCs via several routes (direct contact, inhalation, and ingestion). This evaluation conservatively assumes that an aquatic receptor obtains 100 percent of its exposure from each respective pond.

4.0 ECOLOGICAL TOXICITY ASSESSMENT

ESLs that were identified in the CRA Methodology are typically screening-level concentrations at which adverse effects are rarely observed. They provide a conservative lower bound indicating concentrations above which the potential for adverse effects are possible, as discussed in the CRA Methodology. Alternative toxicity (AT) values were identified for consideration in the risk characterization of ECOPCs to provide an upper-bound concentration at which the potential for adverse effects are possible (Attachment 5).

AT values represent literature-derived toxicity values for contaminants that reflect upper-bound concentrations above which adverse effects are possible. Concentrations between the ESL and AT values are within the range of uncertain toxicity where adverse effects may be observed. The use of both the lower- and upper-bound toxicity values for each ECOPC brackets the potential for risk from each ECOPC and allows an evaluation of the likelihood of potential risk.

Aquatic ATs vary in their endpoint and receptor of interest. The available literature was reviewed to identify suitable AT values for each ECOPC that are correlated to a LOAEL or similar measure. The selection process for AT values, their endpoints, and sources are described in Attachment 5. In general, the AT values were identified from the literature using the same steps applied for the development of ESLs as defined in the CRA Methodology.

5.0 POND ECOLOGICAL RISK EVALUATION

The pond risk evaluation involved two components: 1) chemical risk lines of evidence evaluation; and 2) other lines of evidence gathered from previous studies focused on the evaluation of the pond's ecology. Both components were evaluated and form the final weight-of-evidence risk conclusions for each pond. The chemical risk lines of evidence relied upon specific data sets generated from surface sediment and pond-series results. These data and a summary of their application to this evaluation are provided in Attachment 7. The other lines of evidence also are summarized in detail in Attachment 7, including the ecological setting, chemical risk, and other lines of evidence for each pond.

Chemical risk characterization lines of evidence generally followed three steps. The initial step involved a HQ assessment to compare the ECOPC MDC from surface sediment to the ESLs (based on CRA Methodology) and ATs. Surface sediment represents the realistic exposure medium by which aquatic receptors can become affected. Those ECOPCs that were either not detected or had ESL HQs of 1 or less in surface sediment were eliminated from further risk characterization.

The total PCBs MDC was equal to the total maximum concentration detected in surface sediment, as determined by steps previously described in Section 2.1. The total PAHs MDC was equal to the total detected maximum concentration determined by location for

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each pond. PAH and PCB constituents in surface sediment are shown in Figure A8.30 for the A-series ponds, Figure A8.58 for the B-series ponds, and Figure A8.82 for the C-series ponds.

The HQ evaluation also encompassed the use of the UCL, which provided a measure of the central tendency of chemical concentrations. In addition, summary statistics for the pond series were developed (provided in Attachment 7). From these, an arithmetic mean was calculated and evaluated using the HQ method. The results were used to provide a perspective with regard to HQs from the entire sediment and surface sediment data sets. They were not used for decision purposes.

As described in Section 2.2, the ECOPC identification process used ESLs from the CRA Methodology. For risk characterization, ATs were developed where appropriate. The ESLs and ATs were compared to surface sediment MDCs, sediment (all depth fractions) MDCs, and EPC values (pond-specific UCL 95 and pond-series arithmetic mean) for the HQ process. The HQs were developed using the following standard equation:

$$HQ = EPC/ESL \text{ or } AT$$

where:

EPC = Media-specific EPC (micrograms per kilogram [μg/kg], picocuries per kilogram [pCi/kg], or mg/kg for sediment)
ESL = Media-specific ESL (comparable units to the EPC)
AT = Media-specific Ecological AT (comparable units to the EPC)

The second step of chemical risk characterization was to evaluate the frequency of detection and spatial extent of each ECOPC. A low detection frequency indicates uncertainty in the potential for risk evaluation.

As a final step, the spatial distribution of concentrations of ECOPCs was evaluated. This step involved mapping the location of each surface sediment sample and indicating the concentration relative to the ESL. The spatial extent was evaluated to identify any potential areas that could present a localized risk to aquatic organisms. If all measured results were consistently greater than the ESL within a habitat area, then the potential for risk could not be excluded. If, however, ESL exceedances were scattered and not consistently present throughout the habitat area, then there may be a low potential of risk.

The ECOPCs were mapped for both the comprehensive sediment data set and surface sediment data set. Figures for the comprehensive sediment data set are provided in Attachment 7, while figures for the surface sediment data set are provided here (Figures A8.1 through A8.29 for the A-series ponds, A8.31 through A8.57 for the B-series ponds, and A8.59 through A8.81 for the C-series ponds).

Surface sediment (0.0-1 foot) is evaluated using risk characterization lines of evidence. This depth interval represents the realistic exposure medium for aquatic life because aquatic life does not typically inhabit or forage in sediment in depths greater than 0.5 feet. Defining surface sediment as 0.0 to 1 foot represents a conservative estimate of the exposure medium within each pond.

Subsurface sediment and surface water risks are presented in the CRA AEU screening assessments (Volume 15B(2); NW AEU, SW AEU, and WC AEU). These media were evaluated on an AEU-wide aquatic population basis. The data quality and uncertainty assessments are also included in this CRA volume.

The maps indicate where results are either nondetect, greater than ESLs, or less than ESLs. Because ECOPCs were mapped by pond series, each ECOPC identified for any pond within a series is shown for all ponds within the series regardless of ECOPC status. For instance, arsenic was identified as an ECOPC for Pond A-2 and not for Pond A-1. In order to understand the spatial extent of occurrence within the entire habitat region, arsenic was mapped for surface sediment for the entire series. This same approach was applied for the ECOPCs found in the B- and C-series ponds as well.

In addition to the chemical lines of evidence, a second component of risk characterization was the review of conclusions from other reports and studies (Attachment 7). The ecological setting of RFETS is key to understanding the controlling factors other than chemical concentrations that affect the ecology of each drainage. These lines of evidence consist of previously collected data from the OU 5/OU 6 Watershed Ecological Risk Assessment (ERA) and other studies that have defined ecological conditions at the site over time and provide insight into the changes, adverse effects, or controlling factors that may affect the site ecology. Each study provides a line of evidence describing the RFETS ecological risk setting. Attachment 7 provides a summary of lines of evidence from previous studies that were conducted within the RFETS and that focused specifically on the ponds. The studies encompass the following four line-of-evidence categories:

- **Tissue Analyses –** Included sampling and analysis to determine bioaccumulation and bioconcentration trends;
- **Aquatic Population Studies –** Evaluated populations of benthic macroinvertebrates and fish within RFETS;
- **Bioassay Analyses –** Measured direct toxicity effects to laboratory test organisms from potentially contaminated surface water or sediment; and
- **Waterfowl/Wading Bird Studies –** Determined the potential impacts to these higher trophic level receptors by assessing their potential exposure to aquatic species as food sources (recording feeding behaviors and ranges).

The methods, conclusions, and application of each study to this ecological screening summary also are provided. A summary of findings is then presented within the risk characterization in order to draw weight-of-evidence risk conclusions. Lines of evidence that can provide information regarding risk conditions to aquatic life can be derived using a number of strategies including measurement endpoints.

5.1 A-Series Pond Risk Characterization

The A-Series ponds occur within the North Walnut Creek AEU (NW AEU), which encompasses the watershed components associated with the North Walnut drainage. Runoff from the northern portion of the IA flows into North Walnut Creek. Upstream of Pond A-4, North Walnut Creek is classified as stream Segment 5 in the Big Dry Creek basin by the Colorado Water Quality Control Commission (WQCC). North Walnut Creek

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has continuous flow at approximately 150 acre-feet (ac-ft) per year. These flows are likely to diminish with the removal of buildings and pavement from the IA, which will significantly reduce the volumes and peak discharge rates of runoff. Pond A-1 is isolated from North Walnut Creek by design and does not receive runoff from the IA. Historically, Pond A-1 was held in reserve to catch runoff in the event of a hazardous waste spill in the northern portion of the IA.

Fathead minnows (*Pimephales promelas*), a native species, are present in the A-series ponds and are the dominant fish species found in this AEU. A variety of non-native fish species (rainbow trout [*Salmo Gairdneri*], carp [*Cyprinus carpio*], and bass [*Micropterus sp.*]) were inadvertently introduced into the Walnut Creek ponds, although these introductions have not resulted in established reproducing fish populations. Golden shiners (*Notemigonus crysoleucas*), a non-native fish, is also present in the A-series ponds.

Within the Walnut Creek area, the most common aquatic macroinvertebrates are the larvae of the blackfly (*Order Diptera, Simulidae* sp.) midge (*Order Diptera, Chironomidae sp*), mayfly (*Order Ephemeroptera*) (DOE 1997) and scuds (*Hyalella azteca*). Other species include caddisflies (*Order Trichoptera*), craneflies (*Tipulidae sp.*), and damselfly larvae (*Order Odonata*), as well as snails (*Class Gastropoda*) and other amphipods (*Order Amphipoda*). Large macroinvertebrates such as crayfish (*Order Decapoda, Family Astacidae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

Characterization of the aquatic habitat provided by North Walnut Creek is of primary consideration with regard to aquatic risk. Currently, sustained flows that support some aquatic species exist but are minimal in nature. The location and amount of viable aquatic habitat that will be present after accelerated actions are complete is unclear because overland flow may be altered by the IA accelerated actions.

5.1.1 Pond A-1

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC in Pond A-1. Those chemicals identified for further risk characterization are described in more detail in the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.28 provides the results of the HQ assessment for the Pond A-1 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are presented below.

- Aluminum, with a surface sediment HQ of 2, was retained for further consideration. The spatial extent of aluminum in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.1.
- Antimony was not detected in Pond A-1 surface sediment and was therefore removed from further risk characterization. The spatial extent of antimony

sampling in surface sediment within the A-series ponds is provided in Figure A8.2. As shown on this figure, four locations were sampled with all results at nondetect levels.

- Barium had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. Further analysis indicated that the MDC for barium is less than the maximum detected concentration in background. Based on this comparison, the risk attributable to barium is no greater than the risk attributable to background. The spatial extent of this chemical in surface sediment is shown on Figure A8.4. For barium, three of four locations had measured concentrations greater than the ESL. However, the magnitude of exceedance was low, yielding an HQ just greater than 1. The risk attributable to barium in Pond A-1 is expected to be within the range of background and does not require further evaluation.
- Cadmium had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. The spatial extent of this chemical in surface sediment is shown on Figure A8.5. Cadmium was detected at one location with a concentration greater than the ESL; remaining concentrations were at nondetect levels. Given the extent of detection of cadmium in surface sediment, the risk attributable to cadmium in Pond A-1 is expected to be low and does not require further evaluation.
- Copper had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. The spatial extent of this chemical in surface sediment is shown on Figure A8.7. All measured concentrations for copper within Pond A-1 were below the ESL. Given the magnitude of concentrations in surface sediment, the risk attributable to copper in Pond A-1 is expected to be low and does not require further evaluation.
- Iron and lead had surface sediment HQs of 1 or less and were removed from further consideration. Further analysis indicated that the MDC for both iron and lead is less than the maximum detected concentrations in background. Based on the comparison, the risk attributable to these metals is no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.8 and A8.9. As shown on these figures, all measured concentrations for lead within Pond A-1 were below the ESL, and three of four measured concentrations for iron were just slightly greater than the ESL. The risk attributable to these metals in Pond A-1 is within the range of background and does not require further evaluation.
- Mercury had surface sediment HQs of 1 or less and was removed from further consideration. Further analysis indicated that the MDC for mercury is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to mercury would be no greater than the risk attributable to background. Mercury was detected at one location in surface sediment with a concentration just slightly greater than the ESL (Figure A8.11). The risk

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attributable to mercury is within the range of background and does not require further evaluation.

- Nickel had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. The spatial extent of this chemical in surface sediment is shown on Figure A8.12. All measured concentrations for nickel within Pond A-1 were below the ESL. Given the magnitude of concentrations in surface sediment, the risk attributable to nickel in Pond A-1 is expected to be low and does not require further evaluation.
- Selenium, with a surface sediment HQ of 2, was retained for further consideration. Further analysis indicated that the MDC for selenium is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to this metal is no greater than the risk attributable to background. The spatial extent of selenium in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.13. Because the surface sediment HQ for selenium was greater than 1, it was retained for further risk characterization.
- Silver had a surface sediment HQ of 1 or less and was removed from further consideration. The spatial extent of this chemical in surface sediment is shown on Figure A8.14. The measured concentrations for silver within Pond A-1 were either nondetect or below the ESL. Given the magnitude of concentrations in surface sediment, the risk attributable to silver in Pond A-1 is expected to be low and does not require further evaluation.
- Zinc had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. Further analysis indicated that the MDC for zinc is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to zinc would be no greater than the risk attributable to background. The spatial extent of this chemical in surface sediment is shown on Figure A8.15. For zinc, there were two of four locations with measured concentrations greater than the ESL. However, the magnitude of exceedance was slight, yielding an HQ just greater than 1. The risk attributable to zinc in Pond A-1 would be within the range of background and does not require further evaluation.
- Acenaphthene and anthracene were not detected in Pond A-1 surface sediment and were therefore removed from further risk characterization. The spatial extent of the surface sediment sampling for these chemicals in the A-series ponds surface sediment is provided on Figures A8.16 and A8.17. As shown on these figures, four locations were sampled with concentrations below detection limits.
- Benzo(a)anthracene and benzo(a)pyrene had surface sediment HQs of 1 or less and were removed from further consideration. The spatial extent of these chemicals in surface sediment is shown on Figures A8.19 and A8.20. Benzo(a)anthracene was detected at a concentration slightly greater than the ESL at one location, while concentrations at the remaining locations were less than the ESL. Similarly, benzo(a)pyrene exceeded the ESL at one location, while the

remaining results were either less than the ESL or nondetect. Given the magnitude of concentrations in surface sediment, the risk attributable to these chemicals in Pond A-1 would be low and does not require further evaluation.

- Benzo(g,h,i)perylene, with a surface sediment HQ of 8, was retained for further consideration. The spatial extent of benzo(g,h,i)perylene in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.21.
- Chrysene and fluoranthene had surface sediment HQs of 1 or less and were removed from further consideration. The spatial extent of these chemicals in surface sediment is shown on Figures A8.23 and A8.24. Both chemicals had measured concentrations less than their respective ESLs at all four sampling locations. Given the magnitude of concentrations in surface sediment, the risk attributable to these chemicals in Pond A-1 is expected to be low and does not require further evaluation.
- Indeno(1,2,3-cd)Pyrene, with a surface sediment HQ of 5, was retained for further consideration. The spatial extent of indeno(1,2,3-cd)pyrene in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.25.
- Phenanthrene had a surface sediment HQ of 1 or less and was removed from further consideration. The spatial extent of this chemical in surface sediment is shown on Figure A8.26. All measured concentrations for phenanthrene within Pond A-1 were below the ESL. Given the magnitude of concentrations in surface sediment, the risk attributable to phenanthrene in Pond A-1 is expected to be low and does not require further evaluation.
- Pyrene was not detected in Pond A-1 surface sediment and was therefore removed from further risk characterization. The spatial extent of sampling for this chemical in the A-series ponds surface sediment is provided on Figure A8.27. As shown on this figure, four locations for pyrene were sampled, and all concentrations below detection.
- Aroclor-1254 had an HQ just slightly greater than 1 and was therefore retained for further analysis as a conservative measure. The spatial extent of Aroclor-1254 in surface sediment is shown on Figure A8.28.
- Aroclor-1260 was not detected in surface sediment and was therefore removed from further consideration (Figure A8.29). Aroclor-1260 had a low frequency of detection in the comprehensive sediment data set (detected in 1 of 15 samples) and therefore does not demonstrate a spatial distribution of concern to aquatic life. No further evaluation is required.
- Total PCBs were evaluated for Pond A-1 and were found to have a surface sediment HQ of 2. The MDC was calculated using the results of both Aroclor-1254 and Aroclor-1260. Individually, Aroclor-1254 was the only congener detected in surface sediment. Therefore, total PCBs in surface sediment are truly a measure of Aroclor-1254. Aroclor-1254 was retained for further consideration as a conservative measure even though the surface sediment HQ for this individual congener was just slightly greater than 1. The HQ for Aroclor-1254 differs from

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the HQ of total PCBs due to the different ESL applied. The spatial extent of Aroclor-1254 exceedances as compared to the ESL within the A-series ponds is shown on Figure A8.28. Aroclor-1260 was not detected in surface sediment and was therefore removed from further consideration (Figure A8.29).

- Total PAHs were evaluated for Pond A-1. Results of the total PAH calculation for each sample within the comprehensive data set are provided in Table A8.24, and results by location for the surface sediment data set are provided in Table A8.25. These results reflect the measured values plus half the reported value for the nondetected chemicals. The majority of the values were nondetect. The maximum concentrations for the comprehensive data set (6,230 µg/kg) and the surface sediment data set (4,428 µg/kg) were greater than the ESL, yet represent maximum nondetect values. As shown on Figure A8.30, the maximum detected total PAHs for Pond A-1 was 1,050 µg/kg, which falls below the ESL of1,610 µg/kg, indicating there is low risk associated with these combined chemicals. No further evaluation of total PAHs is required.

Chemical Risk Characterization – Further Analysis

Aluminum, selenium, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs were retained for further risk characterization. Each chemical is discussed in detail below.

Aluminum had a frequency of detection of 100 percent (detected in 11 of 11 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range where adverse effects are uncertain. The surface sediment HQ for the AT is less than 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the Sediment Quality Guideline (SQG) by the Texas Natural Resource Conservation Commission (TNRCC). The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media to which receptors are potentially exposed. Toxicity-based alternative screening benchmarks ranged from 14,000 mg/kg effects range low (ERL[1]) to 58,000 mg/kg effects range moderate (ERM), and a high no-effects concentration (NEC) of 73,000 mg/kg (Ingersoll, et al. 1996). Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. (Refer to Attachment 5 for details regarding alternative screening benchmarks and criteria for selection of AT values used for HQ.) Review of the surface sediment data on a point-by-point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-1, three of the four locations had measured values greater than the ESL; the remaining location was less than the ESL.

[1] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical or the number of toxic samples with concentrations below the sediment effect concentration (SEC) was greater than the number of toxic samples with concentrations above the SEC.

Because the measured concentrations all fall below the AT values, the likelihood for risk attributable to aluminum is expected to be low.

Selenium had a frequency of detection of 27 percent (detected in 3 of 11 samples), indicating minimal spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating selenium concentrations in media to which receptors are potentially exposed. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal, et al. 1998). Therefore, despite sediment concentrations exceeding the ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations lower than the alternative toxicity SQG. Review of the surface sediment data on a point-by-point basis indicates that selenium was detected above the ESL in Pond A-1 surface sediment at two locations. The remaining locations were at nondetect levels. The spatial extent of selenium is limited. In addition, the MDC for selenium was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to selenium is expected to be low and within the range of background. Therefore, no further analysis is required.

Benzo(g,h,i)perylene had a frequency of detection of 64 percent (detected in 7 of 11 samples). The surface sediment HQ for the ESL is 8, while the HQ for the AT is less than 1. The ESL was based on the ERL for *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from the 16 μg/kg threshold effects level (TEL) to 280 μg/kg ERM, and a high NEC of 1,200 μg/kg (Ingersoll, et al. 1996). Review of the surface sediment data on a point-by-point basis revealed all of the measured values of benzo(g,h,i)perylene fell below the AT value. Three of the four measured values were greater than the ESL, while the remaining location was below detection. Therefore, despite the MDC exceeding the ESL, it is unlikely that the concentrations of benzo(g,h,i)perylene in sediment pose a potential for adverse effects to benthic organisms in Pond A-1.

Indeno(1,2,3-cd)pyrene had a frequency of detection of 73 percent (detected in 8 of 11 samples). The surface sediment HQ for the ESL is 5, while the HQ for the AT is less than 1. The ESL is based on the TEL for the *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from the 30 μg/kg ERL to 250 μg/kg ERM, and a high NEC of 770 μg/kg (Ingersoll, et al. 1996). All of the measured values of indeno(1,2,3-cd)pyrene were less than the AT value. Review of the surface sediment data on a point-by-point basis identified three of the four measured values were greater than the ESL, while the remaining location was at concentrations below detection. Therefore, despite the MDC exceeding the ESL, it is unlikely that the concentrations of indeno(1,2,3-cd)pyrene in sediment pose a potential for adverse effects to benthic organisms in Pond A-1.

Aroclor-1254 was retained for further analysis as a conservative step regardless of the low ESL HQ value of 1. Aroclor-1254 had a frequency of detection of 67 percent (detected in 10 of 15 samples). The surface sediment HQ for the ESL is 1, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (300 μg/kg). Review of the surface sediment data on a point-by-point basis identified four locations out of seven with concentrations just slightly above the ESL (Figure A8.30). The remaining three locations were at nondetect levels. Given the low HQ values of 1 to less than 1, it is unlikely that Aroclor-1254, which exceeded the ESL by a low magnitude, poses an unacceptable risk to benthic populations inhabiting Pond A-1.

Two Aroclor congeners of PCB were detected (1254 and 1260); however, Aroclor-1260 was detected in only one subsurface sediment sample out of 15 collected. Because it was not detected in the surface sediment, it was removed from further consideration. The total maximum surface sediment concentration for total PCBs was compared to the total PCBs ESL and yielded an HQ of 1, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based probable effects concentration (PEC) (676 μg/kg). Given the low HQ values of 1 to less than 1, it is unlikely that total PCBs, which exceeded the ESL by a low magnitude, pose an unacceptable risk to benthic populations within Pond A-1.

Other Lines of Evidence

Chemical hazard indices (His) in the A-series ponds are reported in the baseline DOE evaluation (DOE 1996). At Pond A-1, the HI equals 160. Anthracene had an HQ of 89, chrysene had an HQ of 34, and benzo(b)fluoranthene had an HQ of 18. Other ecological contaminants of concern (ECOCs) in Pond A-1 had HQs between 1 and 10, including antimony, magnesium, toluene, cobalt, vanadium, Aroclor-1254, and benzo(k)fluoranthene.

Risks to aquatic life, as indicated by the HI values, were primarily from PAHs in sediments. However, no toxicity was detected in sediment toxicity tests and ecological population measures did not correlate with increasing HI values from the ponds. For example, Pond A-1 had the highest HI and also the highest species richness of any pond sampled. It also had one of the highest densities of organisms (number per square meter) within the A-series ponds, surpassed only by Pond A-3. Furthermore, Pond A-1 had the least pollution-tolerant macroinvertebrate community of all the ponds sampled at RFETS. Although the ecological measures cited here represent only 1 year of observation of pond aquatic life, the measures tend to indicate ecological health as opposed to risk from contaminants in sediments. It is more likely that limited flows and pond management affect aquatic life more than contaminants in sediment.

Weight-of-Evidence Conclusions

The results of the chemical risk characterization indicated that sediment ECOPCs within surface sediment pose a low risk to aquatic life within Pond A-1. Those chemicals requiring further analysis (aluminum, selenium, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs) were found to have measured concentrations greater than their respective ESLs but less than AT values. The ESL HQs for these chemicals were low (less than 10 in all cases), indicating a low risk potential. In addition, selenium was found to be within the range of risk attributable to background, while aluminum, benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, and Aroclor-1254 had a minimal spatial extent of ESL exceedances. The overall risk attributable to these chemicals would be low.

These results coincide with the lines-of-evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. These studies occurred within a timeframe that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk to aquatic populations associated with Pond A-1 is expected to be low.

5.1.2 Pond A-2

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC in Pond A-2. Those chemicals identified for further risk characterization are described in more detail in the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.29 provides the results of the HQ assessment for the Pond A-2 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are presented below.

- Aluminum, with a surface sediment HQ of 2, was retained for further consideration. The spatial extent of aluminum in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.1.
- Arsenic, barium, cadmium, chromium, and copper had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. The spatial extent of these chemicals in surface sediment is shown on Figures A8.3 through A8.7, respectively. For arsenic and barium, two of four sampled locations had measured concentrations greater than the ESL. However, the magnitude of exceedances was low, yielding HQs slightly greater than 1. Cadmium, chromium, and copper had concentrations less than the ESL at

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all four sampled locations. The risk attributable to these metals in Pond A-2 is low and does not require further evaluation.

- Iron and lead had surface sediment HQs of 1 or less and were removed from further consideration. Further analysis indicated that the MDC for both iron and lead is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to these metals is no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.8 and A8.9, respectively. As shown on these figures, all measured concentrations for lead within Pond A-2 were below the ESL, and two of four measured concentrations for iron were just slightly greater than the ESL. The risk attributable to these metals in Pond A-2 is within the range of background and does not require further evaluation.
- Manganese was retained for further consideration with a surface sediment HQ of 2. Further analysis indicated that the MDC for manganese is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to this metal is no greater than the risk attributable to background. The spatial extent of manganese in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.10. Because the surface sediment HQ for manganese was greater than 1, it was retained for further risk characterization.
- Nickel and silver had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. The spatial extent of these chemicals in surface sediment is shown on Figures A8.12 and A8.14, respectively. All measured concentrations for both nickel and silver within Pond A-2 were below the ESL or at concentrations below detection. The risk attributable to nickel and silver in Pond A-2 is low and does not require further evaluation.
- Zinc had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. Further analysis indicated that the MDC for zinc is less than the maximum detected concentrations in background. Based on this comparison, the risk attributable to zinc would be no greater than the risk attributable to background. The spatial extent of this chemical in surface sediment is shown on Figure A8.15. For zinc, all measured results were less than the ESL. The risk attributable to zinc in Pond A-2 would be within the range of background and does not require further evaluation.
- Acenaphthene, anthracene, and indeno(1,2,3-cd)pyrene were retained for further consideration with surface sediment HQs greater than 1. The spatial extent of these chemicals in surface sediment is shown on Figures A8.16, A8.17, and A8.25, respectively.
- Bis(2-ethylhexyl)phthalate had a surface sediment HQ of 1 or less and was removed from further consideration. The spatial extent of this chemical in surface sediment is shown on Figure A8.22. The measured concentrations for bis(2-ethylhexyl)phthalate within Pond A-2 were all below the ESL or at concentrations

below detection levels. The risk attributable to bis(2-ethylhexyl)phthalate in Pond A-2 is low and does not require further evaluation.

- Total PAHs were evaluated for Pond A-2. Results of the total PAH calculation for each sample within the comprehensive data set are provided in Table A8.24, and the results by location for the surface sediment data set are provided in Table A8.25. These results reflect the measured values plus half the reported value for the nondetected chemicals. The majority of the values were nondetect. The maximum concentrations for the comprehensive data set (22,800 µg/kg) and the surface sediment data set (22,800 µg/kg) were greater than the ESL, yet represent maximum nondetect values. Figure A8.30 depicts the spatial extent of each detected PAH constituent within the Pond A-2 surface sediment sampling locations. As shown on Figure A8.30, there was one detected concentration of a PAH constituent within surface sediment (fluoranthene at 652 µg/kg). This detection falls below the ESL (1,610 µg/kg), indicating there is low risk associated with PAH chemicals. No further evaluation of total PAHs is required.
- Aroclor-1254 had a surface sediment HQ of 2 and was therefore retained for further analysis. The spatial extent of this chemical in surface sediment is shown on Figure A8.28. The spatial extent of detected Aroclor-1254 concentrations at each surface sediment location within the A-series ponds is shown on Figure A8.30.
- Total PCBs had a surface sediment HQ of 3 and was therefore retained for further analysis. Aroclor-1254 was the only detected congener, therefore, the spatial distribution of total PCBs is equivalent to that of Aroclor-1254 and is provided on Figure A8.28.

Chemical Risk Characterization – Further Analysis

Aluminum, manganese, acenaphthene, anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs were retained for further risk characterization. Each chemical is discussed in detail below.

Aluminum had a frequency of detection of 100 percent (detected in 10 of 10 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range where adverse effects are uncertain. The surface sediment HQ for the AT was less than 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media to which receptors are potentially exposed. Toxicity-based alternative screening benchmarks ranged from 14,000 mg/kg ERL[2], to 58,000 mg/kg ERM, and a high of 73,000 mg/kg NEC (Ingersoll,

[2] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical or the number of toxic samples with concentrations below the SEC was greater than the number of toxic samples with concentrations above the SEC.

et al. 1996). Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-2, two of six locations had measured values greater than the ESL; values at the remaining four locations were less than the ESL. Because the measured concentrations fall below the AT value and the low ESL HQ level, the likelihood for risk attributable to aluminum is low.

Manganese had a frequency of detection of 100 percent (detected in 10 of 10 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The manganese ESL in sediment (630 mg/kg) was based on the TEL for *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996; cited in MacDonald, et al. 1999). Alternative screening benchmarks ranged from the 460 mg/kg lowest effects level (LEL) (NYSDEC 1994) to 1,200 mg/kg probable effects level (PEL), and 1,700 mg/L ERM (Ingersoll, et al. 1996). Despite concentrations exceeding the ESL, it is uncertain whether concentrations of manganese in sediment pose a real risk potential if they do not exceed the AT value ERM (Ingersoll, et al. 1996). Review of the surface sediment data on a point-by-point basis indicated that there were two locations with measured concentrations just above the ESL, while the remaining four locations were less than the ESL. In addition, the MDC for manganese was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to manganese is low and within the range of background.

Acenaphthene had a frequency of detection of 10 percent (detected in 1 of 10 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 27, while the HQ for the AT is 2. The HQ was based on the result of the one measured value as compared to the ESL. The ESL was based on a PEL (CCME 2002) at which the potential for adverse effects are first observed. The potential for adverse effects is uncertain at concentrations greater than the ESL and below the benchmark identified by Jones, et al., (1997) of 270 μg/kg. Review of the surface sediment data on a point-by-point basis indicates that the one measured value occurs outside the pond area and within the channel above the pond. The sampled locations within the pond were at nondetect levels. Therefore, it is unlikely that acenaphthene, which exceeded the ESL by a small amount and with a low frequency of detection, poses an unacceptable risk to benthic populations that inhabit Pond A-2. The combined lines of evidence indicate that the risk attributable to acenaphthene is low.

Anthracene had a frequency of detection of 10 percent (detected in one of 10 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 4, while the HQ for the AT is less than 1. The HQ was based on the result of the one measured value as compared to the ESL. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 83 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than the ESL, and below the consensus-based PEC of 845 μg/kg. The single measured value of anthracene fell below the AT value. Review of the surface sediment data on a point-by-point basis indicates that the one measured value occurs outside the pond area and within the channel above the pond. The sampled locations within the pond were at nondetect levels. Therefore, it is unlikely that anthracene, which exceeded the ESL by a small amount and had a low frequency of detection, poses an unacceptable risk to benthic populations that inhabit Pond A-2. The combined lines of evidence indicate that the risk attributable to anthracene is low.

Indeno(1,2,3-cd)pyrene had a frequency of detection of 10 percent (detected in one of 10 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 12, while the HQ for the AT is 1. The HQ was based on the result of the one measured value as compared to the ESL. The ESL is based on the TEL for the *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from the 30 μg/kg ERL, to 250 μg/kg ERM, with a high of 770 μg/kg NEC (Ingersoll, et al. 1996). The single measured value of indeno(1,2,3-cd)pyrene fell at or below the AT value. Review of the surface sediment data on a point-by-point basis indicates that the one measured value occurs outside the pond area and within the channel above the pond. The sampled locations within the pond were at nondetect levels. Therefore, it is unlikely that the concentration of indeno(1,2,3-cd)pyrene in sediment poses a potential for adverse effects to benthic organisms in Pond A-2.

Aroclor-1254 had a frequency of detection of 33 percent (detected in 4 of 12 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (300 μg/kg). Review of the data on a point-by-point basis for surface sediment indicated that there were two locations with measured concentrations greater than the ESL. The remaining four sampled locations had concentrations at nondetect levels. Given the low HQ ESL value and minimal surface sediment spatial extent, it is unlikely that Aroclor-1254 poses an unacceptable risk to benthic populations that inhabit Pond A-2.

Total PCBs were evaluated for Pond A-2 and found to have a total detected maximum concentration of 130 μg/kg, attributable to Aroclor-1254. This value exceeds the total PCB ESL of 40 but is less than the total PCB AT of 676 μg/kg. The surface sediment HQ for the ESL is 3, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 μg/kg). Therefore, it is unlikely that total PCBs, which exceeded the ESL by a small amount, pose an unacceptable risk to benthic populations that inhabit Pond A-2.

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Other Lines of Evidence

Chemical risk HIs in the A-series ponds are reported in DOE (1996). For Pond A-2, the HI is 17 (no ECOCs have HQs greater than 10). Analytes with HQs between 1 and 10 were chrysene, magnesium, aldrin, zinc, benzoic acid, cobalt, acetone, and vanadium. Risks to aquatic life, as indicated by the HI values, were primarily from PAHs in sediments. However, no toxicity was detected in sediment toxicity tests, and ecological measures did not correlate with increasing HI values from the ponds. It is more likely that limited flows and pond management affect aquatic life much more than contaminants in sediment.

Weight-of-Evidence Conclusions

Results of the chemical risk characterization indicated that the sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond A-2. Those chemicals requiring further analysis (aluminum, manganese, acenaphthene, anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1254, and total PCBs) were found to have measured concentrations greater than their respective ESLs but less than AT values in most cases. The ESL HQs were low (less than 5) for all chemicals evaluated except for acenaphthene and indeno(1,2,3-cd)pyrene. Acenaphthene and indeno(1,2,3-cd)pyrene had low frequencies of detection within the comprehensive sediment data set (1 of 10 samples) and also within the surface sediment (1 of six samples). This indicates that these chemicals have a minimal spatial extent of occurrence. In addition, manganese was found to be within the range of risk attributable to background, while aluminum, acenaphthene, anthracene, indeno(1,2,3-cd)pyrene, and Aroclor-1254 had a minimal spatial extent of ESL exceedances The overall risk attributable to these chemicals would be low.

The results agree with the line-of-evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. These studies occurred within a timeframe that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk to aquatic populations associated with Pond A-2 is expected to be low associated with Pond A-2.

5.1.3 Pond A-3

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC in Pond A-3. Those chemicals identified for further risk characterization are described in more detail within the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.30 provides the results of the HQ assessment for the Pond A-3 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are presented below.

- Aluminum, with a surface sediment HQ of 2, was retained for further consideration. The spatial extent of aluminum in surface sediment as compared to the ESL within the A-series is shown on Figure A8.1.
- Antimony had a surface sediment HQ of 13 and was retained for further consideration. The spatial extent of antimony in surface sediment as compared to the ESL within the A-series is shown on Figure A8.2.
- Barium, iron, and nickel had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDC for these metals is less than the maximum detected concentrations in background. Therefore, the risk attributable to these metals is no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.4, A8.8, and A8.12, respectively. For barium, there was one location with a measured concentration greater than the ESL, while iron had four locations greater than the ESL. However the magnitude of exceedance was small, yielding HQs just greater than 1. Nickel was detected at concentrations less than the ESL at all five sampled locations. The risk attributable to these metals in Pond A-3 would be within the range of background and does not require further evaluation.
- Selenium, with a surface sediment HQ of 2, was retained for further consideration. Further analysis indicated that the MDC for selenium is less than the MDCs in background. The risk attributable to this metal is no greater than the risk attributable to background. The spatial extent of selenium in surface sediment as compared to the ESL within the A-series is shown on Figure A8.13.
- Zinc was retained for further consideration with a surface sediment HQ of 4. Further analysis indicated that the MDC for zinc is less than the MDCs in background. Therefore, the risk attributable to this metal is no greater than the risk attributable to background. The spatial extent of zinc in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.15. Because the surface sediment HQ for zinc is greater than 1, it was retained for further risk characterization.
- Benzo(a)pyrene, chrysene, fluoranthene, and phenanthrene had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. The spatial extent of these chemicals in surface sediment is shown on Figures A8.20, A8.23, A8.24, and A8.26, respectively.
- Pyrene was retained for further consideration with a surface sediment HQ of 2. The spatial extent of pyrene in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.27.
- Total PAHs were evaluated for Pond A-3. Results of the total PAH calculation for each sample within the comprehensive data set are provided in Table A8.24, while the results by location for the surface sediment data set are provided in Table A8.25. These results reflect the measured values plus half the reported value for the nondetected chemicals. The majority of the values were nondetect. The maximum concentrations for the comprehensive data set (4,480 μg/kg) and

the surface sediment data set (3,710 µg/kg) were greater than the ESL, yet represent maximum nondetect values. The MDC for total PAHs using detected concentrations (Figure A8.30) from the surface sediment data set was 1,270 µg/kg, which is less than the ESL; therefore, no further evaluation is required.

- Aroclor-1254 had an HQ of less than 1 and was therefore removed from further consideration. The spatial extent of Aroclor-1254 in surface sediment is shown in Figure A8.28.
- Total PCBs were retained for further consideration as a conservative measure even though the surface sediment HQ was 1. The only detected congener was Aroclor-1254, with a maximum detected value of 45, which is greater than the total PCB ESL of 40. The results of Aroclor-1254 were greater than the total PCB ESL but less than the Aroclor-1254 ESL. The spatial extent of Aroclor-1254 as compared to the ESL within the A-series ponds is shown on Figure A8.28. The measured results by sample location are shown in Figure A8.30.

Chemical Risk Characterization – Further Analysis

Aluminum, antimony, selenium, zinc, Pyrene, and total PCBs were retained for further risk characterization. The results are provided by chemical below.

Aluminum had a frequency of detection of 100 percent (detected in 8 of 8 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is less than 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media that receptors are potentially exposed to. Toxicity-based alternative screening benchmarks ranged from 14,000 mg/kg ERL[3] to 58,000 mg/kg ERM, and a high of 73,000 mg/kg NEC (Ingersoll, et al. 1996). Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-3, four of the five surface sediment locations had measured values greater than the ESL; the remaining location was less than the ESL. However, because the measured concentrations fall below the AT values, and were just slightly greater than the ESL (as indicated by the low ESL HQ), the likelihood for risk attributable to aluminum is low.

Antimony had a frequency of detection of 26 percent (detected in 1 of 7 samples collected), indicating a limited spatial extent. The surface sediment HQ for the ESL is 13. The surface sediment HQ for the AT is 8. The antimony ESL in sediment (2 mg/kg) was

[3] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical, or the number of toxic samples with concentrations below the SEC was greater than the number of toxic samples with concentrations above the SEC.

based on the 85th percentile concentration in streams (in MacDonald, et al. 1999), which defined the SLCA by NYSDEC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from historical data. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating antimony concentrations in media at the site to which receptors may be exposed. Toxicity-based alternative screening benchmarks ranged from 2 to 500 mg/kg. Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis identified one location with a measured concentration greater than the ESL, while the remaining four locations were at nondetect levels. Because antimony has a very limited spatial extent, the risk attributable to this metal is likely to be low.

Selenium had a frequency of detection of 13 percent (detected in 1 of 8 samples), indicating a minimal spatial extent of occurrence. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating selenium concentrations in media to which receptors are potentially exposed. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal, et al. 1998). Therefore, despite sediment concentrations exceeding the screening level ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations not greater than the alternative toxicity SQG. In addition, selenium had a low frequency of detection, indicating a minimal exposure potential exists for aquatic receptors. Review of the surface sediment data on a point-by-point basis identified one location with measured concentration greater than the ESL. The four remaining sample locations were at nondetect levels. The combined lines of evidence indicate that the risk attributable to selenium is low.

Zinc had a frequency of detection of 100 percent (detected in 8 of 8 samples). The surface sediment HQ for the ESL is 4, while the HQ for the AT is 1. The ESL for zinc in sediment (121 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 81.6 percent of samples (n=347) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 459 mg/kg. All of the measured zinc concentrations occurred at or below the AT value, indicating low risk. Review of the surface sediment data on a point-by-point basis indicated that there are measured concentrations of zinc greater than the ESL at four of five sample locations. However, these exceedances are slight given the low HQ ESL value. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Pyrene had a frequency of detection of 100 percent (detected in 4 of 4 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The pyrene ESL for sediment (195 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 1,520 µg/kg. The measured concentrations yielded low HQ values and were all less than the AT. Review of the surface sediment data on a point-by-point basis identified one sample location with a measured value greater than the ESL. The combined lines of evidence indicate that the risk attributable to pyrene is low.

Total PCBs were evaluated for Pond A-3 and found to have a total detected maximum concentration of 45 µg/kg attributable to Aroclor-1254. The results of Aroclor-1254 were greater than the total PCB ESL but less than the Aroclor-1254 ESL of 60 µg/kg. In addition, this value is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 1, while the HQ for the AT is less than 1. Aroclor-1254 had a frequency of detection of 12.5 percent (detected in 1 of 8 samples from the comprehensive sediment data set and one of four samples from the surface sediment data set), indicating a limited spatial extent. Review of the surface sediment data on a point-by-point basis indicated that Aroclor-1254 was detected in one of four samples with a concentration greater than the ESL. The remaining samples were at nondetect levels. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000) at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 µg/kg). Therefore, it is unlikely that total PCBs pose an unacceptable risk to benthic populations that inhabit Pond A-3.

Other Lines of Evidence

Individual pond HIs in the A-series ponds are reported by DOE (1996). For Pond A-3, the HI is 59 (chrysene and benzo(b)fluoranthene had HQ values of 29.1 and 18.3, respectively). Other ECOCs with HQs between 1 and 10 include antimony, magnesium, vanadium, cobalt, and zinc. Risks to aquatic life, as indicated by the HI values, were primarily due to PAHs in sediments. However, no toxicity was detected in sediment toxicity tests, and ecological measures did not correlate with increasing HI values from the ponds. It is likely that limited flows and pond management affect aquatic life much more than contaminants in sediment.

Weight-of-Evidence Conclusions

The results of the chemical risk characterization indicated that the sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond A-3. Those chemicals requiring further analysis (aluminum, antimony, selenium, zinc, pyrene and total PCBs) were found to have measured concentrations greater than their respective ESLs but less than AT values in most cases. The ESL HQs for these chemicals were low (less than 5, with the exception of antimony), indicating a low risk potential. Antimony had a low frequency of detection in the comprehensive data set (detected in one of seven samples) and within the surface sediment data set (detected in one of five samples), indicating a minimal spatial extent. In addition, selenium and zinc were found to be within the range of risk attributable to background, while aluminum, antimony, pyrene, and total PCBs had a minimal spatial extent of ESL exceedances. Therefore, overall risk attributable to these chemicals would be low.

These results coincide with the line-of-evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. These studies occurred within a timeframe that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk to aquatic populations associated with Pond A-3 is low.

5.1.4 Pond A-4

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC at Pond A-4. Those chemicals identified for further risk characterization described in more detail the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.31 provides the results of the HQ assessment for the Pond A-4 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below.

- Aluminum was retained for further consideration with a surface sediment HQ of 2. The spatial extent of aluminum in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.1.
- Antimony had a surface sediment HQ of 2, and was retained for further consideration. The spatial extent of aluminum in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.2.
- Arsenic had a surface sediment HQ of 1 or less and was removed from further consideration within the risk characterization. The spatial extent of this chemical in surface sediment is shown on Figure A8.3. For arsenic, one of nine locations had a measured concentration greater than the ESL. However, the magnitude of exceedance was small, yielding HQs just greater than 1. The risk attributable to this metal in Pond A-4 is low and does not require further evaluation.
- Barium, copper, iron, nickel, and zinc had surface sediment HQs of 1 or less and were removed from further consideration. Analysis indicated that the MDC for these metals is less than the maximum detected concentrations in background. Therefore, the risk attributable to these metals would be no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.4, A8.7, A8.8, A8.12, and A8.15, respectively.

As shown on these figures, barium had three samples greater than the ESL, iron and nickel each had two samples greater than the ESL, and copper and zinc each had one sample greater than ESL. These values were just slightly greater than the ESL. The risk attributable to these metals in Pond A-4 would be within the range of background and do not require further evaluation.

- Cadmium was retained for further consideration with a surface sediment HQ of 3. The spatial extent of cadmium in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.5.
- Selenium was retained for further consideration with a surface sediment HQ of 2. The spatial extent of selenium in surface sediment as compared to the ESL within the A-series ponds is shown on Figure A8.13.
- Atrazine was not evaluated in Pond A-4 surface sediment because observed detections from historic sampling were all from subsurface samples. An HQ of 7 was calculated based on the subsurface result, which indicates the MDC is within the range of uncertain toxicity. Because this chemical was not detected in the surface sediment, it was not retained for further analysis.
- Total PAHs were evaluated for Pond A-4. Results of the total PAH calculation for each sample within the comprehensive data set were provided in Table A8.24, while the results by location for the surface sediment data set were provided in Table A8.25. These results reflect the measured values plus half the reported value for the nondetected chemicals. For Pond A-4, all of the total PAH values were nondetect. The maximum concentrations for the comprehensive data set (6,930 µg/kg) and the surface sediment data set (6,930 µg/kg) were greater than the ESL, yet represent maximum nondetect values. Figure A8.58 depicts the spatial extent of each detected PAH constituent within the Pond A-4 surface sediment sampling locations. As shown on Figure A8.58, there were nondetected concentrations of PAHs within surface sediment, indicating there is low risk associated with PAH chemicals. No further evaluation of total PAHs is required.

Chemical Risk Characterization – Further Analysis

Aluminum, antimony, cadmium, and selenium were retained for further risk characterization. The results are provided by chemical below.

Aluminum had a frequency of detection of 100 percent (detected in 12 of 12 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is less than 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media to which receptors are potentially exposed. Toxicity-based alternative screening benchmarks ranged from 14,000 mg/kg ERL[4] to 58,000 mg/kg ERM, and a high of 73,000 mg/kg NEC (Ingersoll, et al. 1996). Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated that each measured aluminum result was less than the AT value. Within Pond A-4, six of the nine locations had measured values greater than the ESL; the remaining three locations were less than the ESL. Because the measured concentrations fall below the AT values, the likelihood for risk attributable to aluminum is low.

Antimony had a frequency of detection of 25 percent (detected in 4 of 12 samples collected), indicating a limited spatial extent. The surface sediment HQ for the ESL is 21. The surface sediment HQ for the AT is 13. The antimony ESL in sediment (2 mg/kg) was based on the 85th percentile concentration in streams (in MacDonald, et al. 1999), which defined the SLCA by NYSDEC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from historical data. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating antimony concentrations in media at the site to which receptors are potentially exposed. Toxicity-based alternative screening benchmarks ranged from 2 to 500 mg/kg. Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated three locations had results greater than the ESL, while the remaining six locations either had measured concentrations less than the ESL or were at nondetect levels. Because the measured concentrations fall below AT values, and the spatial extent of antimony is limited, the likelihood for risk attributable to antimony is low.

Cadmium had a frequency of detection of 75 percent (detected in 9 of 12 samples collected). The surface sediment HQ for the ESL is 3. The surface sediment HQ for the AT is 1. The cadmium ESL for sediment (0.99 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 80.4 percent of samples (n=347) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 4.98 mg/kg. . Review of the surface sediment data on a point-by-point basis indicated there was a single measured cadmium result greater than the ESL, while the remaining eight locations had either measured concentrations less than the ESL or were at nondetect levels. Given the limited spatial extent and low HQ values, the risk attributable to cadmium is low.

Selenium had a frequency of detection of 20 percent (detected in 3 of 12 samples), indicating a minimal spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide

[4] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical, or the number of toxic samples with concentrations below the SEC was greater than the number of toxic samples with concentrations above the SEC.

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historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media to which receptors are potentially exposed. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal, et al. 1998). Therefore, despite sediment concentrations exceeding the ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations less than the alternative toxicity SQG. Review of the surface sediment data results indicate that three locations had measured values slightly greater than the ESL, while the remaining six locations had measured values at nondetect levels. In addition, the MDC for selenium was within the range of background values. The combined lines of evidence indicate the risk attributable to selenium is low and within the range of background.

Other Lines of Evidence

Individual pond HIs in the A-series ponds are reported by DOE (1996). Pond A-4 had an HI of 13 (no ECOCs had HQs greater than 10). Analytes with HQs between 1 and 10 included antimony, magnesium, vanadium, and cobalt. Risks to aquatic life, as indicated by the HI values, were primarily due to PAHs in sediments. However, no toxicity was detected in sediment toxicity tests, and ecological measures did not correlate with increasing HI values from the ponds. It is likely that limited flows and pond management affects aquatic life much more than contaminants in sediment.

Weight-of-Evidence Conclusions

The results of the chemical risk characterization indicated that sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond A-4. Those chemicals requiring further analysis (aluminum, antimony, cadmium, and selenium) were found to have measured concentrations greater than their respective ESLs but less than AT values. The ESL HQs for these chemicals were low (less than 5, with the exception of antimony), indicating a low risk potential. Antimony had a frequency of detection of four detected results from 12 samples collected within the comprehensive data set, and four detected results from nine samples from the surface sediment data set. Further analysis indicates that only one surface sediment location had a measured value greater than the ESL, while the remaining locations were nondetect or below the ESL, indicating a minimal spatial extent of concern. In addition, selenium was found to be within the range of risk attributable to background, while aluminum, antimony, and cadmium had a minimal spatial extent of ESL exceedances. The overall risk attributable to these chemicals is expected to be low.

These results coincide with the line-of-evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. These studies occurred within a timeframe that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk to aquatic populations associated with Pond A-4 is expected to be low.

5.1.5 Pond A-5

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC in Pond A-5.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.32 provides the results of the HQ assessment for the Pond A-5 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below.

- Aluminum, barium, iron, silver, and zinc had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDCs for these metals were less than the maximum detected concentrations in background. Therefore, the risk attributable to these metals would be no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.1, A8.4, A8.8, A8.14, and A8.15 respectively. For aluminum, two locations had a measured concentration greater than the ESL. For barium, iron, silver, and zinc, one sample had a measured concentration greater than the ESL. However, the magnitude of exceedances for these results was small, yielding HQs just greater than 1. The risk attributable to these metals in Pond A-5 would be within the range of background.
- Total PAHs were evaluated for Pond A-5. Results of the total PAH calculation for each sample within the comprehensive data set are provided in Table A8.24, while the results by location for the surface sediment data set provided in Table A8.25. These results reflect the measured values plus half the reported value for the non detected chemicals. For Pond A-5, all of the total PAH values were nondetect. The maximum concentrations for the comprehensive data set (4,200 µg/kg) and the surface sediment data set (4,200 µg/kg) were greater than the ESL, yet represent maximum nondetect values. Figure A8.58 depicts the spatial extent of each detected PAH constituent within the Pond A-5 surface sediment sampling locations. As shown on Figure A8.58, there were no detected concentrations of PAHs within surface sediment, indicating there is low risk associated with PAH chemicals.

Other Lines of Evidence

Individual pond HIs in the A-series ponds are reported in the DOE evaluation (DOE 1996). Pond A-5 (Indiana Pond) had an HI of 16 (no ECOCs had HQs greater than 10). Analytes with HQs between 1 and 10 included benzoic acid, acetone, magnesium, vanadium, and cobalt. Risks to aquatic life, as indicated by the HI values, were primarily due to PAHs in sediments. However, no toxicity was detected in sediment toxicity tests and ecological measures did not correlate with increasing HI values from the ponds. It is likely that limited flows and pond management affects aquatic life much more than contaminants in sediment.

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Weight-of-Evidence Conclusions

The results of the chemical risk characterization indicated that sediment ECOPCs within surface sediment conditions would pose a low risk to aquatic life within Pond A-5. The results agree with the line-of-evidence conclusions drawn from other studies of this pond. The weight of evidence indicates the risk to aquatic populations associated with Pond A-5 is low.

5.2 B-Series Pond Risk Characterization

South Walnut Creek is a portion of the watershed that provides the major drainage for the north-central portion of RFETS, including the majority of the IA. South Walnut Creek has five retention ponds: Ponds B-1, B-2, B-3, B-4, and B-5. The section of the stream upgradient from Pond B-5 is classified as stream Segment 5 in the Big Dry Creek basin by the WQCC. Downstream from Pond B-5, South Walnut Creek is classified as stream Segment 4b. The flow in South Walnut Creek was highly dependant on effluent from the former Sewage Treatment Plant, stormwater runoff from the IA, and management of the ponds. This AEU has continuous flows immediately downstream of the IA until the last retention, Pond B-5. Below Pond B-5, the aquatic environment is totally dependent on periodic releases from the ponds. Between batch releases from the terminal ponds (B-5 and A-4), the lower section of Walnut Creek is often dry. The hydrology of South Walnut Creek is expected to change in response to accelerated actions, which include removal of buildings within the IA and elimination of water historically imported for RFETS operations. This includes elimination of the Sewage Treatment Plant discharge and removal of pavement from within the IA. All of these efforts combined are expected to create a decrease in flows within South Walnut Creek.

Native fish species are found in the Walnut Creek ponds and specific sections of the stream. Fathead minnows (*Pimephales promelas*) are present in the B-series ponds, the stream between Ponds B-4 and B-5, and in Lower Walnut Creek. A variety of non-native fish species, including rainbow trout (*Salmo gairdneri*), carp (*Cyprinus carpio*), and bass (*Micropterus* sp.), were introduced into the ponds at various times; however, no introductions have led to established reproducing fish populations in the B-series ponds.

Within the Walnut Creek area, the most common aquatic macroinvertebrates are the larvae of the blackfly (Order *Diptera, Simulidae* sp.), midge (Order *Diptera, Chironomidae* sp), mayfly (Order *Ephemeroptera*) (DOE 1997), and scuds (*Hyalella azteca*). Other species include caddisflies (Order *Trichoptera*), craneflies (*Tipulidae* ssp.), and damselfly larvae (Order *Odonata*), as well as snails (Class *Gastropoda*) and other amphipods (Order *Amphipoda*). Large macroinvertebrate species present in the Walnut Creek area, such as crayfish (Order *Decapoda,* Family *Astacidae*) and snails, are potentially important prey for other fish, waterfowl, and mammal species.

Characterization of the aquatic habitat provided by North Walnut Creek is a primary consideration with regard to aquatic risk. Currently, sustained flows exist, albeit minimal in nature, that support some aquatic species. The location and amount of viable aquatic habitat that will be present after IA accelerated actions are complete is unclear because overland flow may be altered by these actions.

5.2.1 Pond B-4

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC at Pond B-4. Those chemicals identified for further risk characterization are described in more detail in the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.33 provides the results of the HQ assessment for the Pond B-4 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below.

- Aluminum had a surface sediment HQ of 2 and was retained for further consideration. The spatial extent of aluminum in surface sediment as compared to the ESL within the B-series ponds is shown on Figure A8.31.
- Antimony, chromium, copper, lead, mercury, and nickel had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. The spatial extent of these chemicals within surface sediment is shown on Figures A8.32, A8.35, A8.36, A8.38, A8.39, and A8.40, respectively. Antimony, copper, lead, and nickel were detected at one location with a concentration greater than the ESL; the remaining locations had concentrations at nondetect levels or less than the ESL. Chromium and mercury were detected only at concentrations less than the ESL. The risk attributable to these metals in Pond B-4 is low.
- Barium and iron had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDC for these two metals was less than the maximum detected concentrations in background. Therefore, the risk attributable to barium and iron would be no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.33 and A8.37, respectively. For both barium and iron, three of six locations had measured concentrations greater than the ESL. However, the magnitude of exceedance was small, yielding an HQ just greater than 1. The risk attributable to barium and iron in Pond B-4 would be within the range of background.
- Cadmium, with a surface sediment HQ of 2, was retained for further consideration. The spatial extent of cadmium in surface sediment as compared to the ESL within the B-series ponds is shown on Figure A8.34.
- Selenium was retained for further consideration with a surface sediment HQ of 2. The spatial extent of selenium in surface sediment as compared to the ESL within the B-series ponds is shown on Figure A8.41.
- Silver was retained for further consideration with a surface sediment HQ of 3. The spatial extent of silver in surface sediment as compared to the ESL within the B-series is shown on Figure A8.42.

- Zinc was retained for further consideration with a surface sediment HQ of 4. Further analysis indicated that the MDC for zinc is less than the maximum detected concentrations in background. Therefore, the risk attributable to this metal is no greater than the risk attributable to background. The spatial extent of zinc in surface sediment as compared to the ESL within the B-series ponds is shown on Figure A8.43. Because the surface sediment HQ for zinc was greater than 1, it was retained for further risk characterization.
- Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were retained for further consideration because surface sediment HQs were greater than 1. The spatial extent of these chemicals in surface sediment as compared to their respective ESLs within the B-series ponds are shown on Figures A8.44, A8.45, A8.46, A8.47, A8.50, A8.51, A8.52, A8.54, A8.55, and A8.56, respectively.
- Benzo(k)fluoranthene and bis(2-ethylhexyl)phthalate had surface sediment HQs of one or less and were removed from further consideration. The spatial extent of these chemicals in surface sediment is shown on Figures A8.48 and A8.49, respectively. Benzo(k)fluoranthene was detected at a concentration slightly greater than the ESL at two locations; the remaining locations were nondetect. Bis(2-ethylhexyl)phthalate occurred at concentrations less than the ESL or at nondetect levels. Given the magnitude of surface sediment conditions, the risk attributable to these chemicals in Pond B-4 is low and does not require further evaluation.
- Gamma-BHC (Lindane) was not detected in Pond B-4 surface sediment and was therefore removed from further risk characterization (Figure A8.53).
- Total PAHs were evaluated for Pond B-4. As shown on Figure A8.58, the maximum detected total PAH values by location for the surface sediment samples ranged from 360 to 3,620 μg/kg, which exceeds the ESL. Both individual (as identified above) and total PAHs were retained for further evaluation.
- Aroclor-1254 was retained for further consideration with a surface sediment HQ of 4. The spatial extent of Aroclor-1254 as compared to the ESL within the B-series ponds is shown on Figure A8.57. Aroclor-1254 results were used for the total PCB results because it was the only PCB detected. Therefore, this PBC will be retained for further risk characterization analysis.
- Total PCBs were evaluated for Pond B-4 and retained for further evaluation because the ESL HQ was 6. Aroclor-1254 was the only PCB detected; therefore, the extent of total PCB within the B-series ponds is shown on Figure A8.57.

Chemical Risk Characterization – Further Analysis

Aluminum, cadmium, selenium, silver, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, and Aroclor-1254 were retained for further risk characterization. The results are provided by chemical below.

Aluminum had a frequency of detection of 100 percent (detected in 22 of 22 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media that receptors are potentially exposed to. Toxicity-based alternative screening benchmarks ranged from 14,000 mg/kg ERL[5] to 58,000 mg/kg ERM, and a high of 73,000 mg/kg NEC (Ingersoll, et al. 1996). Comparison to these toxicity-based values provides a better indication of the risk potential to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated that each measured aluminum result was less than the AT value. Within Pond B-4, four of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were less than the ESL. Because the measured concentrations fall below these AT values and the ESL HQ value is low, the likelihood for risk attributable to aluminum is low.

Cadmium had a frequency of detection of 86 percent (detected in 19 of 22 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The cadmium ESL for sediment (0.99 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 80.4 percent of samples (n=347) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 4.98 mg/kg. In this situation, the potential for risks can not be excluded but is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the surface sediment data on a point-by-point basis indicated that each measured cadmium result was less than the AT value. Within Pond B-4, three of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were less than the ESL. Because the measured concentrations fall below these AT values, and the ESL HQ value is low, the likelihood for risk attributable to cadmium is low.

Selenium had a frequency of detection of 14 percent (detected in 3 of 22 samples), indicating a minimal spatial extent of occurrence. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating selenium

[5] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical, or the number of toxic samples with concentrations below the SEC was greater than the number of toxic samples with concentrations above the SEC.

concentrations in media to which receptors are potentially exposed. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal, et al. 1998). Therefore, despite sediment concentrations exceeding the screening level ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations below the alternative toxicity SQG. Review of the surface sediment data on a point-by-point basis indicated that the measured selenium results were at or below the AT values. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were at nondetect levels. The combined lines of evidence indicate the risk attributable to selenium is low.

Silver had a frequency of detection of 50 percent (detected in 11 of 22 samples), indicating a minimal spatial extent of occurrence. The surface sediment HQ for the ESL is 3, while the HQ for the AT is 2. The silver ESL in sediment (1.00 mg/kg) was based on a study completed by Long, et al. (1995), which represents the ERL for the protection of benthic macroinvertebrates (MacDonald, et al. 1999). The potential for adverse effects associated with this ESL is considered low because it reflects a benchmark below which adverse effects are not expected. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating silver concentrations in media to which receptors are potentially exposed. Toxicity-based alternative screening benchmarks ranged from 0.5 to 4.5 mg/kg. Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicated that the measured silver results were at or below the AT value. Within Pond B-4, three of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were below detection levels. Because the measured concentrations fall below these AT values, and the ESL HQ value is low, the likelihood for risk attributable to silver is low.

Zinc had a frequency of detection of 100 percent (detected in 22 of 22 samples). The surface sediment HQ for the ESL is 4, while the HQ for the AT is less than 1. The ESL for zinc in sediment (121 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 81.6 percent of samples (n=347) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 459 mg/kg. In this situation, the potential for risks cannot be excluded but is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the surface sediment data on a point-by-point basis indicates that all measured concentrations within Pond B-4 exceed the ESL slightly, thus providing a low HQ. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Anthracene had a frequency of detection of 45 percent (detected in 10 of 22 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The anthracene ESL for sediment (57.2 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 83 percent of samples (n=129) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 845 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured anthracene results were below the AT value. Within Pond B-4, two of five locations had measured values greater than the ESL (but less than the AT); the remaining locations had concentrations below detection levels. The combined lines of evidence indicate the risk attributable to anthracene is low.

Benzo(a)anthracene had a frequency of detection of 73 percent (detected in 16 of 22 samples). The surface sediment HQ for the ESL is 3, while the HQ for the AT is less than 1. The benzo(a)anthracene ESL for sediment (108 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 83 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 1,050 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured benzo(a)anthracene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were below the ESL or below detection levels. The combined lines of evidence indicate the risk attributable to benzo(a)anthracene is low.

Benzo(a)pyrene had a frequency of detection of 77 percent (detected in 17 of 22 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The benzo(a)pyrene ESL for sediment (150 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 1,450 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured benzo(a)pyrene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were below the ESL or below detection levels. The combined lines of evidence indicate the risk attributable to benzo(a)pyrene is low.

Benzo(g,h,i)perylene had a frequency of detection of 45 percent (detected in 10 of 22 samples). The surface sediment HQ for the ESL is 21, while the HQ for the AT is 1. The ESL was based on the ERL for *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from 16 µg/kg TEL to 280 µg/kg ERM, and a high of 1,200 µg/kg NEC (Ingersoll, et al. 1996). Review of the surface sediment data on a point-by-point basis indicated that the measured benzo(g,h,i)perylene results were at or below the AT value. Within Pond B-4, three of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were at concentrations below detection levels. The combined lines of evidence indicate the risk attributable to benzo(g,h,i)pyrene is low.

Chrysene had a frequency of detection of 82 percent (detected in 18 of 22 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The chrysene ESL for sediment (166 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 1,290 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured chrysene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations below the ESL or were below detection levels. The combined lines of evidence indicate the risk attributable to chrysene is low.

Dibenz(a,h)anthracene had a frequency of detection of 14 percent (detected in 3 of 22 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 3, while the HQ for the AT is less than 1. The dibenz(a,h)anthracene ESL for sediment (33 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 240 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured dibenz(a,h)anthracene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations had concentrations below detection levels. The combined lines of evidence indicate the risk attributable to dibenz(a,h)anthracene is low.

Indeno(1,2,3-cd)pyrene had a frequency of detection of 45 percent (detected in 10 of 22 samples), indicating a limited spatial extent. The surface sediment HQ for the ESL is 12, while the HQ for the AT is 1. The ESL is based on the TEL for the *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from 30 µg/kg ERL to 250 µg/kg ERM, and a high of 770 µg/kg NEC (Ingersoll, et al. 1996). Review of the surface sediment data on a point-by-point basis indicated that the measured indeno(1,2,3-cd)pyrene results were at or below the AT value. Within Pond B-4, three of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were at or below detection levels. Therefore, despite the MDC exceeding the ESL, it is unlikely that the concentrations of indeno(1,2,3-cd)pyrene in sediment pose a potential for adverse effects to benthic organisms in Pond B-4.

Phenanthrene had a frequency of detection of 82 percent (detected in 18 of 22 samples). The surface sediment HQ for the ESL is 3, while the HQ for the AT is 1. The phenanthrene ESL for sediment (204 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 1,170 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured phenanthrene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were below the ESL or below detection levels. The combined lines of evidence indicate the risk attributable to phenanthrene is low.

Pyrene had a frequency of detection of 73 percent (detected in 16 of 22 samples). The surface sediment HQ for the ESL is 4, while the HQ for the AT is less than 1. The pyrene ESL for sediment (195 µg/kg) ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 1,520 µg/kg. Review of the surface sediment data on a point-by-point basis indicated that the measured pyrene results were at or below the AT value. Within Pond B-4, two of six locations had measured values greater than the ESL (but less than the AT); the remaining locations were at nondetect levels. The combined lines of evidence indicate the risk attributable to pyrene is low.

Total PAHs were determined to be an ECOPC for the surface sediment samples collected within Pond B-4. As shown on Figure A8.58, four locations had detected PAH concentrations. From these locations the total PAH sum ranged from 360 to 3,620 µg/kg. Using the maximum detected total PAH concentration, an HQ of 2 was developed. Using the total PAH AT (22,800 µg/kg) an AT HQ of less than 1 was derived. The total PAH ESL for sediment (1,610 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (22,800µg/kg). The combined lines of evidence indicate that the risk attributable to total PAHs would be low.

Aroclor-1254 had a frequency of detection of 56 percent (detected in 15 of 27 samples in the comprehensive sediment data set and six of 11 samples in the surface sediment data set). The detected concentrations within surface sediment are shown on Figure A8.58. These values were greater than the ESL but less than the AT at five locations; the remaining values were nondetect. The surface sediment HQ for the ESL is 4, while the HQ for the AT is 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (300 µg/kg). All of the measured values occur within this range, indicating uncertain toxicity associated with this chemical. Given the magnitude of measured concentrations as compared to the ESL, it is unlikely that Aroclor-1254 poses an unacceptable risk to benthic populations that inhabit Pond B-4.

Total PCBs were evaluated for Pond B-4 and found to have a total detected maximum concentration of 220 µg/kg attributable to Aroclor-1254. This value exceeds the total PCB ESL of 40 but is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 6, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 µg/kg). Therefore, it is unlikely that total PCBs pose an unacceptable risk to benthic populations that inhabit Pond B-4.

Other Lines of Evidence

Chemical risk HIs in the B-series ponds were identified by DOE (1996) evaluation. Pond B-4 has an HI of 250 (anthracene, chrysene, benzo(b)fluoranthene, and silver had HQs ranging from 15 to 105). Other ECOCs with HQs between 1 and 10 included antimony, gamma-BHC, magnesium, benzo(k)fluoranthene, vanadium, Aroclor-1254, zinc, and cobalt. Risks to aquatic life, as indicated by the HI values, were primarily due to PAHs in sediments. However, no toxicity was detected in sediment toxicity tests, and ecological measures did not correlate with increasing HI values from the ponds. The importance of sediment contamination is unclear but does not appear to be the primary factor controlling benthic community structure in the B-series ponds. In addition, aquatic monitoring in streams between the ponds found a naturally self-sustaining population of fathead minnows in South Walnut Creek between Ponds B-4 and B-5. Fish in the ponds are more likely limited by flow and water management practices than by the chemicals of potential concern.

Weight-of-Evidence Conclusions

Results of the chemical risk characterization indicated that the sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond B-4. Those chemicals requiring further analysis (aluminum, cadmium, selenium, silver, zinc, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, Aroclor-1254, and total PCBs) were found to have measured concentrations greater than their respective ESLs but less than AT values in most cases. In addition, zinc was found to be within the range of risk attributable to background. The ESL HQs for these chemicals were low (less than 5, with the exceptions of benzo(g,h,i)perylene, indeno(1,2,3-cd)Pyrene, and total PCBs), indicating a low risk potential. Two PAH constituents had large HQ values (benzo(g,h,i)peryelene HQ = 21 and indeno(1,2,3-cd)pyrene HQ = 12). The MDCs for these chemicals fell below the AT and were limited in their spatial extent. Both chemicals had three detected values that were greater than the ESL and three sample locations that were below detection levels. Similarly, total PCBs were found to be entirely attributable to Aroclor-1254, which when compared to the

Aroclor-1254 ESL, yielded low HQ values indicating a low risk potential. The overall risk attributable to these chemicals is therefore low.

The results agree with the line-of-evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. Bioassay analyses indicated that results of Pond B-4 sediment toxicity were comparable to control tests, indicating no chemical stressor affects. These studies occurred within a timeframe that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk to aquatic populations associated with Pond B-4 is low.

5.2.2 Pond B-5

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC at Pond B-5.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.34 provides the results of the HQ assessment for the Pond B-5 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below.

- Aluminum, barium, iron, lead, nickel, and silver had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDC for these metals is less than the maximum detected concentrations in background. The risk attributable to these metals is no greater than the risk attributable to background. Therefore, no further evaluation is required. The spatial extent of these chemicals in surface sediment is shown on Figures A8.31, A8.33, A8.37, A8.38, A8.40, and A8.42, respectively.
- Selenium and zinc were retained for further consideration with surface sediment HQs of 2. The spatial extent of selenium and zinc in surface sediment as compared to the ESL within the B-series ponds is shown on Figure A8.41 and A8.43, respectively. Further analysis indicated that the MDC for these metals is less than the maximum detected concentrations in background. The risk attributable to these metals is no greater than the risk attributable to background.
- Total PAHs were evaluated for Pond B-5. Results of the total PAH calculation for each sample within the comprehensive data set were provided in Table A8.24, while the results by location for the surface sediment data set were provided in Table A8.25. These results reflect the measured values plus half the reported value for the non detected chemicals. The majority of the values were nondetect. The maximum concentrations for the comprehensive data set (5,030 µg/kg) and the surface sediment data set (5,030 µg/kg) were greater than the ESL, yet represent maximum nondetect values. Figure A8.58 depicts the spatial extent of each detected PAH constituent within B-series surface sediment sampling locations. As shown on Figure A8.58, the maximum total PAH value of 350

847

µg/kg is less than the ESL of 1,610 µg/kg, indicating there is low risk associated with PAH chemicals. No further evaluation of total PAHs is required.

Chemical Risk Characterization – Further Analysis

Selenium and zinc were retained for further risk characterization. The results are provided by chemical below.

Selenium had a frequency of detection of 23 percent (detected in 3 of 13 samples) indicating a minimal spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity-based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating selenium concentrations in media to which receptors are potentially exposed. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal, et al. 1998). Therefore, despite sediment concentrations exceeding the ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations less than the alternative toxicity SQG. Results of a point-by-point evaluation of the surface sediment data set indicated that there is one location within Pond B-5 with a measured concentration greater than the ESL. The remaining locations had results less than the ESL or below detection levels. In addition, the MDC for selenium was within the range of background values. The combined lines of evidence indicate that the risk attributable to selenium is low and within the range of background.

Zinc had a frequency of detection of 100 percent (detected in 14 of 14 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The ESL for zinc in sediment (121 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 81.6 percent of samples (n=347) below this concentration were accurately predicted to be non-toxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC of 459 mg/kg. All of the measured zinc concentrations occurred at or below the AT value, indicating low risk. Results of a point-by-point evaluation of the surface sediment data set indicated there are three locations within Pond B-5 with a measured concentration greater than the ESL. The remaining nine locations had values less than the ESL, indicating a minimal spatial extent. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate that the risk attributable to zinc is low and within the range of background.

Other Lines of Evidence

Chemical risk HIs in the B-series ponds were identified by DOE (1996). Pond B-5 has an HI of 8.1 (ECOCs in Pond B-5 that had HQs between 1 and 10 were magnesium, vanadium, and cobalt) (DOE 1996). Risks to aquatic life, as indicated by the HI values, were primarily due to PAHs in sediments. However, no toxicity was detected in sediment toxicity tests, and ecological measures did not correlate with increasing HI values from the ponds. The importance of sediment contamination is unclear but does not appear to be the primary factor controlling benthic community structure in the B-series ponds. In addition, aquatic monitoring in streams between the ponds found a naturally self-sustaining population of fathead minnows in South Walnut Creek between Ponds B-4 and B-5. Fish in the ponds are more likely limited by flow and water management practices than by the chemicals of potential concern.

Weight-of-Evidence Conclusions

Results of the chemical risk characterization indicated that ECOPCs in surface sediments would pose a low risk within background ranges to aquatic life at Pond B-5. These results agree with the line-of-evidence conclusions drawn from other studies of this pond. The weight of evidence indicates the risk associated with Pond B-5 to aquatic populations is low.

5.3 C-Series Pond Risk Characterization

The C-series ponds occur within the Woman Creek AEU (WC AEU). Aquatic habitats within the WC AEU are restricted to the headwaters of Woman Creek and its tributaries (i.e., the area above Pond C-2). Intermittent stream flows alternate with areas of persistent flow within the headwaters. Intermittent segments contain isolated pools that provide important habitat for many aquatic species during the late summer and early fall when flow ceases. Persistent flows originate from seeps and springs and provide year-round aquatic habitats. Pond C-1 is the only pond directly associated with Woman Creek because Pond C-2 is hydrologically isolated from the creek and receives flows from the SID. The SID provides only marginal ephemeral habitats comprising a few small pools where water collects during storm events and they dry out quickly. Below Pond C-2, only one or two small pools remain most of the year in Lower Woman Creek. The rest of this reach is dry the majority of the year.

Woman Creek retains a significant amount of stream habitat and holds the majority of RFETS fish species. Native fish species that reproduce within Woman Creek include white suckers (*Catostomus commersoni*), fathead minnows, green sunfish (*Lepomis cyanellus*), stonerollers (*Capostoma anomalus*), and creek chubs (*Semotilus atromaculatus*). Two non-native fish species, golden shiners (*Notemigonus crysoleucas* and largemouth bass (*Micropterus salmoides*), also are found in the drainage.

Within Woman Creek, the most common aquatic macroinvertebrates are Oligochaetes (tubificid worms), the larvae of the blackfly (Order *Diptera, Simulidae* sp.), midge (Order *Diptera, Chironomidae* sp), and mayfly (Order *Ephemeroptera*). Other species include caddisflies (Order *Trichoptera*), craneflies (*Tipulidae* ssp.), damselfly larvae (Order *Odonata*), and stonefly larva (Order *Plecoptera*) as well as snails (Class *Gastropoda*) and amphipods (Order *Amphipoda*). Large macroinvertebrates such as crayfish (Order *Decapoda,* Family *Astacidae*) and snails are potentially important prey for other fish, waterfowl, and mammal species.

The hydrology in the Woman Creek tributaries is expected to remain unchanged between the historic and future configuration of RFETS, with the exception of the SID, where reduced flows are anticipated. Woman Creek flows through Pond C-1, which was reconfigured as a low-profile, flow-through structure in 2005. Woman Creek is isolated from IA surface runoff by the SID, which intercepts surface flow and diverts it to Pond C- 2. Woman Creek is diverted around Pond C-2 via a concrete diversion wall and channel, rejoining the original Woman Creek channel downstream of Pond C-2.

Characterization of the aquatic habitat provided by Woman Creek is a primary consideration with regard to aquatic risk. Currently, sustained flows exist in portions of the creek that support aquatic species. The location and amount of viable aquatic habitat that will be present after accelerated actions at RFETS are complete is unclear because overland flow may be altered by these actions.

5.3.1 Pond C-1

The following describes the outcome of the surface sediment HQ analysis completed for each identified ECOPC at Pond C-1. Those chemicals identified for further risk characterization are described in more detail in the Chemical Risk Characterization – Further Analysis subsection.

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.35 provides the results of the HQ assessment for the Pond C-1 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below.

- Aluminum, barium, iron, manganese, mercury, and selenium were retained for further consideration with surface sediment HQs greater than 1. The spatial extent of these metals within the C-series ponds in surface sediment is shown on Figures A8.59, A8.61, A8.63, A8.65, A8.66 and A8.68, respectively. Iron, manganese, and selenium had MDCs that were less than the maximum background level. Therefore, the risk attributable to these metals is within the range of background. Because the HQs for these metals were greater than 1, however, they were retained for further evaluation.
- Lead, nickel, and zinc had surface sediment HQs of 1 or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDC for these metals was less than the maximum detected concentrations in background. The risk attributable to lead, nickel, and zinc is no greater than the risk attributable to background. The spatial extent of these chemicals is shown on Figures A8.64, A8.67, and A8.69, respectively. Lead, nickel, and zinc were detected at one location with a concentration greater than the ESL, wile the remaining concentrations were less than the ESL. The risk attributable to these metals within Pond C-1 would be within the range of background and does not require further evaluation.
- Acenaphthene, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene,

and pyrene were retained for further consideration because surface sediment HQs were greater than 1. The spatial extent of these chemicals in surface sediment as compared to their respective ESLs within the C-series ponds are shown on Figures A8.70, A8.71, A8.72, A8.74, A8.76, A8.77, A8.78, A8.79, and A8.80, respectively.

- Benzo(a)pyrene and chrysene had surface sediment HQs of one or less and were removed from further consideration. The spatial extent of these chemicals in surface sediment is shown on Figures A8.73 and A8.75, respectively. Both chemicals were detected at one concentration slightly greater than the ESL, while the remaining locations were less than the ESL or below detection levels. The risk attributable to these chemicals in Pond C-1 is low and does not require further evaluation.
- Aroclor-1254 was retained for further consideration with a surface sediment HQ of 2. The spatial extent of Aroclor-1254 in surface sediment as compared to the ESL within the C-series ponds is shown on Figure A8.81. The results of Aroclor-1254 were used for the total PCB results because it was the only congener detected. Therefore, this congener will be the only chemical retained for further risk characterization analysis.
- Total PCBs were retained for further consideration with a surface sediment HQ of 2. Aroclor-1254 was the only detected congener; therefore, the spatial distribution of total PCBs depicted on Figure A8.81 also demonstrates the results for Aroclor-1254 within the C-series ponds.
- Total PAHs were evaluated for Pond C-1. As shown on Figure A8.82, the range of detected total PAHs for the surface sediment samples ranged from 1,104 to 2,510 µg/kg, which exceeds the ESL. Both individual (identified above) and total PAHs were retained for further evaluation.

Chemical Risk Characterization – Further Analysis

Aluminum, barium, iron, manganese, mercury, selenium, acenaphthene, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, Aroclor-1254, total PCBs, and total PAHs were retained for further risk characterization. The results are provided by chemical below.

Aluminum had a frequency of detection of 100 percent (detected in 7 of 7 samples collected). The surface sediment HQ for the ESL is 2, which is within the HQ range of uncertainty where adverse effects are unknown. The surface sediment HQ for the AT is 1. The aluminum ESL in sediment (15,900 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media that receptors are potentially exposed to. Toxicity based alternative screening benchmarks ranged from

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14,000 mg/kg ERL[6] to 58,000 mg/kg ERM, and a high of 73,000 mg/kg NEC (Ingersoll, et al. 1996). Comparison to these toxicity-based values provides a better indication of the potential for risk to sediment organisms. Review of the surface sediment data on a point-by-point basis indicates that aluminum was detected at concentrations greater than the ESL at four of six locations within Pond C-2. These concentrations, however, were just slightly greater than the ESL. The remaining two locations had concentrations less than the ESL. Because the measured concentrations fall below the AT values, the likelihood for risk attributable to aluminum is low.

Barium had a frequency of detection of 100 percent (detected in 7 of 7 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The barium ESL for sediment (189 m/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999). The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity based. As a regulatory screening level, it is not enforceable, but rather provides a basis for evaluating aluminum concentrations in media that receptors are potentially exposed to. Toxicity from barium in sediment is not well documented and there are no other applicable screening criteria available for this metal. Buchman (1999) proposed a PEL for barium of 48 mg/kg, but this was based on an apparent effects threshold (AET) concentration from marine sediment amphipod bioassays. Comparison to these toxicity-based values provide an indication of when the potential for risk to sediment organisms is likely to be absent, but do not adequately evaluate when risks exist. Because of the lack of an appropriate ESL for barium, it is considered an uncertainty, although barium is not considered a priority pollutant by the EPA and therefore is unlikely to pose a significant risk to benthic receptors. Review of the surface sediment data on a point-by-point basis indicates that barium had measured concentrations at each of the sampled locations. However, these values were only slightly greater than the ESL. The combined lines of evidence indicate the risk attributable to barium is low.

Iron had a frequency of detection of 100 percent (detected in 7 of 7 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The iron ESL for sediment (20,000 mg/kg) was based on a LEL (NYSDEC 1994; cited in MacDonald, et al. 1999). The potential for adverse effects associated with this ESL is low, because this is a concentration at which effects were first observed in test sediment. TELs for RFETS will depend on the relative sensitivity of site receptors and sediment chemical properties. Alternative screening benchmarks ranged from 8,000 mg/kg, indicating light pollution (Pavlou and Weston 1983), to the 190,000 mg/kg TEL for the *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996), and a 290,000 mg/kg NEC for *Hyalella azteca* (Ingersoll, et al. 1996). Low frequencies of AT exceedances suggest that the potential for adverse effects to benthic macroinvertebrate receptors from iron in sediments at Pond C-1 is unlikely. Review of the surface sediment data on a point-by-point basis indicates that iron was measured at concentrations greater than the ESL at five of the six sample

[6] This value was not used as an ESL because it was noted as unreliable (Ingersoll, et al. 1996) where fewer than five samples designated as toxic for the chemical, or the number of toxic samples with concentrations below the SEC was greater than the number of toxic samples with concentrations above the SEC.

locations. These measured values, however, were only slightly greater than the ESL. In addition, the MDC for iron was within the range of background conditions. The combined lines of evidence indicate the risk attributable to iron would be low and within the range of background.

Manganese had a frequency of detection of 100 percent (detected in 7 of 7 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is 1. The manganese ESL in sediment (630 mg/kg) was based on the TEL for *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996; cited in MacDonald, et al. 1999). Alternative screening benchmarks ranged from the 460 mg/kg LEL (NYSDEC 1994) to the 1,200 mg/kg PEL, and the 1,700 mg/L ERM (Ingersoll, et al. 1996). Despite concentrations exceeding the ESL, it is uncertain whether concentrations of manganese in sediment pose a real potential for risk if they do not exceed the AT value represented by the ERM (Ingersoll, et al. 1996). Review of the surface sediment data on a point-by-point basis indicates that manganese was measured at only one location with a concentration greater than the ESL. The remaining five sample locations had concentrations less than the ESL. In addition, the MDC for manganese was within the range of background conditions. The combined lines of evidence indicate the risk attributable to manganese is low and within the range of background.

Mercury had a frequency of detection of 100 percent (detected in 7 of 7 samples). The surface sediment HQ for the ESL is 9, while the HQ for the AT is less than 1. The ESL for mercury in sediment (0.18 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 34.3 percent of samples (n=79) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. Thus, there is low confidence that this ESL predicts the potential for adverse effects from mercury in sediment. The potential for adverse effects is also uncertain at concentrations greater than this ESL and below the consensus-based PEC (1.06 mg/kg). Given the uncertainty associated with mercury ESLs the potential for risks can not be excluded; however, it is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the data on a point-by-point basis indicated that each measured mercury result was equal to or less than the AT value. Review of the surface sediment data on a point-by-point basis indicates that mercury was measured at only two locations with concentrations greater than the ESL. The remaining four sample locations had concentrations less than the ESL. The combined lines of evidence indicate the risk attributable to mercury is low.

Selenium had a frequency of detection of 50 percent (detected in 3 of 6 samples). The surface sediment HQ for the ESL is 3, while the HQ for the AT is 1. The selenium ESL for sediment (0.95 mg/kg) was based on the 85th percentile concentration in streams (TNRCC 1996; cited in MacDonald, et al. 1999), which defined the SQG by TNRCC. The potential for adverse effects associated with this ESL is uncertain because it is based on a percentile concentration from statewide historical data and is not toxicity based. As a regulatory screening level it is not enforceable, but rather provides a basis for evaluating selenium concentrations in media that receptors are potentially exposed to. Alternative screening benchmarks ranged from 1.73 for the 85th percentile concentration in reservoirs (TNRCC 1996) up to 5.0 mg/kg for the British Columbia SQG (Nagpal et al.

1998). Therefore, despite sediment concentrations exceeding the ESL, the potential for adverse effects is uncertain and unlikely for selenium concentrations not greater than the alternative toxicity SQG. Review of the data on a point-by-point basis indicated that each measured selenium result was less than the AT value. There were three locations with measured concentrations greater than the ESL, while the remaining two locations were at below detection levels. The combined lines of evidence indicate the risk attributable to selenium is low.

Acenaphthene had a frequency of detection of 50 percent (detected in 3 of 6 samples). The surface sediment HQ for the ESL is 48, while the HQ for the AT is 4. The acenaphthene ESL for sediment (6.71 µg/kg) was based on the Canadian interim sediment quality guideline (ISQG) (CCME 2002). Alternative screening benchmarks ranged from the 89 µg/kg British Columbia PEL (Nagpal et al. 1998), and the 7320 µg/kg interim EPA freshwater chronic value (FCV) determined by the EqP method (EPA 1997), to the apparent effects threshold approach (AETA[7]) of 100,000 µg/kg (Cubbage et al. 1997). Despite concentrations exceeding the ESL, it is unlikely the concentrations of acenaphthene in sediment pose a real potential for risk if they do not exceed the AT value represented by the British Columbia PEL (89 µg/kg). The recently measured concentrations of acenaphthene in surface sediment ranged from 74 to 320 µg/kg. These values fall within the range of AT values within the literature indicating that there is uncertainty associated with the toxicity attributable to acenaphthene. Review of the surface sediment data on a point-by-point basis indicated within Pond C-1, two of the five locations had measured values greater than the ESL; the remaining were below detection levels. The combined lines of evidence indicate the risk attributable to acenaphthene is low.

Anthracene had a frequency of detection of 83 percent (detected in 5 of 6 samples). The surface sediment HQ for the ESL is 8, while the HQ for the AT is 1. The anthracene ESL for sediment (57.2 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 83 percent of samples (n=129) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 845 Review of the data on a point-by-point basis indicated that within Pond C-1, four of the five locations had measured values greater than the ESL; the remaining location was below detection levels. The combined lines of evidence indicate that the risk attributable to anthracene is low.

Benzo(a)anthracene had a frequency of detection of 67 percent (detected in 4 of 6 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The benzo(a)anthracene ESL for sediment (108 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 83 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic

[7] The AETA is an calculated value based on measured sediment concentrations and observed effects. This approach defines the sediment concentration above, which significant ($p<0.05$) biological effects are always observed.

macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 1,050 µg/kg. Review of the data on a point-by-point basis indicated that within Pond C-1, two of the five locations had measured values greater than the ESL; the remaining locations were below detection levels or less than the ESL. The combined lines of evidence describing the limited spatial extent of exceedance indicate that the risk attributable to benzo(a)anthracene is low.

Benzo(g,h,i)perylene had a frequency of detection of 17 percent (detected in 1 of 6 samples) indicating a limited spatial extent. The surface sediment HQ for the ESL is 12, while the HQ for the AT is 1. The ESL was based on the ERL for *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from the 16 µg/kg TEL to 280 µg/kg ERM, and a high of 1,200 µg/kg NEC (Ingersoll, et al. 1996). Review of the data on a point-by-point basis indicated that within Pond C-1, only one of the five locations had measured values greater than the ESL, the remaining four locations were below detection levels. Therefore, given the limited spatial extent of exceedance, it is unlikely that the concentrations of benzo(g,h,i)perylene in sediment pose a potential for adverse effects to benthic organisms in Pond C-1.

Dibenz(a,h)anthracene had a frequency of detection of 20 percent (detected in 1 of 5 samples) indicating a limited spatial extent. The surface sediment HQ for the ESL is 16, while the HQ for the AT is 2. The dibenz(a,h)anthracene ESL for sediment (33 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 240 µg/kg. Review of the data on a point-by-point basis indicated that within Pond C-1, only one of the four locations had measured values greater than the ESL, the remaining locations were below detection levels. The combined lines of evidence describing the limited spatial extent of exceedances indicate that the risk attributable to dibenz(a,h)anthracene is low.

Indeno(1,2,3-cd)pyrene had a frequency of detection of 50 percent (detected in 3 of 6 samples). The surface sediment HQ for the ESL is 29, while the HQ for the AT is 2. The ESL is based on the TEL for the *Hyalella azteca* 28-day sediment bioassay (Ingersoll, et al. 1996). Alternative screening benchmarks ranged from the 30 µg/kg ERL, to 250 µg/kg ERM, and a high of 770 µg/kg NEC (Ingersoll, et al. 1996). Review of the data on a point-by-point basis indicated that within Pond C-1, two of the five locations had measured values greater than the ESL, the remaining locations were below detection levels. The combined lines of evidence describing the limited spatial extent of exceedances indicate that the risk attributable to indeno(1,2,3-cd)pyrene is low.

Pentachlorophenol had a frequency of detection of 17 percent (detected in 1 of 6 samples) indicating a limited spatial extent. The surface sediment HQ for the ESL is 4, while the HQ for the AT is 3. The pentachlorophenol ESL for sediment (255 µg/kg) was based on an equilibrium partitioning (EqP) based equation using the chronic ESL for surface water, and an estimate of 1 percent organic carbon (EPA 1997). There is uncertainty added to the potential for risk evaluation when extrapolating screening benchmarks using

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this method. However, it is the best option when alternative screening benchmarks are unavailable. Including the site specific organic carbon content in this calculation would improve the appropriateness of the refined ESL; however, the current estimate of 1 percent organic carbon is conservative and likely results in an overprotective ESL. An AT value of 360 was available from Cubbage et al. (1997). This Washington State sediment quality standard was derived as a protective concentration in marine waters. Review of the data on a point-by-point basis indicated that within Pond C-1, only one of the five locations had measured values greater than the ESL, the remaining locations were below detection levels. The combined lines of evidence describing the limited spatial extent of exceedance indicate that the risk attributable to pentachlorophenol is low.

Phenanthrene had a frequency of detection of 83 percent (detected in 5 of 6 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The phenanthrene ESL for sediment (204 µg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 1,170 µg/kg. Review of the data on a point-by-point basis indicated that within Pond C-1, four of the five sample locations had measured concentrations greater than the ESL. The remaining location was below detection levels. The magnitude of exceedances were slight lending to the low ESL HQ. The combined lines of evidence describing the limited spatial extent of exceedance indicate that the risk attributable to phenanthrene is low.

Pyrene had a frequency of detection of 17 percent (detected in 1 of 6 samples) indicating a limited spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The pyrene ESL for sediment (195 µg/kg) ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 1,520 µg/kg. Review of the data on a point-by-point basis indicated that within Pond C-1, only one of the five locations had measured values greater than the ESL, the remaining locations were below detection levels. The combined lines of evidence describing the limited spatial extent of exceedance indicate that the risk attributable to pyrene is low.

Total PAHs were determined for the surface sediment samples collected within Pond C-1. As shown within Figure A8.82, four locations had detected PAH concentrations. From these locations the total PAH sum ranged from 790 to 2,510 µg/kg. Using the maximum detected total PAH concentration, an HQ of 2 was developed. Using the total PAH AT (22,800 µg/kg) an AT HQ of less than 1 was derived. The total PAH ESL for sediment (1,610 µg/kg) ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 80 percent of samples (n=139) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC (22,800 µg/kg). The combined lines of evidence indicate that the risk attributable to total PAHs would be low.

Aroclor-1254 had a frequency of detection of 14 percent (detected in 1 of 7 samples) indicating a limited spatial extent. The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be non-toxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (300 µg/kg). Review of the data on a point-by-point basis indicated that within Pond C-1, only one of the six locations had measured values greater than the ESL, the remaining locations were below detection levels. Therefore, it is unlikely that Aroclor-1254, exceeding the ESL by a small amount, poses an unacceptable risk to benthic populations that inhabit Pond C-1.

Total PCBs were evaluated for Pond C-1 and found to have a total detected maximum concentration of 94 µg/kg attributable to Aroclor-1254. This value exceeds the total PCB ESL of 40 but is less than the total PCB AT of 676 µg/kg. The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The ESL was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 82 percent of samples (n=139) below this concentration were accurately predicted to be non-toxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL and below the consensus-based PEC (676 µg/kg). Therefore, it is unlikely that total PCBs pose an unacceptable risk to benthic populations that inhabit Pond C-1.

Other Lines of Evidence

Chemical risk HIs in the Woman Creek Ponds identified Pond C-1 as having an HI of 2.6. Benzoic acid was the only ECOC with an HQ greater than 1 (HQ = 2.6) (DOE 1996). Additional results from biomonitoring, gathered as a LOE for the DOE 1996 effort, indicated that Pond C-1 appears to have thriving aquatic life within the pond with high diversity of macroinvertebrates and fish. In addition, upstream of the ponds, Woman Creek supports good quality aquatic habitat and several fish species. Risk estimates indicate low risk and ecological monitoring support the fact that the ecosystem is healthy.

Weight-of-Evidence Conclusions

Results of the chemical risk characterization indicated that the sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond C-1. Those chemicals requiring further analysis (aluminum, barium, iron, manganese, mercury, selenium, acenaphthene, anthracene, benzo(a)anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pentachlorophenol, phenanthrene, pyrene, Aroclor-1254, total PCBs and total PAHs) were found to have measured concentrations greater than their respective ESLs but less than AT values in most cases. In addition, iron and manganese were found to be within the range of risk attributable to background, while the remaining chemicals evaluated had a minimal spatial extent of exceedances of the ESL. While five organic chemicals yielded large HQ values (acenaphthene with an HQ = 48, anthracene with an HQ of 8, benzo(g,h,i)peryelene with an HQ = 12, dibenz(a,h)anthracene with an HQ of 16, indeno(1,2,3-cd)pyrene with an HQ = 29 and pentachlorophenol with an HQ of 4) the MDCs for anthracene, benzo(g,h,i)perylene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene were comparable to the AT. In addition, dibenz(a,h)anthracene, benzo(g,h,i)perylene and pentachlorophenol were infrequently detected above their respective ESLs. The remaining chemicals with uncertain toxicity potential were acenaphthene and indeno(1,2,3-cd)pyrene since they were frequently detected (50 percent of total samples) and had moderate spatial exceedances as compared to their ESLs . Therefore, other lines of evidence in which the review of point-by-point data results were reviewed. Results indicated a limited spatial extent of exceedance for these chemicals as well.

Evaluation of other lines of evidence provided from previous studies indicates that the results of sediment bioassay analysis of Pond C-1 sediment is comparable to controls. There were no chemical stressors measured as a result of the bioassay analysis. In addition, previous studies did not identify PAHs as creating a risk to aquatic life or other receptors (wildlife and waterfowl) associated with the Pond.

In summary, the chemical risk findings are likely conservative of risk conditions within Pond C-1. The majority of the chemical risk findings coincide with the other lines of evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. Bioassay analysis indicated that results of Pond C-1 sediment toxicity were comparable to control tests indicating no chemical stressor affects. These studies occurred within a time-frame that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. Although there are two chemicals of uncertain toxicity (acenaphthene and indeno(1,2,3-cd)Pyrene), the weight of evidence indicates the risk associated with Pond C-1 to aquatic populations is low.

5.3.2 Pond C-2

Chemical Risk Characterization – Surface Sediment Screen Results

Table A8.36 provides the results of the HQ assessment for the Pond C-2 ECOPCs. As shown in this table, several chemicals had surface sediment MDCs that were less than the ESL. Those chemicals with surface sediment MDC ESL HQs of 1 or less were eliminated from further consideration. Results of the HQ screen are provided below:

- Aluminum, arsenic, barium, copper, iron, and selenium had surface sediment HQs of one or less and were removed from further consideration within the risk characterization. Further analysis indicated that the MDC for aluminum, barium, copper, iron, and selenium were less than the maximum detected concentration in background. The risk attributable to these metals is no greater than the risk attributable to background. The spatial extent of these chemicals in surface sediment is shown on Figures A8.59, A8.60, A8.61, A8.62, A8.63, and A8.68. Iron was detected at four locations with a concentration greater than the ESL, aluminum and barium were detected at two locations, while arsenic, copper, and selenium were detected at one location. The remaining concentrations were less than the ESL (or at nondetect levels for selenium). The risk attributable to these metals within Pond C-2 would be within the range of background and does not require further evaluation.

- Mercury and zinc were retained for further consideration with surface sediment HQs greater than 1. The spatial extent of these metals within the surface sediment of the C-series ponds is shown on Figures A8.66 and A8.69. Zinc had an MDC less than the maximum background level. Therefore the risk attributable to this metal would be within the range of background. Because the HQs for these metals were greater than 1 however, they were retained for further evaluation.
- Total PAHs were evaluated for Pond C-2. Results of the total PAH calculation for each sample within the comprehensive data set was provided in Table A8.24, while the results by location for the surface sediment data set were provided in Table A8.25. These results reflect the measured values as well as ½ the reported value for the non detected chemicals. The majority of the values were nondetect. The maximum concentrations for the comprehensive data set (14700 µg/kg) and the surface sediment data set (14700) were greater than the ESL, yet represent maximum nondetect values. Figure A8.82 depicts the spatial extent of each detected PAH constituent within the Pond C-2 surface sediment sampling locations. As shown on Figure A8.82, there was a maximum detected total PAH concentration of 140 µg/kg which is less than the ESL within surface sediment, indicating there is low risk associated with PAH chemicals. No further evaluation of total PAHs is required.

Chemical Risk Characterization – Further Analysis

Mercury and zinc were retained for further risk characterization. The results are provided by chemical below

Mercury had a frequency of detection of 91 percent (detected in 10 of 11 samples). The surface sediment HQ for the ESL is 4, while the HQ for the AT is 1. The ESL for mercury in sediment (0.18 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), at which the potential for adverse effects are first observed. Validation of this benchmark found that 34.3 percent of samples (n=79) below this concentration were accurately predicted to be nontoxic to benthic macroinvertebrates. Thus, there is low confidence that this ESL, predicts the potential for adverse effects from mercury in sediment. The potential for adverse effects is also uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 1.06 mg/kg. Given the uncertainty associated with mercury ESLs the potential for risks can not be excluded; however, it is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the data on a point-by-point basis indicated that each measured mercury result was less than the AT value. Within Pond C-2, three of the eight locations had measured values greater than the ESL; the remaining locations were less than the ESL. The combined lines of evidence describing the limited spatial extent of exceedances indicate that risk attributable to mercury is low and within the range of background.

Zinc had a frequency of detection of 100 percent (detected in 11 of 11 samples). The surface sediment HQ for the ESL is 2, while the HQ for the AT is less than 1. The ESL for zinc in sediment (121 mg/kg) was based on a consensus-based TEC (MacDonald, et al. 2000), where the potential for adverse effects are first observed. Validation of this benchmark found that 81.6 percent of samples (n=347) below this concentration were accurately predicted to be non-toxic to benthic macroinvertebrates. The potential for adverse effects is uncertain at concentrations greater than this ESL, and below the consensus-based PEC of 459 mg/kg. In this situation the potential for risks can not be excluded but is not considered likely if fewer than 20 percent of samples exceed the ESL. Review of the data on a point-by-point basis indicated that each measured zinc result was less than the AT value. Within Pond C-2, three of the eight locations had measured values greater than the ESL; the remaining locations were less than the ESL. In addition, the MDC for zinc was within the range of background conditions. The combined lines of evidence indicate the risk attributable to zinc is low and within the range of background.

Other Lines of Evidence

Individual pond HIs in the Woman Creek Ponds identified Pond C-2 as having an HI of 3.0. Benzoic acid and zinc were the only ECOCs with and HQ greater than 1 (1.7 and 1.3, respectively) (DOE 1996). Additional results from biomonitoring described Pond C-2 is an off-channel reservoir and does not have as high a diversity of aquatic life, however, pond management including limited inflow and rapid fluctuations of water levels makes a harsh physical environment for aquatic organisms. Upstream of the ponds, Woman Creek supports good quality aquatic habitat and several fish species. Risk estimates indicate low risk and ecological monitoring support the fact that the ecosystem is healthy.

Weight-of-Evidence Conclusions

The results of the chemical risk characterization indicated that the sediment ECOPCs within surface sediment would pose a low risk to aquatic life within Pond C-2. Those chemicals requiring further analysis (mercury and zinc) were found to have measured concentrations greater than their respective ESLs but less than AT values in most cases. In addition, zinc was found to be within the range of risk attributable to background, while mercury had a minimal spatial extent of ESL exceedances. The overall risk attributable to these chemicals would be low.

These results coincide with the other lines of evidence conclusions drawn from other studies of this pond. Previous research indicates that the aquatic populations represent typical assemblages unaffected by chemical stressors. These studies occurred within a time-frame that overlaps with the data collected and evaluated for this effort and provides supporting evidence that there are no chemical stressors controlling the ecology. The weight of evidence indicates that the risk associated with Pond C-2 to aquatic populations is low.

6.0 UNCERTAINTIES ASSOCIATED WITH THE ECOLOGICAL RISK ASSESSMENT

Quantitative evaluation of ecological risks is limited by uncertainties regarding the assumptions used to predict risk and the data available for quantifying risk. These limitations are usually addressed by making estimates based on the data available or by making assumptions based on professional judgment when data are limited. Because of these assumptions and estimates, the results of the risk calculations themselves are uncertain, and it is important for risk managers and the public to view the results of the risk assessment with this in mind. The detailed assessment of uncertainties associated with ecological evaluations for AEUs is provided in Volume 15B2 of the CRA.

An additional uncertainty introduced by this evaluation is the assumption that each pond provides sufficient habitat for an aquatic population. This is likely an overestimate of habitat quality and conditions because the flow controls the amount of available habitat, and aquatic species often utilize larger habitat areas than those provided within a single pond. Therefore these pond-specific estimates likely overestimate the risk potential to an aquatic population within a given AEU.

7.0 CONCLUSIONS

Multiple LOEs were gathered to evaluate the aquatic risk conditions within Ponds A-1, A-2, A-3, A-4, A-5, B-4, B-5, C-1, and C-2. An evaluation of the chemical risk potential was conducted using a standard HQ approach as well as other chemical risk lines of evidence. Additional LOEs gathered from other studies were also compiled with the chemical risk evaluation in order to formulate a risk conclusion.

The sediment ECOPCs carried through the chemical risk characterization process were determined to have no-to-low risk potential. The spatial distribution evaluation indicated few locations where observed concentrations exceeded ESL values. Detailed analysis of certain chemicals indicates the frequency of detection and magnitude of the ECOPCs is not substantial compared to the ESLs and ATs.

The methods applied within the chemical risk characterization likely overestimate risk conditions because data were evaluated on a point-by-point basis and conservative ESLs were applied throughout the process. The aquatic conditions within the ponds indicate that these habitats are limited and largely controlled by flow conditions. Flows are seasonal and related to precipitation events. In turn, the aquatic life within the ponds are comprised of an opportunistic assemblage of aquatic invertebrates. There are minimal records of these ponds containing fish species. There have been no studies to indicate water quality is a controlling factor to the ecology. Instead, it is well documented that flow conditions are the controlling factor that limit the amount of available habitat year-round.

In summary, the multiple LOEs support the weight-of-evidence conclusion that there is low-to-no potential risk to aquatic life within the ponds evaluated as related to the ECOPCs. The overlying risk driver to these organisms is the habitat condition itself.

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TABLES

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Table A8.1
Sediment ECOPCs by Pond within the A-Series

ECOPC	A-1	A-2	A-3	A-4	A-5
Inorganics					
Aluminum	x	x	x	x	x
Antimony	x		x	x	
Arsenic		x		x	
Barium	x	x	x	x	x
Cadmium	x	x		x	
Chromium		x			
Copper	x	x		x	
Iron	x	x	x	x	x
Lead	x	x			
Manganese		x			
Mercury	x				
Nickel	x	x	x	x	
Selenium	x		x	x	
Silver	x	x			x
Zinc	x	x	x	x	x
Organics					
Acenaphthene	x	x			
Anthracene	x	x			
Atrazine				x	
Benzo(a)anthracene	x				
Benzo(a)pyrene	x		x		
Benzo(g,h,i)perylene	x				
Bis(2-ethyl-hexyl)phthalate		x			
Chrysene	x		x		
Fluoranthene	x		x		
Indeno(1,2,3-cd)pyrene	x	x			
Pentachlorophenol					
Phenanthrene	x		x		
Pyrene	x		x		
Aroclor-1254	x	x			
Aroclor-1260	x				
Total PAHs	23	9	x	x	
Total PCBs	x	x	x		
Total ECOPCs	29	9	14	12	5

x = Indicates analyte is an ECOPC.

Table A8.2

Sediment ECOPCs by Pond within the B-Series

ECOPC	B-4	B-5
Inorganics		
Aluminum	x	x
Antimony	x	
Arsenic		
Barium	x	x
Cadmium	x	
Chromium	x	
Copper	x	
Iron	x	x
Lead	x	x
Manganese		
Mercury	x	
Nickel	x	x
Selenium	x	x
Silver	x	x
Zinc	x	x
Organics		
Anthracene	x	
Benzo(a)anthracene	x	
Benzo(a)pyrene	x	
Benzo(g,h,i)perylene	x	
Benzo(k)fluoranthene	x	
Bis(2-ethyl-hexyl)phthalate	x	
Chrysene	x	
Dibenz(a,h)anthracene	x	
Fluoranthene	x	
Fluorene		
gamma-BHC	x	
Indeno(1,2,3-cd)pyrene	x	
Pentachlorophenol		
Phenanthrene	x	
Pyrene	x	
Aroclor-1254	x	
Total PAHs	23	9
Total PCBs	x	
Total ECOPCs	29	9

x = Indicates analyte is an ECOPC.

Table A8.3

Sediment ECOPCs by Pond within the C-Series

ECOPC	C-1	C-2
Inorganics		
Aluminum	x	x
Antimony		
Arsenic		x
Barium	x	x
Cadmium		
Chromium		
Copper		x
Fluoride		
Iron	x	x
Lead	x	
Manganese	x	
Mercury	x	x
Nickel	x	
Selenium	x	x
Silver		
Zinc	x	x
Organics		
Acenaphthene	x	
Anthracene	x	
Benzo(a)anthracene	x	
Benzo(a)pyrene	x	
Benzo(g,h,i)perylene	x	
Chrysene	x	
Dibenz(a,h)anthracene	x	
Indeno(1,2,3-cd)pyrene	x	
Pentachlorophenol	x	
Phenanthrene	x	
Pyrene	x	
Aroclor-1254	x	
Total PAHs	x	x
Total PCBs	x	
Total ECOPCs	**23**	**9**

x = Indicates analyte is an ECOPC.

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Table A8.4
Summary of Sediment ECOI Data for Pond A-1

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	11	11	100	5.9 - 40	8,500	29,000	17,345	7,448
Antimony	2	11	18.2	0.47 - 12	29.6	30.4	7.61	11.8
Arsenic	11	11	100	0.78 - 2	4.60	9.30	6.84	1.58
Barium	11	11	100	0.15 - 40	53.0	230	171	60.1
Beryllium	9	11	81.8	0.034 - 1	0.480	1.50	0.956	0.473
Boron	7	7	100	1.2 - 2	3.50	12.0	8.79	2.92
Cadmium	8	11	72.7	0.031 - 1	0.140	8.30	1.80	2.33
Calcium	11	11	100	7.6 - 1,000	6,400	27,000	15,164	5,811
Cesium	4	4	100	200 - 200	1.80	5.80	3.15	1.84
Chromium	11	11	100	0.081 - 2	10.0	30.0	19.3	7.11
Cobalt	11	11	100	0.12 - 10	3.60	13.0	8.76	2.62
Copper	11	11	100	0.1 - 5	15.0	43.0	26.3	7.39
Iron	11	11	100	1.7 - 20	5,400	24,000	18,045	6,029
Lead	11	11	100	0.33 - 1	20.0	39.0	28.9	6.76
Lithium	7	11	63.6	0.37 - 20	8.30	22.0	12.6	7.07
Magnesium	11	11	100	4.5 - 1,000	1,800	5,300	4,175	1,077
Manganese	11	11	100	0.096 - 3	72.0	500	319	112
Mercury	11	11	100	0.0058 - 0.1	0.071	0.470	0.231	0.155
Molybdenum	7	11	63.6	0.27 - 40	0.580	2.30	2.10	1.41
Nickel	9	11	81.8	0.27 - 8	7.80	26.4	16.8	7.29
Potassium	11	11	100	48 - 1,000	800	3,700	2,593	962
Selenium	3	11	27.3	0.97 - 1.4	1.20	1.80	0.760	0.520
Silica	7	7	100	2 - 6.9	1,000	1,500	1,243	190
Silver	3	11	27.3	0.099 - 2	0.710	2.00	0.864	0.546
Sodium	11	11	100	72 - 1,000	360	1,200	633	230
Strontium	11	11	100	0.079 - 40	65.0	140	94.5	27.6
Tin	6	11	54.5	0.77 - 40	1.20	1.80	7.52	8.35
Titanium	7	7	100	0.17 - 0.3	36.0	170	114	48.1
Vanadium	11	11	100	0.47 - 10	26.0	57.0	40.3	10.6
Zinc	11	11	100	0.43 - 4	55.0	140	107	28.2
Organics (ug/kg)								
1234678-HpCDF	1	1	100	0.00184 - 0.00184	0.030	0.030	0.030	N/A
1234789-HpCDF	1	1	100	0.00184 - 0.00184	0.002	0.002	0.002	N/A
123478-HxCDD	1	1	100	0.00184 - 0.00184	0.001	0.001	0.001	N/A
123478-HxCDF	1	1	100	0.00184 - 0.00184	0.004	0.004	0.004	N/A
123678-HxCDD	1	1	100	0.00184 - 0.00184	0.005	0.005	0.005	N/A
123678-HxCDF	1	1	100	0.00184 - 0.00184	0.003	0.003	0.003	N/A
123789-HxCDD	1	1	100	0.00184 - 0.00184	0.003	0.003	0.003	N/A
12378-PeCDF	1	1	100	0.00184 - 0.00184	0.002	0.002	0.002	N/A
234678-HxCDF	1	1	100	0.00184 - 0.00184	0.002	0.002	0.002	N/A
23478-PeCDF	1	1	100	0.00184 - 0.00184	0.004	0.004	0.004	N/A
2378-TCDD	1	1	100	0.000735 - 0.000735	0.003	0.003	0.003	N/A
2378-TCDF	1	1	100	0.000735 - 0.000735	0.006	0.006	0.006	N/A
2-Butanone	4	5	80.0	7.3 - 10	6.00	19.0	12.7	4.99
4-Methyl-2-pentanone	1	5	20.0	6.1 - 10	6.00	6.00	10.2	3.40
Acenaphthene	1	11	9.09	21 - 330	89.0	89.0	243	61.7
Acetone	1	5	20.0	7.2 - 10	11.0	11.0	40.0	19.4
Anthracene	3	11	27.3	21 - 330	52.0	88.0	203	91.7

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Table A8.4
Summary of Sediment ECOI Data for Pond A-1

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Benzo(a)anthracene	9	11	81.8	25 - 330	73.0	270	212	141
Benzo(a)pyrene	8	11	72.7	25 - 330	83.0	310	263	148
Benzo(b)fluoranthene	8	11	72.7	44 - 330	83.0	420	270	138
Benzo(g,h,i)perylene	7	11	63.6	20 - 330	60.0	210	239	164
Benzo(k)fluoranthene	8	11	72.7	48 - 330	63.0	200	214	171
bis(2-ethylhexyl)phthalate	4	11	36.4	39 - 330	230	360	386	103
Chrysene	9	11	81.8	34 - 330	82.0	350	239	138
Di-n-octylphthalate	2	11	18.2	30 - 330	66.0	130	374	154
Fluoranthene	9	11	81.8	34 - 330	170	790	435	199
Heptachlorodibenzo-p-dioxin	1	1	100	0.00184 - 0.00184	0.095	0.095	0.095	N/A
Indeno(1,2,3-cd)pyrene	8	11	72.7	28 - 330	50.0	210	206	145
Methylene Chloride	1	5	20.0	1.3 - 5	3.70	3.70	13.3	17.8
OCDD	1	1	100	0.00368 - 0.00368	0.539	0.539	0.539	N/A
OCDF	1	1	100	0.00368 - 0.00368	0.041	0.041	0.041	N/A
PCB-1254	10	15	66.7	8.3 - 530	55.0	5,200	496	1,314
PCB-1260	1	15	6.67	1.8 - 530	150	150	121	92.6
Phenanthrene	9	11	81.8	21 - 330	87.0	520	302	173
Phenol	1	11	9.09	23 - 330	54.0	54.0	371	134
Pyrene	4	11	36.4	160 - 330	420	710	492	83.9
Toluene	4	5	80.0	1.2 - 5	97.0	280	140	105
Radionuclides (pCi/g)								
Americium-241	15	15	100	0 - 0.115	0.116	13.2	4.60	4.66
Cesium-134	4	4	100	0.03 - 0.04	0.040	0.050	0.045	0.006
Cesium-137	8	8	100	0.05 - 0.09	0.210	0.685	0.384	0.181
Gross Alpha	8	8	100	2.26 - 4.36	19.8	70.7	40.4	20.1
Gross Beta	8	8	100	2.3 - 4.03	27.3	31.5	29.0	1.50
Plutonium-239/240	15	15	100	0 - 0.129	0.256	36.2	12.5	12.4
Radium-226	4	4	100	0.25 - 0.29	1.84	2.10	1.95	0.120
Radium-228	4	4	100	0.149 - 0.247	1.59	1.83	1.72	0.098
Strontium-89/90	5	5	100	0.0503 - 0.3504	0.270	0.827	0.601	0.215
Uranium-233/234	15	15	100	0.035 - 0.381	1.33	3.87	2.07	0.643
Uranium-235	15	15	100	0 - 0.47	0.041	0.352	0.113	0.081
Uranium-238	15	15	100	0.024 - 0.347	1.05	5.35	2.54	1.20

N/A = Not applicable; not calculated. Only one sample was collected.

Table A8.5
Summary of Sediment ECOI Data for Pond A-2

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	10	10	100	4.3 - 40	5,790	49,000	19,357	13,448
Arsenic	10	10	100	0.56 - 3.5	2.40	12.0	7.55	3.43
Barium	10	10	100	0.13 - 40	73.0	390	210	98.0
Beryllium	7	10	70.0	0.025 - 1	0.440	2.50	1.13	0.712
Boron	7	7	100	1.1 - 6	5.90	26.0	14.0	6.47
Cadmium	7	10	70.0	0.027 - 1	0.340	3.20	1.11	0.813
Calcium	10	10	100	6.6 - 1,000	8,350	43,000	20,755	11,633
Chromium	10	10	100	0.058 - 2	4.70	44.0	20.5	13.7
Cobalt	10	10	100	0.11 - 10	3.00	15.0	9.35	3.19
Copper	10	10	100	0.072 - 5	9.10	56.0	27.1	15.6
Iron	10	10	100	1.2 - 20	7,700	39,000	21,410	9,093
Lead	10	10	100	0.29 - 1.4	8.00	45.0	27.5	11.6
Lithium	10	10	100	0.28 - 20	4.90	37.0	16.9	10.6
Magnesium	10	10	100	4 - 1,000	2,100	11,000	5,059	2,619
Manganese	10	10	100	0.084 - 3	310	1,100	548	285
Mercury	7	10	70.0	0.005 - 0.1	0.024	0.150	0.072	0.042
Molybdenum	6	10	60.0	0.19 - 40	0.650	5.40	2.82	1.93
Nickel	9	10	90.0	0.19 - 8	6.10	34.0	19.6	8.75
Potassium	10	10	100	35 - 1,000	1,200	6,500	3,191	1,568
Silica	7	7	100	1.5 - 23	720	4,900	2,297	1,453
Silver	4	10	40.0	0.071 - 2.6	0.098	3.90	1.14	1.09
Sodium	10	10	100	63 - 1,000	378	2,100	925	522
Strontium	10	10	100	0.069 - 40	48.5	220	118	64.5
Tin	1	10	10.0	0.55 - 40	2.70	2.70	7.17	9.18
Titanium	7	7	100	0.15 - 0.88	66.0	310	159	79.5
Uranium	3	7	42.9	1 - 39	4.30	20.0	11.8	6.77
Vanadium	10	10	100	0.34 - 10	16.0	96.0	44.7	24.2
Zinc	10	10	100	0.38 - 4	33.0	170	97.7	46.8
Organics (ug/kg)								
1234678-HpCDF	2	3	66.7	0.00286 - 0.00474	0.003	0.003	0.002	3.69E-04
1234789-HpCDF	2	3	66.7	0.00286 - 0.00474	7.40E-04	7.70E-04	9.80E-04	3.90E-04
123478-HxCDF	2	3	66.7	0.00286 - 0.00474	5.50E-04	5.66E-04	0.001	8.87E-04
123678-HxCDD	1	3	33.3	0.00286 - 0.00474	0.001	0.001	0.002	6.01E-04
123789-HxCDD	1	3	33.3	0.00286 - 0.00474	0.001	0.001	0.002	6.91E-04
123789-HxCDF	1	3	33.3	0.00286 - 0.00474	5.53E-04	5.53E-04	0.001	9.09E-04
2-Butanone	3	6	50.0	10 - 22	26.0	71.0	291	617
Acenaphthene	1	10	10.0	18 - 330	180	180	479	234
Acetone	4	6	66.7	10 - 21	77.0	400	439	608
Anthracene	1	10	10.0	18 - 330	210	210	482	229
Benzo(a)anthracene	1	10	10.0	21 - 330	52.0	52.0	835	589
Benzo(a)pyrene	2	10	20.0	21 - 330	51.0	80.0	763	636
Benzo(b)fluoranthene	1	10	10.0	56 - 330	64.0	64.0	836	587
Benzoic Acid	3	10	30.0	300 - 1600	290	2,700	3,532	2,884
bis(2-ethylhexyl)phthalate	9	10	90.0	33 - 330	110	47,000	6,211	14,543
Chrysene	2	10	20.0	28 - 330	60.0	81.0	764	635
Fluoranthene	2	10	20.0	38 - 330	89.0	140	772	624
Heptachlorodibenzo-p-dioxin	2	3	66.7	0.00286 - 0.00474	0.020	0.020	0.014	0.010
Indeno(1,2,3-cd)pyrene	1	10	10.0	23 - 330	210	210	851	567

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Table A8.5

Summary of Sediment ECOI Data for Pond A-2

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Methylene Chloride	3	6	50.0	2.4 - 5	5.60	9.30	698	1,691
OCDD	3	3	100	0.00571 - 0.00948	0.018	0.161	0.098	0.073
OCDF	2	3	66.7	0.00571 - 0.00948	0.006	0.009	0.006	0.002
PCB-1254	4	12	33.3	7.1 - 690	34.0	130	83.6	53.5
Phenanthrene	2	10	20.0	18 - 330	99.0	190	778	618
Pyrene	2	10	20.0	140 - 690	71.0	83.0	809	616
Toluene	3	6	50.0	2.3 - 5	4.00	860	257	391
Radionuclides (pCi/g)								
Americium-241	12	12	100	0.00377 - 0.225	0.154	3.47	1.46	0.773
Cesium-134	3	3	100	0.05 - 0.05	0.050	0.100	0.077	0.025
Cesium-137	6	6	100	0.07 - 0.11	0.130	0.610	0.424	0.182
Gross Alpha	6	6	100	1.6 - 3.77	21.7	45.6	31.7	7.90
Gross Beta	6	6	100	3.6 - 5.5	27.8	32.7	30.0	1.94
Plutonium-239/240	13	13	100	0 - 0.155	0.587	10.5	4.32	2.50
Radium-226	3	3	100	0.37 - 0.42	2.75	3.08	2.92	0.165
Radium-228	3	3	100	0.17 - 0.18	1.70	1.89	1.81	0.101
Strontium-89/90	3	3	100	0.0536 - 0.0581	0.357	0.779	0.542	0.215
Uranium-233/234	13	13	100	0 - 0.418	1.11	3.70	2.36	0.888
Uranium-235	13	13	100	0 - 0.392	0.016	0.338	0.165	0.089
Uranium-238	13	13	100	0 - 0.313	1.21	6.10	3.70	1.70

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Table A8.6
Summary of Sediment ECOI Data for Pond A-3

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	8	8	100	6.7 - 40	13,100	27,400	21,650	4,617
Antimony	1	7	14.3	0.52 - 12	26.0	26.0	6.79	9.65
Arsenic	8	8	100	0.9 - 2	5.60	7.80	7.11	0.698
Barium	8	8	100	0.16 - 40	160	200	179	13.4
Beryllium	4	8	50.0	0.2 - 1	1.10	1.30	0.906	0.296
Boron	4	4	100	1.3 - 2.1	5.50	9.90	7.30	2.06
Cadmium	4	8	50.0	0.034 - 1	0.350	0.490	0.588	0.181
Calcium	8	8	100	8.4 - 1,000	7,200	51,000	17,213	14,533
Cesium	4	4	100	200 - 200	3.30	4.90	4.30	0.693
Chromium	8	8	100	0.37 - 2	12.9	29.9	21.9	5.24
Cobalt	8	8	100	0.14 - 10	8.50	15.5	11.1	2.57
Copper	8	8	100	0.76 - 5	19.0	24.1	22.2	1.96
Iron	8	8	100	2 - 20	18,000	25,000	21,775	2,279
Lead	8	8	100	0.37 - 1	20.0	29.3	25.4	3.20
Lithium	8	8	100	0.41 - 20	7.70	18.0	14.1	3.24
Magnesium	8	8	100	5 - 1,000	3,930	5,400	4,645	605
Manganese	8	8	100	0.11 - 3	321	520	396	65.5
Mercury	4	8	50.0	0.0064 - 0.1	0.040	0.068	0.047	0.009
Molybdenum	4	8	50.0	0.35 - 40	0.680	1.10	2.14	1.41
Nickel	7	8	87.5	0.33 - 8	15.4	25.6	18.2	5.36
Potassium	8	8	100	56 - 1,000	1,690	3,440	2,583	613
Selenium	1	8	12.5	1 - 1.9	1.80	1.80	0.673	0.500
Silica	4	4	100	6 - 9.6	1,300	2,000	1,725	310
Sodium	8	8	100	80 - 1,000	240	850	377	195
Strontium	8	8	100	0.087 - 40	53.0	140	80.7	27.2
Tin	4	8	50.0	1.2 - 40	2.00	3.90	9.54	7.40
Titanium	4	4	100	0.19 - 0.31	140	170	150	14.1
Vanadium	8	8	100	0.84 - 10	39.6	62.7	50.0	8.17
Zinc	8	8	100	0.48 - 4	120	540	192	142
Organics (ug/kg)								
2-Butanone	4	4	100	10 - 10	2.00	4.00	2.75	0.957
Benzo(a)pyrene	3	4	75.0	330 - 330	150	240	214	66.5
Benzo(b)fluoranthene	4	4	100	330 - 330	240	370	278	62.4
bis(2-ethylhexyl)phthalate	1	4	25.0	330 - 330	570	570	413	142
Chrysene	4	4	100	330 - 330	170	250	193	38.6
Fluoranthene	4	4	100	330 - 330	360	540	423	80.2
PCB-1254	1	8	12.5	160 - 450	45.0	45.0	151	57.6
Phenanthrene	4	4	100	330 - 330	170	260	208	37.7
Pyrene	4	4	100	330 - 330	290	460	355	73.3
Toluene	4	4	100	5 - 5	6.00	62.0	32.5	25.6
Radionuclides (pCi/g)								
Americium-241	8	8	100	0 - 0.201	0.155	0.666	0.367	0.158
Cesium-137	4	4	100	0.05 - 0.07	0.083	0.288	0.202	0.086
Gross Alpha	4	4	100	2.44 - 3	15.3	22.4	18.1	3.17
Gross Beta	4	4	100	2.23 - 2.46	27.1	30.2	28.7	1.44
Plutonium-239/240	8	8	100	0 - 0.415	0.323	2.05	0.936	0.536
Strontium-89/90	4	4	100	0.04 - 0.06	0.124	0.162	0.142	0.020

Table A8.6
Summary of Sediment ECOI Data for Pond A-3

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Uranium-233/234	8	8	100	0.032 - 0.779	0.527	1.59	1.24	0.349
Uranium-235	8	8	100	0 - 0.993	-0.052	0.149	0.042	0.055
Uranium-238	8	8	100	0.022 - 0.709	1.04	1.63	1.26	0.184

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Table A8.7
Summary of Sediment ECOI Data for Pond A-4

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	12	12	100	5.5 - 40	6,200	26,000	16,597	5,801
Antimony	4	12	33.3	0.43 - 12	0.740	41.4	9.77	14.8
Arsenic	12	12	100	0.75 - 2	3.80	10.2	6.33	1.80
Barium	12	12	100	0.14 - 40	120	206	166	31.2
Beryllium	10	12	83.3	0.17 - 1	0.870	1.20	0.927	0.192
Boron	8	8	100	1.1 - 1.6	6.50	10.0	7.69	1.27
Cadmium	9	12	75.0	0.028 - 1	0.350	3.10	0.800	0.804
Calcium	12	12	100	7 - 1,000	4,300	38,000	13,051	10,399
Cesium	4	4	100	200 - 200	2.10	5.50	3.85	1.61
Chromium	10	12	83.3	0.31 - 2	4.70	27.0	16.6	7.47
Cobalt	12	12	100	0.11 - 10	7.40	13.9	9.53	2.24
Copper	12	12	100	0.63 - 5	9.70	33.4	18.2	5.86
Iron	12	12	100	1.7 - 20	16,000	55,000	21,392	10,809
Lead	12	12	100	0.31 - 1	12.0	35.9	20.6	6.08
Lithium	9	12	75.0	0.34 - 20	5.70	19.0	11.5	5.17
Magnesium	12	12	100	4.2 - 1,000	1,900	5,220	3,780	1,006
Manganese	12	12	100	0.088 - 3	220	630	349	115
Mercury	8	12	66.7	0.0053 - 0.1	0.016	0.035	0.034	0.020
Molybdenum	6	12	50.0	0.29 - 40	0.390	0.930	1.63	1.97
Nickel	11	12	91.7	0.27 - 8	15.0	25.5	18.2	3.59
Nitrate / Nitrite	2	2	100	0.2 - 0.2	2.43	2.50	2.47	0.049
Potassium	9	12	75.0	46 - 1,000	940	4,300	2,194	1,175
Selenium	3	12	25.0	0.97 - 1.4	1.60	1.90	0.790	0.581
Silica	8	8	100	5 - 7	590	980	790	143
Sodium	8	12	66.7	67 - 1,000	79.0	486	192	140
Strontium	12	12	100	0.072 - 40	31.0	140	73.2	29.9
Thallium	2	12	16.7	0.73 - 2	0.350	0.580	0.405	0.105
Titanium	8	8	100	0.16 - 0.22	62.0	160	107	37.6
Vanadium	12	12	100	0.7 - 10	25.7	59.0	42.8	10.4
Zinc	12	12	100	0.4 - 4	46.0	169	84.1	33.6
Organics (ug/kg)								
Atrazine	1	1	100	50 - 50	120	120	120	
Benzene	1	4	25.0	5 - 5	3.00	3.00	4.63	2.59
bis(2-ethylhexyl)phthalate	2	4	50.0	330 - 330	170	950	399	369
Toluene	2	4	50.0	5 - 5	5.00	8.00	5.00	2.12
Radionuclides (pCi/g)								
Americium-241	12	12	100	0 - 0.128	-0.015	0.173	0.070	0.059
Cesium-137	4	4	100	0.05 - 0.07	0.297	0.598	0.430	0.127
Gross Alpha	4	4	100	2.07 - 2.91	11.3	17.0	13.3	2.59
Gross Beta	4	4	100	2.27 - 2.45	25.4	29.0	27.6	1.66
Plutonium-239/240	12	12	100	0 - 0.126	-0.009	0.498	0.153	0.160
Strontium-89/90	4	4	100	0.04 - 0.06	0.468	1.80	1.24	0.585
Uranium-233/234	12	12	100	0.025 - 0.263	0.500	1.68	1.19	0.320
Uranium-235	12	12	100	0 - 0.296	0.023	0.243	0.109	0.071
Uranium-238	12	12	100	0 - 0.272	0.802	1.67	1.28	0.261

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Table A8.8
Summary of Sediment ECOI Data for Pond A-5

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	9	9	100	7.4 - 40	7,710	21,000	12,434	4,678
Arsenic	9	9	100	1 - 2	3.40	4.60	3.92	0.387
Barium	9	9	100	0.18 - 40	120	220	159	29.9
Beryllium	4	9	44.4	0.23 - 1	0.630	1.20	0.686	0.300
Boron	4	4	100	1.5 - 2.4	5.20	11.0	7.68	2.52
Calcium	9	9	100	9.4 - 1,000	7,740	17,000	10,861	2,969
Chromium	9	9	100	0.41 - 2	8.30	21.0	13.3	4.45
Cobalt	9	9	100	0.15 - 10	6.20	13.3	9.60	2.14
Copper	9	9	100	0.85 - 5	11.0	22.0	17.2	2.92
Iron	9	9	100	2.3 - 20	13,000	22,000	15,911	2,751
Lead	9	9	100	0.41 - 1	13.0	21.0	17.2	2.59
Lithium	9	9	100	0.45 - 20	6.50	17.0	10.0	3.85
Magnesium	9	9	100	5.6 - 1,000	2,000	4,200	3,068	615
Manganese	9	9	100	0.12 - 3	130	330	230	61.2
Molybdenum	3	9	33.3	0.39 - 40	0.400	0.990	2.18	1.52
Nickel	8	9	88.9	0.36 - 8	12.0	19.0	15.4	3.36
Potassium	9	9	100	62 - 1,000	1,360	3,400	2,063	740
Silica	4	4	100	6.7 - 11	1,300	2,000	1,600	316
Silver	3	9	33.3	0.73 - 2	0.880	1.20	0.974	0.257
Sodium	8	9	88.9	89 - 1,000	138	790	285	212
Strontium	9	9	100	0.097 - 40	51.5	95.0	63.8	13.1
Thallium	3	9	33.3	0.99 - 2	0.610	0.690	0.516	0.214
Titanium	4	4	100	0.21 - 0.35	79.0	130	105	21.2
Vanadium	9	9	100	0.94 - 10	26.0	46.0	33.9	6.46
Zinc	9	9	100	0.53 - 4	55.0	130	75.7	22.3
Organics (ug/kg)								
2-Butanone	4	5	80.0	10 - 10	8.00	51.0	26.2	18.6
Acetone	2	5	40.0	10 - 10	130	210	114	60.1
Benzoic Acid	4	5	80.0	1,600 - 1,600	240	500	578	389
bis(2-ethylhexyl)phthalate	4	5	80.0	330 - 330	68.0	130	128	74.6
Methylene Chloride	1	5	20.0	5 - 5	18.0	18.0	8.50	5.85
Phenol	1	5	20.0	330 - 330	110	110	237	73.4
Toluene	5	5	100	5 - 5	3.00	18.0	13.6	6.27
Radionuclides (pCi/g)								
Americium-241	11	11	100	0 - 0.119	0.024	0.121	0.061	0.028
Cesium-137	5	5	100	0.086 - 0.103	0.003	0.100	0.038	0.048
Gross Alpha	5	5	100	1.6 - 2.6	21.0	28.3	24.3	3.11
Gross Beta	5	5	100	5.3 - 5.6	22.2	30.7	26.5	3.07
Plutonium-239/240	12	12	100	0 - 0.13	0.045	0.332	0.138	0.074
Uranium-233/234	12	12	100	0.019 - 0.306	0.780	1.33	1.03	0.166
Uranium-235	12	12	100	0 - 0.328	0.019	0.183	0.073	0.052
Uranium-238	12	12	100	0 - 0.279	0	1.44	0.975	0.336

Table A8.9
Summary of Sediment ECOI Data for Pond B-4

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	22	22	100	6 - 40	5,890	29,000	15,376	6,300
Antimony	5	18	27.8	0.46 - 12	0.730	25.6	4.24	8.11
Arsenic	22	22	100	0.8 - 2	4.40	9.10	6.58	1.57
Barium	22	22	100	0.15 - 40	110	230	171	32.0
Beryllium	15	22	68.2	0.18 - 1	0.550	2.20	0.955	0.522
Boron	14	14	100	1.2 - 2.6	4.10	30.0	9.14	6.64
Cadmium	19	22	86.4	0.03 - 1	0.130	44.0	3.24	9.13
Calcium	22	22	100	7.6 - 1,000	3,900	51,000	17,036	10,782
Cesium	7	8	87.5	200 - 200	1.40	3.50	2.26	0.945
Chromium	22	22	100	0.33 - 2	4.50	140	23.1	26.9
Cobalt	22	22	100	0.12 - 10	3.50	12.0	8.46	2.07
Copper	22	22	100	0.68 - 5	13.0	120	29.2	21.5
Iron	22	22	100	1.8 - 20	11,600	24,000	17,132	3,520
Lead	22	22	100	0.33 - 1	14.0	110	38.1	21.9
Lithium	19	22	86.4	0.37 - 20	3.40	27.0	11.2	6.47
Magnesium	22	22	100	4.5 - 1,000	1,600	5,800	3,637	1,003
Manganese	22	22	100	0.095 - 3	110	350	244	67.3
Mercury	16	22	72.7	0.0057 - 0.1	0.013	1.70	0.145	0.350
Molybdenum	14	22	63.6	0.32 - 40	0.430	4.10	1.96	1.28
Nickel	21	22	95.5	0.29 - 8	8.70	31.0	16.9	5.25
Potassium	22	22	100	50 - 1,000	930	3,900	2,289	838
Selenium	3	22	13.6	1 - 2.3	1.50	3.60	0.780	0.734
Silica	14	14	100	5.4 - 12	860	1,700	1,164	233
Silver	11	22	50.0	0.58 - 130	0.780	3,100	149	660
Sodium	21	22	95.5	72 - 1,000	190	990	322	189
Strontium	22	22	100	0.078 - 40	40.0	150	76.5	29.3
Thallium	4	22	18.2	0.79 - 2	0.380	1.20	0.487	0.245
Tin	5	22	22.7	1 - 40	1.20	24.0	7.52	8.10
Titanium	14	14	100	0.17 - 0.37	53.0	190	124	40.6
Vanadium	22	22	100	0.76 - 10	20.9	63.0	38.7	10.8
Zinc	22	22	100	0.43 - 4	63.0	510	205	120
Organics (ug/kg)								
2-Butanone	3	5	60.0	10 - 10	3.00	11.0	7.00	2.92
Acenaphthene	1	22	4.55	21 - 330	110	110	333	181
Acetone	1	5	20.0	10 - 10	61.0	61.0	29.3	19.9
Anthracene	10	22	45.5	21 - 330	60.0	420	254	204
Benzo(a)anthracene	16	22	72.7	24 - 330	80.0	430	399	381
Benzo(a)pyrene	17	22	77.3	24 - 330	100	570	485	364
Benzo(b)fluoranthene	17	22	77.3	65 - 330	180	1,500	686	405
Benzo(g,h,i)perylene	10	22	45.5	19 - 330	90.0	320	449	441
Benzo(k)fluoranthene	12	22	54.5	49 - 330	200	540	546	421
bis(2-ethylhexyl)phthalate	18	22	81.8	38 - 330	300	25,000	2,916	5,360
Butylbenzylphthalate	2	22	9.09	52 - 330	66.0	110	576	424
Chrysene	18	22	81.8	33 - 330	74.0	650	510	363
Dibenz(a,h)anthracene	3	22	13.6	23 - 330	65.0	110	516	443
Di-n-octylphthalate	3	22	13.6	29 - 330	74.0	250	571	427
Fluoranthene	18	22	81.8	44 - 330	170	1,400	889	403

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Table A8.9
Summary of Sediment ECOI Data for Pond B-4

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Fluorene	1	22	4.55	22 - 330	94.0	94.0	560	421
gamma-BHC (Lindane)	1	7	14.3	8 - 8	25.0	25.0	9.00	7.11
Indeno(1,2,3-cd)pyrene	10	22	45.5	27 - 330	74.0	300	435	448
PCB-1254	15	27	55.6	8 - 370	120	3,100	322	611
Phenanthrene	18	22	81.8	21 - 330	110	760	537	367
Pyrene	16	22	72.7	160 - 710	310	1,200	806	340
Toluene	4	5	80.0	5 - 5	2.00	360	80.2	157
Radionuclides (pCi/g)								
Americium-241	22	22	100	0 - 0.802	0.027	56.5	5.00	12.3
Cesium-137	8	8	100	0.04 - 0.07	0.090	0.832	0.270	0.240
Gross Alpha	8	8	100	2.08 - 2.8	16.9	49.0	26.6	12.0
Gross Beta	8	8	100	2.27 - 2.64	25.0	30.8	26.8	1.81
Plutonium-239/240	21	21	100	0 - 0.666	-0.008	217	17.6	47.3
Radium-226	4	4	100	0.5 - 0.5	0.749	1.02	0.888	0.111
Radium-228	4	4	100	0.5 - 0.5	1.45	1.78	1.65	0.147
Strontium-89/90	4	4	100	0.05 - 0.07	0.155	0.217	0.174	0.029
Uranium-233/234	22	22	100	0.028 - 1.54	0.857	6.04	1.71	1.35
Uranium-235	22	22	100	0 - 1.96	-0.015	0.293	0.109	0.085
Uranium-238	22	22	100	0 - 1.76	0.939	8.51	1.97	1.81

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Table A8.10
Summary of Sediment ECOI Data for Pond B-5

Analyte	Num Detects	Num Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	14	14	100	3.2 - 40	2,600	24,000	14,671	5,804
Antimony	2	13	15.4	0.17 - 12	0.580	0.580	3.56	5.12
Arsenic	14	14	100	0.27 - 2	2.40	8.60	5.38	1.76
Barium	14	14	100	0.05 - 40	73.0	240	139	44.3
Beryllium	9	14	64.3	0.04 - 1	0.220	1.30	0.775	0.283
Boron	7	7	100	1.2 - 1.9	1.30	8.50	4.96	2.40
Cadmium	9	14	64.3	0.03 - 1	0.036	0.620	0.513	0.279
Calcium	14	14	100	0.98 - 1,000	4,000	16,900	8,871	3,319
Cesium	5	5	100	200 - 200	2.40	3.50	3.04	0.451
Chromium	14	14	100	0.08 - 2	5.00	27.0	16.3	6.04
Cobalt	14	14	100	0.1 - 10	4.70	11.0	7.81	2.02
Copper	14	14	100	0.17 - 5	4.40	29.9	17.9	7.12
Iron	14	14	100	1.5 - 20	5,400	22,000	15,550	4,499
Lead	14	14	100	0.17 - 1	6.90	36.8	19.9	8.61
Lithium	14	14	100	0.32 - 20	2.50	19.0	10.9	4.29
Magnesium	14	14	100	1.2 - 1,000	640	5,000	3,190	1,187
Manganese	14	14	100	0.05 - 3	58.0	350	226	77.5
Mercury	7	14	50.0	0.0057 - 0.1	0.017	0.086	0.041	0.022
Molybdenum	8	14	57.1	0.08 - 40	0.440	1.40	1.78	1.47
Nickel	14	14	100	0.08 - 8	8.00	23.8	15.8	4.33
Potassium	14	14	100	3.1 - 1,000	410	3,600	2,026	851
Selenium	3	13	23.1	0.26 - 1.6	0.720	1.60	0.643	0.350
Silica	7	7	100	5.3 - 8.3	490	1,300	867	273
Silver	4	14	28.6	0.09 - 2	0.340	1.40	0.738	0.451
Sodium	13	14	92.9	24.5 - 1,000	84.0	510	300	136
Strontium	14	14	100	0.05 - 40	16.0	87.0	53.6	18.5
Thallium	3	14	21.4	0.25 - 2	0.450	0.720	0.410	0.196
Tin	2	14	14.3	0.31 - 40	1.90	39.5	8.39	12.0
Titanium	7	7	100	0.17 - 0.26	43.0	160	108	46.5
Vanadium	14	14	100	0.25 - 10	11.0	51.0	36.3	11.4
Zinc	14	14	100	0.12 - 4	22.0	240	103	56.6
Organics (ug/kg)								
2-Butanone	3	7	42.9	10 - 1,300	2.00	21.0	192	313
Acetone	1	7	14.3	10 - 1,300	87.0	87.0	205	305
bis(2-ethylhexyl)phthalate	2	5	40.0	330 - 330	180	270	306	142
Carbon Tetrachloride	2	7	28.6	5 - 1,300	390	440	122	201
Di-n-octylphthalate	1	5	20.0	330 - 330	240	240	253	20.2
Fluoranthene	2	5	40.0	330 - 330	84.0	190	203	71.4
Methylene Chloride	2	7	28.6	5 - 1,300	410	420	122	200
Pyrene	1	5	20.0	330 - 330	160	160	237	47.0
Toluene	5	6	83.3	5 - 1,300	12.0	47.0	129	256
Radionuclides (pCi/g)								
Americium-241	12	12	100	0 - 0.119	0.024	0.337	0.129	0.106
Cesium-137	5	5	100	0.05 - 0.06	0.032	0.187	0.093	0.057
Gross Alpha	5	5	100	2.15 - 3.56	13.0	34.0	18.7	8.63
Gross Beta	5	5	100	2.27 - 2.46	20.7	28.6	24.8	3.08
Plutonium-239/240	12	12	100	0 - 0.127	-0.002	0.895	0.315	0.253

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Table A8.10
Summary of Sediment ECOI Data for Pond B-5

Analyte	Num Detects	Num Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Radium-226	5	5	100	0.5 - 0.5	0.773	0.961	0.889	0.071
Radium-228	5	5	100	0.5 - 0.5	1.47	1.84	1.62	0.139
Strontium-89/90	5	5	100	0.01 - 0.06	0.111	0.579	0.369	0.199
Uranium-233/234	12	12	100	0 - 0.272	0.889	1.83	1.21	0.274
Uranium-235	12	12	100	0 - 0.31	-0.006	0.243	0.098	0.074
Uranium-238	12	12	100	0 - 0.339	0.759	1.53	1.15	0.238

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Table A8.11
Summary of Sediment ECOI Data for Pond C-1

Analyte	Num Detects	Num Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	7	7	100	8.9 - 40	13,000	32,000	23,643	7,341
Antimony	1	6	16.7	0.69 - 12	0.820	0.820	1.13	1.59
Arsenic	7	7	100	1.2 - 2	4.90	8.90	6.44	1.30
Barium	7	7	100	0.22 - 40	208	330	274	41.6
Beryllium	7	7	100	0.27 - 1	0.860	6.70	2.05	2.07
Boron	5	5	100	1.8 - 2.3	7.90	11.0	9.16	1.30
Cadmium	5	6	83.3	0.045 - 1	0.560	0.850	0.707	0.157
Calcium	7	7	100	11 - 1,000	7,000	19,000	11,300	4,629
Chromium	7	7	100	0.49 - 2	17.4	30.0	24.3	4.64
Cobalt	7	7	100	0.18 - 10	10.9	13.0	11.9	0.932
Copper	7	7	100	1 - 5	23.0	30.0	26.8	2.15
Iron	7	7	100	2.7 - 20	19,100	31,000	26,086	3,954
Lead	7	7	100	0.49 - 0.65	26.0	38.0	30.5	3.67
Lithium	7	7	100	0.55 - 20	12.4	28.0	20.4	5.38
Magnesium	7	7	100	6.7 - 1,000	3,540	5,800	4,607	691
Manganese	7	7	100	0.14 - 3	200	970	397	260
Mercury	7	7	100	0.0085 - 0.1	0.075	1.60	0.483	0.667
Molybdenum	3	6	50.0	0.47 - 40	0.830	2.00	1.06	0.831
Nickel	7	7	100	0.44 - 8	16.4	24.0	20.5	2.38
Nitrate / Nitrite	2	2	100	0.2 - 0.2	1.00	1.30	1.15	0.212
Potassium	7	7	100	75 - 1,000	2,320	4,200	3,167	662
Selenium	3	6	50.0	1 - 2.1	1.50	2.80	1.61	0.918
Silica	5	5	100	8 - 11	1,100	1,600	1,420	192
Sodium	4	7	57.1	110 - 1,000	23.3	290	124	108
Strontium	7	7	100	0.12 - 40	54.5	89.0	68.5	11.9
Thallium	2	6	33.3	1.2 - 2	7.70	10.0	3.66	4.10
Tin	2	7	28.6	1.6 - 40	11.0	11.0	5.86	3.60
Titanium	5	5	100	0.25 - 0.33	190	300	246	42.8
Vanadium	7	7	100	1.1 - 10	32.4	56.0	44.4	7.78
Zinc	7	7	100	0.64 - 4	95.2	140	109	14.9
Organics (ug/kg)								
1234678-HpCDF	2	2	100	0.00226 - 0.00271	8.07E-04	0.002	0.001	5.47E-04
123478-HxCDF	1	2	50.0	0.00226 - 0.00271	0.001	0.001	0.001	6.01E-05
123678-HxCDF	1	2	50.0	0.00226 - 0.00271	5.62E-04	5.62E-04	9.59E-04	5.61E-04
2,4-Dinitrophenol	1	6	16.7	220 - 1,600	890	890	2,873	1,088
234678-HxCDF	1	2	50.0	0.00226 - 0.00271	7.81E-04	7.81E-04	0.001	4.06E-04
23478-PeCDF	1	2	50.0	0.00226 - 0.00271	0.001	0.001	0.001	5.30E-05
4,6-Dinitro-2-methylphenol	1	6	16.7	290 - 1,600	750	750	2,850	1,139
Acenaphthene	3	6	50.0	31 - 330	74.0	360	335	142
Anthracene	5	6	83.3	31 - 330	90.0	450	373	147
Benzo(a)anthracene	4	6	66.7	36 - 330	69.0	190	297	293
Benzo(a)pyrene	3	6	50.0	36 - 330	66.0	170	386	324
Benzo(b)fluoranthene	2	6	33.3	97 - 330	170	180	492	265
Benzo(g,h,i)perylene	1	6	16.7	29 - 330	150	150	575	232
Benzo(k)fluoranthene	1	6	16.7	73 - 330	150	150	575	232
Benzoic Acid	2	7	28.6	510 - 1,600	190	410	2,579	1,583
Chrysene	4	6	66.7	49 - 330	65.0	190	294	295
Dibenz(a,h)anthracene	1	5	20.0	35 - 45	530	530	666	104

Table A8.11

Summary of Sediment ECOI Data for Pond C-1

Analyte	Num Detects	Num Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Di-n-butylphthalate	1	6	16.7	53 - 330	110	110	602	249
Fluoranthene	4	6	66.7	66 - 330	120	330	333	275
Heptachlorodibenzo-p-dioxin	2	2	100	0.00226 - 0.00271	0.003	0.005	0.004	0.002
Indeno(1,2,3-cd)pyrene	3	6	50.0	40 - 330	340	500	540	177
OCDD	2	2	100	0.00452 - 0.00542	0.013	0.031	0.022	0.012
OCDF	2	2	100	0.00452 - 0.00542	0.001	0.002	0.002	3.39E-04
PCB-1254	1	7	14.3	12 - 160	94.0	94.0	142	179
Pentachlorodibenzo-p-dioxin	1	2	50.0	0.00226 - 0.00271	3.72E-04	3.72E-04	8.64E-04	6.95E-04
Pentachlorophenol	1	6	16.7	200 - 1,600	950	950	2,883	1,066
Phenanthrene	5	6	83.3	31 - 330	310	360	367	67.4
Pyrene	1	6	16.7	240 - 330	310	310	602	176
Toluene	2	2	100	5 - 5	380	520	450	99.0
Radionuclides (pCi/g)								
Americium-241	9	9	100	0.005 - 0.11	0.059	0.442	0.169	0.125
Gross Alpha	4	4	100	2.2 - 3.5	37.0	59.0	45.5	9.75
Gross Beta	4	4	100	4.4 - 5.6	28.0	46.0	34.5	7.94
Plutonium-239/240	9	9	100	0.003 - 0.135	0.320	2.20	0.971	0.580
Uranium-233/234	9	9	100	0.012 - 0.203	1.70	3.50	2.35	0.687
Uranium-235	9	9	100	0.012 - 0.242	0.071	0.405	0.196	0.113
Uranium-238	9	9	100	0.012 - 0.23	1.30	3.36	2.15	0.666

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Table A8.12
Summary of Sediment ECOI Data for Pond C-2

Analyte	Num Detects	Num Samples	Detection Frequency (%)	Range of Reported Detection Limits	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration	Standard Deviation
Inorganics (mg/kg)								
Aluminum	11	11	100	5.3 - 40	4,460	22,000	13,069	6,157
Arsenic	11	11	100	0.71 - 2	2.50	9.80	5.75	1.94
Barium	11	11	100	0.13 - 40	70.0	226	152	52.9
Beryllium	9	10	90.0	0.16 - 1	0.470	1.20	0.803	0.325
Boron	8	8	100	1.1 - 1.5	3.60	10.0	6.21	2.05
Cadmium	1	10	10.0	0.027 - 1	0.130	0.130	0.178	0.327
Calcium	11	11	100	6.7 - 1,000	1,400	47,700	13,965	16,130
Chromium	11	11	100	0.29 - 2	7.00	25.0	15.1	5.78
Cobalt	11	11	100	0.11 - 10	4.00	12.0	8.53	2.52
Copper	11	11	100	0.6 - 5	6.40	35.9	18.2	8.62
Iron	11	11	100	1.6 - 20	8,090	29,000	18,563	5,590
Lead	11	11	100	0.29 - 0.6	9.70	34.6	19.7	7.73
Lithium	11	11	100	0.32 - 20	3.60	19.0	10.9	4.87
Magnesium	11	11	100	4 - 1,000	1,100	5,400	3,222	1,465
Manganese	11	11	100	0.084 - 3	250	602	431	122
Mercury	10	11	90.9	0.005 - 0.1	0.014	0.680	0.200	0.296
Molybdenum	7	10	70.0	0.28 - 40	0.400	1.10	0.880	0.581
Nickel	11	11	100	0.26 - 8	5.30	21.0	15.3	5.12
Nitrate / Nitrite	3	3	100	0.2 - 0.2	0.700	1.90	1.40	0.624
Potassium	11	11	100	44 - 1,000	1,100	3,900	2,270	967
Selenium	1	10	10.0	0.92 - 1.3	1.10	1.10	0.584	0.196
Silica	8	8	100	4.7 - 6.7	610	1,400	858	286
Sodium	9	11	81.8	63 - 1,000	76.3	460	175	124
Strontium	11	11	100	0.069 - 40	16.0	167	72.2	53.1
Titanium	8	8	100	0.15 - 0.21	53.0	160	104	35.0
Vanadium	11	11	100	0.67 - 10	14.3	50.0	34.5	10.7
Zinc	11	11	100	0.38 - 4	27.0	201	84.3	55.3
Organics (ug/kg)								
Benzoic Acid	1	2	50.0	1,600 - 1,600	240	240	2,620	3,366
Fluoranthene	1	2	50.0	330 - 330	140	140	595	643
Phenol	1	2	50.0	330 - 330	150	150	600	636
Toluene	3	3	100	5 - 5	340	410	373	35.1
Radionuclides (pCi/g)								
Americium-241	11	11	100	0.002 - 0.13	0.024	0.727	0.292	0.187
Gross Alpha	3	3	100	2.4 - 3.1	33.0	59.0	44.0	13.5
Gross Beta	3	3	100	4.9 - 5.2	32.0	44.0	39.0	6.24
Plutonium-239/240	11	11	100	0.002 - 0.106	0.027	2.96	1.58	0.795
Uranium-233/234	8	8	100	0.195 - 0.278	0.801	1.40	1.09	0.205
Uranium-235	8	8	100	0.198 - 0.355	0.037	0.247	0.130	0.075
Uranium-238	8	8	100	0.18 - 0.289	0.805	1.79	1.10	0.340

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Table A8.13
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-1

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	>Bkg	95th UTL>ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	29,000	11.0	11.0	34,291	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	30.4	11.0	2.00	30.4	18.2	Yes	Yes	N/A	Yes	Yes
Arsenic	9.79	9.30	11.0	11.0	10.4	100	No	--	--	--	No
Barium	189	230	11.0	11.0	230	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.50	11.0	9.00	2.03	81.8	N/A	--	--	--	N/A
Boron	N/A	12.0	7.00	7.00	16.8	100	N/A	--	--	--	N/A
Cadmium	0.990	8.30	11.0	8.00	11.4	72.7	Yes	Yes	N/A	Yes	Yes
Calcium	N/A	27,000	11.0	11.0	28,386	100	N/A	--	--	--	N/A
Cesium	N/A	5.80	4.00	4.00	10.8	100	N/A	--	--	--	N/A
Chromium	43.4	30.0	11.0	11.0	35.4	100	No	--	--	--	No
Cobalt	N/A	13.0	11.0	11.0	14.7	100	N/A	--	--	--	N/A
Copper	31.6	43.0	11.0	11.0	43.1	100	Yes	Yes	Yes	Yes	Yes
Iron	20,000	24,000	11.0	11.0	24,000	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	39.0	11.0	11.0	44.3	100	Yes	Yes	Yes	Yes	Yes
Lithium	N/A	22.0	11.0	7.00	45.1	63.6	N/A	--	--	--	N/A
Magnesium	N/A	5,300	11.0	11.0	6,626	100	N/A	--	--	--	N/A
Manganese	630	500	11.0	11.0	574	100	No	--	--	--	No
Mercury	0.180	0.470	11.0	11.0	0.583	100	Yes	Yes	N/A	Yes	Yes
Molybdenum	N/A	2.30	11.0	7.00	3.95	63.6	N/A	--	--	--	No
Nickel	22.7	26.4	11.0	9.00	26.4	81.8	Yes	Yes	Yes	Yes	Yes
Potassium	N/A	3,700	11.0	11.0	4,782	100	N/A	--	--	--	N/A
Selenium	0.950	1.80	11.0	3.00	1.80	27.3	Yes	Yes	Yes	Yes	Yes
Silica	N/A	1,500	7.00	7.00	1,767	100	N/A	--	--	--	N/A
Silver	1.00	2.00	11.0	3.00	2.11	27.3	Yes	--	--	--	Yes
Sodium	N/A	1,200	11.0	11.0	1,157	100	N/A	--	--	--	N/A
Strontium	N/A	140	11.0	11.0	157	100	N/A	--	--	--	N/A
Tin	N/A	1.80	11.0	6.00	18.8	54.5	N/A	--	--	--	No
Titanium	N/A	170	7.00	7.00	246	100	N/A	--	--	--	N/A
Vanadium	N/A	57.0	11.0	11.0	64.4	100	N/A	--	--	--	N/A
Zinc	121	140	11.0	11.0	171	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
1234678-HpCDF	TEQ	0.030	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
1234789-HpCDF	TEQ	0.002	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
123478-HxCDD	TEQ	0.001	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
123478-HxCDF	TEQ	0.004	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
123678-HxCDD	TEQ	0.005	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
123678-HxCDF	TEQ	0.003	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
123789-HxCDD	TEQ	0.003	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
12378-PeCDF	TEQ	0.002	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
234678-HxCDF	TEQ	0.002	1.00	1.00	N/A	100	N/A	--	--	--	TEQ

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Table A8.13
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-1

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
23478-PeCDF	TEQ	0.004	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
2378-TCDD	0.009	0.003	1.00	1.00	N/A	100	No	--	--	--	No
2378-TCDF	TEQ	0.006	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
2-Butanone	84.2	19.0	5.00	4.00	N/A	80.0	No	--	--	--	No
4-Methyl-2-pentanone	N/A	6.00	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
Acenaphthene	6.71	89.0	11.0	1.00	383	9.09	Yes	Yes	N/A	Yes	Yes
Acetone	N/A	11.0	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
Anthracene	57.2	88.0	11.0	3.00	412	27.3	Yes	Yes	N/A	Yes	Yes
Benzo(a)anthracene	108	270	11.0	9.00	532	81.8	Yes	Yes	N/A	Yes	Yes
Benzo(a)pyrene	150	310	11.0	8.00	599	72.7	Yes	Yes	N/A	Yes	Yes
Benzo(b)fluoranthene	N/A	420	11.0	8.00	N/A	72.7	N/A	--	--	--	N/A
Benzo(g,h,i)perylene	13.0	210	11.0	7.00	613	63.6	Yes	Yes	N/A	Yes	Yes
Benzo(k)fluoranthene	240	200	11.0	8.00	N/A	72.7	No	--	--	--	No
bis(2-ethylhexyl)phthalate	24,900	360	11.0	4.00	N/A	36.4	No	--	--	--	No
Chrysene	166	350	11.0	9.00	554	81.8	Yes	Yes	N/A	Yes	Yes
Di-n-octylphthalate	N/A	130	11.0	2.00	N/A	18.2	N/A	--	--	--	N/A
Fluoranthene	423	790	11.0	9.00	889	81.8	Yes	Yes	N/A	Yes	Yes
Heptachlorodibenzo-p-dioxin	N/A	0.095	1.00	1.00	N/A	100	N/A	--	--	--	N/A
Indeno(1,2,3-cd)pyrene	17.0	210	11.0	8.00	535	72.7	Yes	Yes	N/A	Yes	Yes
Methylene Chloride	N/A	3.70	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
OCDD	TEQ	0.539	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
OCDF	TEQ	0.041	1.00	1.00	N/A	100	N/A	--	--	--	TEQ
Aroclor-1254	60.0	5,200	15.0	10.0	2,868	66.7	Yes	Yes	N/A	Yes	Yes
Aroclor-1260	05.0	150	15.0	1.00	265	6.67	Yes	Yes	N/A	Yes	Yes
Phenanthrene	204	520	11.0	9.00	695	81.8	Yes	Yes	N/A	Yes	Yes
Phenol	773	54.0	11.0	1.00	N/A	9.09	No	--	--	--	No
Pyrene	195	710	11.0	4.00	710	36.4	Yes	Yes	N/A	Yes	Yes
Toluene	1,660	280	5.00	4.00	N/A	80.0	No	--	--	--	No
Total PCBs	40.0	5,200	N/A	N/A	5,221	N/A	Yes	N/A	N/A	Yes	Yes
Total PAHs	1,610	6,230	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	13.2	15.0	15.0	13.2	100	No	--	--	--	No
Cesium-134	N/A	0.050	4.00	4.00	0.050	100	N/A	--	--	--	No
Cesium-137	3,120	0.685	8.00	8.00	0.851	100	No	--	--	--	No
Gross Alpha	N/A	70.7	8.00	8.00	92.2	100	N/A	--	--	--	N/A
Gross Beta	N/A	31.5	8.00	8.00	32.9	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	36.2	15.0	15.0	36.2	100	No	--	--	--	No
Radium-226	101	2.10	4.00	4.00	2.45	100	No	--	--	--	No
Radium-228	87.8	1.83	4.00	4.00	2.13	100	No	--	--	--	No
Strontium-89/90	582	0.827	5.00	5.00	1.33	100	No	--	--	--	No
Uranium-233/234	5,280	3.87	15.0	15.0	3.87	100	No	--	--	--	No

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Table A8.13
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-1

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Uranium-235	3,730	0.352	15.0	9.00	0.352	60.0	No	--	--	--	No
Uranium-238	2,490	5.35	15.0	15.0	5.02	100	No	--	--	--	No

TEQ = Dioxin and furan cogeners were evaluated using a total equivalent quotient. Summary values are provided in tables.
N/A = Not applicable; ESL not available.
-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

Table A8.14
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-2

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	49,000	10.0	10.0	51,022	100	Yes	Yes	Yes	Yes	Yes
Arsenic	9.79	12.0	10.0	10.0	15.6	100	Yes	Yes	Yes	Yes	Yes
Barium	189	390	10.0	10.0	441	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	2.50	10.0	7.00	2.81	70.0	N/A	--	--	--	N/A
Boron	N/A	26.0	7.00	7.00	31.9	100	N/A	--	--	--	N/A
Cadmium	0.990	3.20	10.0	7.00	3.20	70.0	Yes	Yes	N/A	Yes	Yes
Calcium	N/A	43,000	10.0	10.0	48,146	100	N/A	--	--	--	N/A
Chromium	43.4	44.0	10.0	10.0	52.9	100	Yes	Yes	Yes	Yes	Yes
Cobalt	N/A	15.0	10.0	10.0	16.9	100	N/A	--	--	--	N/A
Copper	31.6	56.0	10.0	10.0	63.8	100	Yes	Yes	Yes	Yes	Yes
Iron	20,000	39,000	10.0	10.0	42,822	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	45.0	10.0	10.0	54.8	100	Yes	Yes	Yes	Yes	Yes
Lithium	N/A	37.0	10.0	10.0	41.9	100	N/A	--	--	--	N/A
Magnesium	N/A	11,000	10.0	10.0	11,225	100	N/A	--	--	--	N/A
Manganese	630	1,100	10.0	10.0	1,519	100	Yes	Yes	Yes	Yes	Yes
Mercury	0.180	0.150	10.0	7.00	0.171	70.0	No	--	--	--	No
Molybdenum	N/A	5.40	10.0	6.00	7.37	60.0	N/A	--	--	--	No
Nickel	22.7	34.0	10.0	9.00	40.2	90.0	Yes	Yes	Yes	Yes	Yes
Potassium	N/A	6,500	10.0	10.0	6,882	100	N/A	--	--	--	N/A
Silica	N/A	4,900	7.00	7.00	6,300	100	N/A	--	--	--	N/A
Silver	1.00	3.90	10.0	4.00	3.90	40.0	Yes	Yes	N/A	Yes	Yes
Sodium	N/A	2,100	10.0	10.0	2,154	100	N/A	--	--	--	N/A
Strontium	N/A	220	10.0	10.0	269	100	N/A	--	--	--	N/A
Tin	N/A	2.70	10.0	1.00	81.6	10.0	N/A	--	--	--	N/A
Titanium	N/A	310	7.00	7.00	378	100	N/A	--	--	--	N/A
Uranium	N/A	20.0	7.00	3.00	30.4	42.9	N/A	--	--	--	N/A
Vanadium	N/A	96.0	10.0	10.0	102	100	N/A	--	--	--	N/A
Zinc	121	170	10.0	10.0	208	100	Yes	Yes	Yes	Yes	Yes
Oranics (ug/kg)											
1234678-HpCDF	TEQ	0.003	3.00	2.00	N/A	66.7	N/A	--	--	--	N/A
1234789-HpCDF	TEQ	7.70E-04	3.00	2.00	N/A	66.7	N/A	--	--	--	N/A
123478-HxCDF	TEQ	5.66E-04	3.00	2.00	N/A	66.7	N/A	--	--	--	N/A
123678-HxCDD	TEQ	0.001	3.00	1.00	N/A	33.3	N/A	--	--	--	N/A
123789-HxCDD	TEQ	0.001	3.00	1.00	N/A	33.3	N/A	--	--	--	N/A
123789-HxCDF	TEQ	5.53E-04	3.00	1.00	N/A	33.3	N/A	--	--	--	N/A
2-Butanone	84.2	71.0	6.00	3.00	N/A	50.0	No	--	--	--	No
Acenaphthene	6.71	180	10.0	1.00	1,028	10.0	Yes	Yes	N/A	Yes	Yes
Acetone	N/A	400	6.00	4.00	N/A	66.7	N/A	--	--	--	N/A
Anthracene	57.2	210	10.0	1.00	1,022	10.0	Yes	Yes	N/A	Yes	Yes
Benzo(a)anthracene	108	52.0	10.0	1.00	N/A	10.0	No	--	--	--	No
Benzo(a)pyrene	150	80.0	10.0	2.00	N/A	20.0	No	--	--	--	No

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Table A8.14
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-2

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Benzo(b)fluoranthene	N/A	64.0	10.0	1.00	N/A	10.0	N/A	--	--	--	N/A
Benzoic Acid	N/A	2,700	10.0	3.00	N/A	30.0	N/A	--	--	--	N/A
bis(2-ethylhexyl)phthalate	24,900	47,000	10.0	9.00	80,294	90.0	Yes	Yes	N/A	Yes	Yes
Chrysene	166	81.0	10.0	2.00	N/A	20.0	No	--	--	--	No
Fluoranthene	423	140	10.0	2.00	N/A	20.0	No	--	--	--	No
Heptachlorodibenzo-p-dioxin	TEQ	0.020	3.00	2.00	N/A	66.7	N/A	--	--	--	TEQ
Indeno(1,2,3-cd)pyrene	17.0	210	10.0	1.00	2,186	10.0	Yes	Yes	N/A	Yes	Yes
Methylene Chloride	N/A	9.30	6.00	3.00	N/A	50.0	N/A	--	--	--	N/A
OCDD	TEQ	0.161	3.00	3.00	N/A	100	N/A	Yes	N/A	N/A	TEQ
OCDF	TEQ	0.009	3.00	2.00	N/A	66.7	N/A	Yes	N/A	N/A	TEQ
Aroclor-1254	60.0	130	12.0	4.00	202	33.3	Yes	Yes	N/A	Yes	Yes
Phenanthrene	204	190	10.0	2.00	N/A	20.0	No	--	--	--	No
Pyrene	195	83.0	10.0	2.00	N/A	20.0	No	--	--	--	No
Toluene	1,660	860	6.00	3.00	N/A	50.0	No	--	--	--	No
Total PCBs	40.0	185	N/A	N/A	185.00	N/A	Yes	N/A	N/A	Yes	Yes
Total PAHs	1,610	22,800	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	3.47	12.0	12.0	3.47	100	No	--	--	--	No
Cesium-134	N/A	0.100	3.00	3.00	0.100	100	N/A	--	--	--	No
Cesium-137	3,120	0.610	6.00	6.00	0.971	100	No	--	--	--	No
Gross Alpha	N/A	45.6	6.00	6.00	55.5	100	N/A	--	--	--	N/A
Gross Beta	N/A	32.7	6.00	6.00	35.9	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	10.5	13.0	13.0	9.72	100	No	--	--	--	No
Radium-226	101	3.08	3.00	3.00	3.08	100	No	--	--	--	No
Radium-228	87.8	1.89	3.00	3.00	1.89	100	No	--	--	--	No
Strontium-89/90	582	0.779	3.00	3.00	0.779	100	No	--	--	--	No
Uranium-233/234	5,280	3.70	13.0	13.0	4.28	100	No	--	--	--	No
Uranium-235	3,730	0.285	13.0	7.00	0.357	53.8	No	--	--	--	No
Uranium-238	2,490	6.10	13.0	13.0	7.36	100	No	--	--	--	No

TEQ = Dioxin and furan cogeners were evaluated using a total equivalent quotient. Summary values are provided in Tables A.26 and A.27.
N/A = Not applicable; ESL not available.
-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

Table A8.15
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-3

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	27,400	8.00	8.00	33,572	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	26.0	7.00	1.00	26.0	14.3	Yes	Yes	N/A	Yes	Yes
Arsenic	9.79	7.80	8.00	8.00	8.91	100	No	--	--	--	No
Barium	189	200	8.00	8.00	213	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.30	8.00	4.00	1.67	50.0	N/A	--	--	--	N/A
Boron	N/A	9.90	4.00	4.00	15.9	100	N/A	--	--	--	N/A
Cadmium	0.990	0.490	8.00	4.00	1.05	50.0	No	--	--	--	No
Calcium	N/A	51,000	8.00	8.00	69,727	100	N/A	--	--	--	N/A
Cesium	N/A	4.90	4.00	4.00	7.18	100	N/A	--	--	--	N/A
Chromium	43.4	29.9	8.00	8.00	35.4	100	No	--	--	--	No
Cobalt	N/A	15.5	8.00	8.00	17.8	100	N/A	--	--	--	N/A
Copper	31.6	24.1	8.00	8.00	27.2	100	No	--	--	--	No
Iron	20,000	25,000	8.00	8.00	27,659	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	29.3	8.00	8.00	33.7	100	No	--	--	--	No
Lithium	N/A	18.0	8.00	8.00	22.5	100	N/A	--	--	--	N/A
Magnesium	N/A	5,400	8.00	8.00	6,207	100	N/A	--	--	--	N/A
Manganese	630	520	8.00	8.00	566	100	No	--	--	--	No
Mercury	0.180	0.068	8.00	4.00	0.068	50.0	No	--	--	--	No
Molybdenum	N/A	1.10	8.00	4.00	3.65	50.0	N/A	--	--	--	No
Nickel	22.7	25.6	8.00	7.00	32.1	87.5	Yes	--	--	--	Yes
Potassium	N/A	3,440	8.00	8.00	4,164	100	N/A	--	--	--	N/A
Selenium	0.950	1.80	8.00	1.00	1.80	12.5	Yes	--	--	--	N/A
Silica	N/A	2,000	4.00	4.00	3,013	100	N/A	--	--	--	Yes
Sodium	N/A	850	8.00	8.00	850	100	N/A	--	--	--	N/A
Strontium	N/A	140	8.00	8.00	140	100	N/A	--	--	--	N/A
Tin	N/A	3.90	8.00	4.00	17.4	50.0	N/A	--	--	--	N/A
Titanium	N/A	170	4.00	4.00	209	100	N/A	--	--	--	No
Vanadium	N/A	62.7	8.00	8.00	71.1	100	N/A	--	--	--	N/A
Zinc	121	540	8.00	8.00	540	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
2-Butanone	84.2	4.00	4.00	4.00	N/A	100	No	--	--	--	No
Benzo(a)pyrene	150	240	4.00	3.00	491	75.0	Yes	Yes	N/A	Yes	Yes
Benzo(b)fluoranthene	N/A	370	4.00	4.00	N/A	100	N/A	--	--	--	N/A
bis(2-ethylhexyl)phthalate	24,900	570	4.00	1.00	N/A	25.0	No	--	--	--	No
Chrysene	166	250	4.00	4.00	250	100	Yes	Yes	N/A	Yes	Yes
Fluoranthene	423	540	4.00	4.00	756	100	Yes	Yes	N/A	Yes	Yes
Aroclor-1254	60.0	45.0	8.00	1.00	300	12.5	No	Yes	N/A	Yes	Yes
Phenanthrene	204	260	4.00	4.00	365	100	Yes	Yes	N/A	Yes	No
Pyrene	195	460	4.00	4.00	660	100	Yes	Yes	N/A	Yes	Yes
Toluene	1,660	62.0	4.00	4.00	N/A	100	No	--	--	--	No
Total PCBs	40.0	225	N/A	N/A	225	N/A	Yes	N/A	N/A	Yes	Yes
Total PAHs	1,610	4,480	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes

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Table A8.15
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-3

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
Radionuclides (pCi/g)											
Americium-241	5,150	0.666	8.00	8.00	0.775	100	No	--	--	--	No
Cesium-137	3,120	0.288	4.00	4.00	0.560	100	No	--	--	--	No
Gross Alpha	N/A	22.4	4.00	4.00	31.3	100	N/A	Yes	No	--	No
Gross Beta	N/A	30.2	4.00	4.00	34.6	100	N/A	Yes	No	--	No
Plutonium-239/240	5,860	2.05	8.00	8.00	2.32	100	No	--	--	--	No
Strontium-89/90	582	0.162	4.00	4.00	0.227	100	No	--	--	--	No
Uranium-233/234	5,280	1.59	8.00	7.00	2.15	87.5	No	--	--	--	No
Uranium-235	3,730	0.060	8.00	4.00	0.184	50.0	No	--	--	--	No
Uranium-238	2,490	1.63	8.00	8.00	1.74	100	No	--	--	--	No

N/A = Not applicable; ESL not available.

-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

Table A8.16
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-4

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	26,000	12.0	12.0	29,418	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	41.4	12.0	4.00	41.4	33.3	Yes	Yes	N/A	Yes	Yes
Arsenic	9.79	10.2	12.0	12.0	10.3	100	Yes	Yes	Yes	Yes	Yes
Barium	189	206	12.0	12.0	235	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.20	12.0	10.0	1.20	83.3	N/A	--	--	--	N/A
Boron	N/A	10.0	8.00	8.00	11.0	100	N/A	--	--	--	N/A
Cadmium	0.990	3.10	12.0	9.00	3.10	75.0	Yes	Yes	N/A	Yes	Yes
Calcium	N/A	38,000	12.0	12.0	38,000	100	N/A	--	--	--	N/A
Cesium	N/A	5.50	4.00	4.00	10.6	100	N/A	--	--	--	N/A
Chromium	43.4	27.0	12.0	10.0	33.1	83.3	No	--	--	--	No
Cobalt	N/A	13.9	12.0	12.0	13.9	100	N/A	--	--	--	N/A
Copper	31.6	33.4	12.0	12.0	33.4	100	Yes	Yes	Yes	Yes	Yes
Iron	20,000	55,000	12.0	12.0	55,000	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	35.9	12.0	12.0	34.1	100	Yes	Yes	Yes	No	No
Lithium	N/A	19.0	12.0	9.00	23.0	75.0	N/A	--	--	--	N/A
Magnesium	N/A	5,220	12.0	12.0	6,004	100	N/A	--	--	--	N/A
Manganese	630	630	12.0	12.0	603	100	No	--	--	--	No
Mercury	0.180	0.035	12.0	8.00	0.085	66.7	No	--	--	--	No
Molybdenum	N/A	0.930	12.0	6.00	6.50	50.0	N/A	--	--	--	No
Nickel	22.7	25.5	12.0	11.0	26.1	91.7	Yes	Yes	Yes	Yes	Yes
Nitrate / Nitrite	N/A	2.50	2.00	2.00	N/A	100	N/A	--	--	--	N/A
Potassium	N/A	4,300	12.0	9.00	4,792	75.0	N/A	--	--	--	N/A
Selenium	0.950	1.90	12.0	3.00	1.90	25.0	Yes	Yes	Yes	Yes	Yes
Silica	N/A	980	8.00	8.00	1,159	100	N/A	--	--	--	N/A
Sodium	N/A	486	12.0	8.00	501	66.7	N/A	--	--	--	No
Strontium	N/A	140	12.0	12.0	139	100	N/A	--	--	--	N/A
Thallium	N/A	0.580	12.0	2.00	0.637	16.7	N/A	--	--	--	N/A
Titanium	N/A	160	8.00	8.00	204	100	N/A	--	--	--	N/A
Vanadium	N/A	59.0	12.0	12.0	65.9	100	N/A	--	--	--	N/A
Zinc	121	169	12.0	12.0	169	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
Atrazine	16.8	120	1.00	1.00	N/A	100	Yes	Yes	N/A	N/A	Yes
Benzene	260	3.00	4.00	1.00	N/A	25.0	No	--	--	--	No
bis(2-ethylhexyl)phthalate	24,900	950	4.00	2.00	N/A	50.0	No	--	--	--	No
Toluene	1,660	8.00	4.00	2.00	N/A	50.0	No	--	--	--	No
Total PAHs	1,610	6930.00	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	0.173	12.0	7.00	0.201	58.3	No	--	--	--	No
Cesium-137	3,120	0.598	4.00	4.00	0.959	100	No	--	--	--	No
Gross Alpha	N/A	17.0	4.00	4.00	24.1	100	N/A	--	--	--	No
Gross Beta	N/A	29.0	4.00	4.00	34.6	100	N/A	--	--	--	No

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Table A8.16
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-4

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Plutonium-239/240	5,860	0.498	12.0	8.00	0.507	66.7	No	--	--	--	No
Strontium-89/90	582	1.80	4.00	4.00	3.67	100	No	--	--	--	No
Uranium-233/234	5,280	1.68	12.0	12.0	1.90	100	No	--	--	--	No
Uranium-235	3,730	0.084	12.0	4.00	0.267	33.3	No	--	--	--	No
Uranium-238	2,490	1.67	12.0	12.0	1.85	100	No	--	--	--	No

N/A = Not applicable; ESL not available.
-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

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Table A8.17
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-5

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	21,000	9.00	9.00	23,912	100	Yes	Yes	Yes	Yes	Yes
Arsenic	9.79	4.60	9.00	9.00	4.87	100	No	--	--	--	No
Barium	189	220	9.00	9.00	233	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.20	9.00	4.00	1.42	44.4	N/A	--	--	--	N/A
Boron	N/A	11.0	4.00	4.00	18.1	100	N/A	--	--	--	N/A
Calcium	N/A	17,000	9.00	9.00	18,147	100	N/A	--	--	--	N/A
Chromium	43.4	21.0	9.00	9.00	24.2	100	No	--	--	--	No
Cobalt	N/A	13.3	9.00	9.00	14.9	100	N/A	--	--	--	N/A
Copper	31.6	22.0	9.00	9.00	24.4	100	No	--	--	--	No
Iron	20,000	22,000	9.00	9.00	22,661	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	21.0	9.00	9.00	23.6	100	No	--	--	--	No
Lithium	N/A	17.0	9.00	9.00	22.5	100	N/A	--	--	--	N/A
Magnesium	N/A	4,200	9.00	9.00	4,578	100	N/A	--	--	--	N/A
Manganese	630	330	9.00	9.00	380	100	No	--	--	--	No
Molybdenum	N/A	0.990	9.00	3.00	5.91	33.3	N/A	--	--	--	No
Nickel	22.7	19.0	9.00	8.00	23.6	88.9	No	--	--	--	No
Potassium	N/A	3,400	9.00	9.00	3,878	100	N/A	--	--	--	N/A
Silica	N/A	2,000	4.00	4.00	2,916	100	N/A	--	--	--	N/A
Silver	1.00	1.20	9.00	3.00	1.60	33.3	Yes	Yes	N/A	Yes	Yes
Sodium	N/A	790	9.00	8.00	790	88.9	N/A	--	--	--	N/A
Strontium	N/A	95.0	9.00	9.00	95.0	100	N/A	--	--	--	N/A
Thallium	N/A	0.690	9.00	3.00	1.04	33.3	N/A	--	--	--	N/A
Titanium	N/A	130	4.00	4.00	193	100	N/A	--	--	--	N/A
Vanadium	N/A	46.0	9.00	9.00	49.8	100	N/A	--	--	--	N/A
Zinc	121	130	9.00	9.00	135	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
2-Butanone	84.2	51.0	5.00	4.00	N/A	80.0	No	--	--	--	No
Acetone	N/A	210	5.00	2.00	N/A	40.0	N/A	--	--	--	N/A
Benzoic Acid	N/A	500	5.00	4.00	N/A	80.0	N/A	--	--	--	N/A
bis(2-ethylhexyl)phthalate	24,900	130	5.00	4.00	N/A	80.0	No	--	--	--	No
Methylene Chloride	N/A	18.0	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
Phenol	773	110	5.00	1.00	N/A	20.0	No	--	--	--	No
Toluene	1,660	18.0	5.00	5.00	N/A	100	No	--	--	--	No
Total PAHs	1,610	4200.0	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	0.121	11.0	8.00	0.124	72.7	No	--	--	--	No
Cesium-137	3,120	0.100	5.00	2.00	0.100	40.0	No	--	--	--	No
Gross Alpha	N/A	28.3	5.00	5.00	34.9	100	N/A	--	--	--	N/A
Gross Beta	N/A	30.7	5.00	5.00	36.9	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	0.332	12.0	12.0	0.332	100	No	--	--	--	No
Uranium-233/234	5,280	1.33	12.0	12.0	1.40	100	No	--	--	--	No

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Table A8.17

Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond A-5

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL?	ECOPC
Uranium-235	3,730	0.072	12.0	8.00	0.183	66.7	No	--	--	--	No
Uranium-238	2,490	1.44	12.0	12.0	1.44	100	No	--	--	--	No

N/A = Not applicable; ESL not available.

-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

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Table A8.18
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond B-4

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	29,000	22.0	22.0	27,260	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	25.6	18.0	5.00	25.6	27.8	Yes	Yes	N/A	Yes	Yes
Arsenic	9.79	9.10	22.0	22.0	9.55	100	No	--	--	--	No
Barium	189	230	22.0	22.0	230	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	2.20	22.0	15.0	1.94	68.2	N/A	--	--	--	N/A
Boron	N/A	30.0	14.0	14.0	23.1	100	N/A	--	--	--	N/A
Cadmium	0.990	44.0	22.0	19.0	9.64	86.4	Yes	Yes	N/A	Yes	Yes
Calcium	N/A	51,000	22.0	22.0	37,376	100	N/A	--	--	--	N/A
Cesium	N/A	3.50	8.00	7.00	4.70	87.5	N/A	--	--	--	N/A
Chromium	43.4	140	22.0	22.0	73.8	100	Yes	Yes	Yes	Yes	Yes
Cobalt	N/A	12.0	22.0	22.0	12.4	100	N/A	--	--	--	N/A
Copper	31.6	120	22.0	22.0	69.7	100	Yes	Yes	Yes	Yes	Yes
Iron	20,000	24,000	22.0	22.0	24,000	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	110	22.0	22.0	79.4	100	Yes	Yes	Yes	Yes	Yes
Lithium	N/A	27.0	22.0	19.0	35.8	86.4	N/A	--	--	--	N/A
Magnesium	N/A	5,800	22.0	22.0	5,530	100	N/A	--	--	--	N/A
Manganese	630	350	22.0	22.0	371	100	No	--	--	--	No
Mercury	0.180	1.70	22.0	16.0	0.806	72.7	Yes	Yes	N/A	Yes	Yes
Molybdenum	N/A	4.10	22.0	14.0	4.10	63.6	N/A	--	--	--	No
Nickel	22.7	31.0	22.0	21.0	31.0	95.5	Yes	Yes	Yes	Yes	Yes
Potassium	N/A	3,900	22.0	22.0	3,869	100	N/A	--	--	--	N/A
Selenium	0.950	3.60	22.0	3.00	3.60	13.6	Yes	Yes	N/A	Yes	Yes
Silica	N/A	1,700	14.0	14.0	1,655	100	N/A	--	--	--	N/A
Silver	1.00	3,100	22.0	11.0	1,393	50.0	Yes	Yes	N/A	Yes	Yes
Sodium	N/A	990	22.0	21.0	678	95.5	N/A	--	--	--	N/A
Strontium	N/A	150	22.0	22.0	132	100	N/A	--	--	--	N/A
Thallium	N/A	1.20	22.0	4.00	1.20	18.2	N/A	--	--	--	N/A
Tin	N/A	24.0	22.0	5.00	24.0	22.7	N/A	--	--	--	No
Titanium	N/A	190	14.0	14.0	210	100	N/A	--	--	--	N/A
Vanadium	N/A	63.0	22.0	22.0	59.2	100	N/A	--	--	--	N/A
Zinc	121	510	22.0	22.0	432	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
2-Butanone	84.2	11.0	5.00	3.00	N/A	60.0	No	--	--	--	No
Acenaphthene	6.71	110	22.0	1.00	675	4.55	Yes	No	--	--	No
Acetone	N/A	61.0	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
Anthracene	57.2	420	22.0	10.0	638	45.5	Yes	Yes	N/A	Yes	Yes
Benzo(a)anthracene	108	430	22.0	16.0	1,118	72.7	Yes	Yes	N/A	Yes	Yes
Benzo(a)pyrene	150	570	22.0	17.0	1,173	77.3	Yes	Yes	N/A	Yes	Yes
Benzo(b)fluoranthene	N/A	1,500	22.0	17.0	N/A	77.3	N/A	--	--	--	N/A
Benzo(g,h,i)perylene	13.0	320	22.0	10.0	1,281	45.5	Yes	Yes	N/A	Yes	Yes
Benzo(k)fluoranthene	240	540	22.0	12.0	1,800	54.5	Yes	Yes	N/A	Yes	Yes

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Table A8.18
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond B-4

Analyte	ESL	MDC	Number of Samples	Number of Detectionss	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
bis(2-ethylhexyl)phthalate	24,900	25,000	22.0	18.0	25,000	81.8	Yes	Yes	N/A	Yes	Yes
Butylbenzylphthalate	11,400	110	22.0	2.00	N/A	9.09	No	--	--	--	No
Chrysene	166	650	22.0	18.0	1,194	81.8	Yes	Yes	N/A	Yes	Yes
Dibenz(a,h)anthracene	33.0	110	22.0	3.00	1,800	13.6	Yes	Yes	N/A	Yes	Yes
Di-n-octylphthalate	N/A	250	22.0	3.00	N/A	13.6	N/A	--	--	--	N/A
Fluoranthene	423	1,400	22.0	18.0	1,649	81.8	Yes	Yes	N/A	Yes	Yes
Fluorene	77.4	94.0	22.0	1.00	1,800	4.55	Yes	No	--	--	No
gamma-BHC (Lindane)	2.37	25.0	7.00	1.00	25.0	14.3	Yes	Yes	N/A	Yes	Yes
Indeno(1,2,3-cd)pyrene	17.0	300	22.0	10.0	1,281	45.5	Yes	Yes	N/A	Yes	Yes
Aroclor-1254	60.0	3,100	27.0	15.0	1,479	55.6	Yes	Yes	N/A	Yes	Yes
Phenanthrene	204	760	22.0	18.0	1,230	81.8	Yes	Yes	N/A	Yes	Yes
Pyrene	195	1,200	22.0	16.0	1,800	72.7	Yes	Yes	N/A	Yes	Yes
Toluene	1,660	360	5.00	4.00	N/A	80.0	No	--	--	--	No
Total PAHs	40.0	3,100	N/A	N/A	3,100	N/A	Yes	N/A	N/A	Yes	Yes
Total PCBs	1,610	23,400	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	56.5	22.0	20.0	56.5	90.9	No	--	--	--	No
Cesium-137	3,120	0.832	8.00	8.00	0.890	100	No	--	--	--	No
Gross Alpha	N/A	49.0	8.00	8.00	57.4	100	N/A	--	--	--	N/A
Gross Beta	N/A	30.8	8.00	8.00	31.5	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	217	21.0	19.0	217	90.5	No	--	--	--	No
Radium-226	101	1.02	4.00	4.00	1.35	100	No	--	--	--	No
Radium-228	87.8	1.78	4.00	4.00	2.27	100	No	--	--	--	No
Strontium-89/90	582	0.217	4.00	4.00	0.295	100	No	--	--	--	No
Uranium-233/234	5,280	6.04	22.0	22.0	6.04	100	No	--	--	--	No
Uranium-235	3,730	0.143	22.0	8.00	0.293	36.4	No	--	--	--	No
Uranium-238	2,490	8.51	22.0	22.0	5.37	100	No	--	--	--	No

N/A = Not applicable; ESL not available.

-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

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Table A8.19
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond B-5

Analyte	ESL	MDC	Number of Samples	Number of Detections	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	24,000	14.0	14.0	26,912	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	0.580	13.0	2.00	13.6	15.4	No	--	--	--	No
Arsenic	9.79	8.60	14.0	14.0	9.08	100	No	--	--	--	No
Barium	189	240	14.0	14.0	240	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.30	14.0	9.00	1.37	64.3	N/A	--	--	--	N/A
Boron	N/A	8.50	7.00	7.00	11.6	100	N/A	--	--	--	N/A
Cadmium	0.990	0.620	14.0	9.00	2.72	64.3	No	--	--	--	No
Calcium	N/A	16,900	14.0	14.0	15,871	100	N/A	--	--	--	N/A
Cesium	N/A	3.50	5.00	5.00	4.57	100	N/A	--	--	--	N/A
Chromium	43.4	27.0	14.0	14.0	29.0	100	No	--	--	--	No
Cobalt	N/A	11.0	14.0	14.0	12.1	100	N/A	--	--	--	N/A
Copper	31.6	29.9	14.0	14.0	32.9	100	No	--	--	--	No
Iron	20,000	22,000	14.0	14.0	22,000	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	36.8	14.0	14.0	38.0	100	Yes	Yes	Yes	Yes	Yes
Lithium	N/A	19.0	14.0	14.0	29.0	100	N/A	--	--	--	N/A
Magnesium	N/A	5,000	14.0	14.0	5,692	100	N/A	--	--	--	N/A
Manganese	630	350	14.0	14.0	389	100	No	--	--	--	No
Mercury	0.180	0.086	14.0	7.00	0.087	50.0	No	--	--	--	No
Molybdenum	N/A	1.40	14.0	8.00	4.70	57.1	N/A	--	--	--	No
Nickel	22.7	23.8	14.0	14.0	23.8	100	Yes	Yes	Yes	Yes	Yes
Potassium	N/A	3,600	14.0	14.0	3,820	100	N/A	--	--	--	N/A
Selenium	0.950	1.60	13.0	3.00	1.60	23.1	Yes	Yes	Yes	Yes	Yes
Silica	N/A	1,300	7.00	7.00	1,619	100	N/A	--	--	--	N/A
Silver	1.00	1.40	14.0	4.00	1.69	28.6	Yes	Yes	N/A	Yes	Yes
Sodium	N/A	510	14.0	13.0	587	92.9	N/A	--	--	--	N/A
Strontium	N/A	87.0	14.0	14.0	92.5	100	N/A	--	--	--	N/A
Thallium	N/A	0.720	14.0	3.00	0.720	21.4	N/A	--	--	--	N/A
Tin	N/A	39.5	14.0	2.00	39.5	14.3	N/A	--	--	--	N/A
Titanium	N/A	160	7.00	7.00	236	100	N/A	--	--	--	N/A
Vanadium	N/A	51.0	14.0	14.0	60.3	100	N/A	--	--	--	N/A
Zinc	121	240	14.0	14.0	222	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
2-Butanone	84.2	21.0	7.00	3.00	N/A	42.9	No	--	--	--	No
Acetone	N/A	87.0	7.00	1.00	N/A	14.3	N/A	--	--	--	N/A
bis(2-ethylhexyl)phthalate	24,900	270	5.00	2.00	N/A	40.0	No	--	--	--	No
Carbon Tetrachloride	7,890	440	7.00	2.00	N/A	28.6	No	--	--	--	No
Di-n-octylphthalate	N/A	240	5.00	1.00	N/A	20.0	N/A	--	--	--	N/A
Fluoranthene	423	190	5.00	2.00	N/A	40.0	No	--	--	--	No
Methylene Chloride	N/A	420	7.00	2.00	N/A	28.6	N/A	--	--	--	N/A
Pyrene	195	160	5.00	1.00	N/A	20.0	No	--	--	--	No
Toluene	1,660	47.0	6.00	5.00	N/A	83.3	No	--	--	--	No

Table A8.19
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond B-5

Analyte	ESL	MDC	Number of Samples	Number of Detections	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL>ESL ?	ECOPC
Total PAHs	1,610	5,030	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	0.337	12.0	9.00	0.337	75.0	No	--	--	--	No
Cesium-137	3,120	0.187	5.00	5.00	0.287	100	No	--	--	--	No
Gross Alpha	N/A	34.0	5.00	5.00	48.1	100	N/A	--	--	--	N/A
Gross Beta	N/A	28.6	5.00	5.00	35.3	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	0.895	12.0	10.0	0.895	83.3	No	--	--	--	No
Radium-226	101	0.961	5.00	5.00	1.13	100	No	--	--	--	No
Radium-228	87.8	1.84	5.00	5.00	2.09	100	No	--	--	--	No
Strontium-89/90	582	0.579	5.00	5.00	1.05	100	No	--	--	--	No
Uranium-233/234	5,280	1.83	12.0	12.0	1.83	100	No	--	--	--	No
Uranium-235	3,730	0.243	12.0	6.00	0.243	50.0	No	--	--	--	No
Uranium-238	2,490	1.53	12.0	12.0	1.68	100	No	--	--	--	No

N/A = Not applicable; ESL not available.

-- = Screen not performed because analyte was eliminated from further consideration in a previous ECOPC step.

Table A8.20
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond C-1

Analyte	ESL	MDC	Number of Samples	Number of Detects	Pond UTL	% Detect	MDC > ESL?	Detection Frequency > 5%	> Bkg	95th UTL > ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	32,000	7	7	43,871	100	Yes	Yes	Yes	Yes	Yes
Antimony	2.00	0.820	6	1	4.35	16.7	No	--	--	--	No
Arsenic	9.79	8.90	7	7	10.0	100	No	--	--	--	No
Barium	189	330	7	7	389	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	6.70	7	7	6.70	100	N/A	--	--	--	N/A
Boron	N/A	11.0	5	5	13.6	100	N/A	--	--	--	N/A
Cadmium	0.990	0.850	6	5	1.18	83.3	No	--	--	--	No
Calcium	N/A	19,000	7	7	24,054	100	N/A	--	--	--	N/A
Chromium	43.4	30.0	7	7	37.1	100	No	--	--	--	No
Cobalt	N/A	13.0	7	7	14.5	100	N/A	--	--	--	N/A
Copper	31.6	30.0	7	7	32.7	100	No	--	--	--	No
Iron	20,000	31,000	7	7	36,981	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	38.0	7	7	40.6	100	Yes	Yes	Yes	Yes	Yes
Lithium	N/A	28.0	7	7	35.3	100	N/A	--	--	--	N/A
Magnesium	N/A	5,800	7	7	6,512	100	N/A	--	--	--	N/A
Manganese	630	970	7	7	1,380	100	Yes	Yes	Yes	Yes	Yes
Mercury	0.180	1.60	7	7	1.60	100	Yes	Yes	N/A	Yes	Yes
Molybdenum	N/A	2.00	6	3	3.56	50.0	N/A	--	--	--	No
Nickel	22.7	24.0	7	7	27.1	100	Yes	Yes	Yes	Yes	Yes
Nitrate / Nitrite	N/A	1.30	2	2		100	N/A	--	--	--	N/A
Potassium	N/A	4,200	7	7	4,991	100	N/A	--	--	--	N/A
Selenium	0.950	2.80	6	3	4.37	50.0	Yes	Yes	Yes	Yes	Yes
Silica	N/A	1,600	5	5	2,075	100	N/A	--	--	N/A	N/A
Sodium	N/A	290	7	4	290	57.1	N/A	--	--	--	No
Strontium	N/A	89.0	7	7	101	100	N/A	--	--	--	N/A
Thallium	N/A	10.0	6	2	10.0	33.3	N/A	--	--	--	N/A
Tin	N/A	11.0	7	2	11.0	28.6	N/A	--	--	--	No
Titanium	N/A	300	5	5	392	100	N/A	--	--	--	N/A
Vanadium	N/A	56.0	7	7	65.8	100	N/A	--	--	--	N/A
Zinc	121	140	7	7	140	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
1234678-HpCDF	TEQ	0.002	2	2	N/A	100	N/A	--	--	--	TEQ
123478-HxCDF	TEQ	0.001	2	1	N/A	50.0	N/A	--	--	--	TEQ
123678-HxCDF	TEQ	5.62E-04	2	1	N/A	50.0	N/A	--	--	--	TEQ
2,4-Dinitrophenol	TEQ	890	6	1	N/A	16.7	N/A	--	--	--	TEQ
234678-HxCDF	TEQ	7.81E-04	2	1	N/A	50.0	N/A	--	--	--	TEQ
23478-PeCDF	TEQ	0.001	2	1	N/A	50.0	N/A	--	--	--	TEQ
4,6-Dinitro-2-methylphenol	N/A	750	6	1	N/A	16.7	N/A	--	--	--	TEQ
Acenaphthene	6.71	360	6	3	761	50.0	Yes	Yes	N/A	Yes	Yes
Anthracene	57.2	450	6	5	816	83.3	Yes	Yes	N/A	Yes	Yes
Benzo(a)anthracene	108	190	6	4	1,177	66.7	Yes	Yes	N/A	Yes	Yes
Benzo(a)pyrene	150	170	6	3	1,361	50.0	Yes	Yes	N/A	Yes	Yes
Benzo(b)fluoranthene	N/A	180	6	2	N/A	33.3	N/A	--	--	--	N/A
Benzo(g,h,i)perylene	13.0	150	6	1	1,272	16.7	Yes	Yes	N/A	Yes	Yes

Table A8.20
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond C-1

Analyte	ESL	MDC	Number of Samples	Number of Detects	Pond UTL	% Detect	MDC > ESL?	Detection Frequency > 5%	> Bkg	95th UTL > ESL?	ECOPC
Benzo(k)fluoranthene	240	150	6	1	N/A	16.7	No	--	--	--	No
Benzoic Acid	N/A	410	7	2	N/A	28.6	N/A	--	--	--	N/A
Chrysene	166	190	6	4	1,180	66.7	Yes	Yes	N/A	Yes	Yes
Dibenz(a,h)anthracene	33.0	530	5	1	1,020	20.0	Yes	Yes	N/A	Yes	Yes
Di-n-butylphthalate	612	110	6	1	N/A	16.7	No	--	--	--	No
Fluoranthene	423	330	6	4	N/A	66.7	No	--	--	--	No
Heptachlorodibenzo-p-dioxin	TEQ	0.005	2	2	N/A	100	N/A	--	--	--	TEQ
Indeno(1,2,3-cd)pyrene	17.0	500	6	3	1,071	50.0	Yes	Yes	N/A	Yes	Yes
OCDD	TEQ	0.031	2	2	N/A	100	N/A	--	--	--	TEQ
OCDF	TEQ	0.002	2	2	N/A	100	N/A	--	--	--	TEQ
Aroclor-1254	60.0	94.0	7	1	1,825	14.3	Yes	Yes	N/A	Yes	Yes
Pentachlorodibenzo-p-dioxin	TEQ	3.72E-04	2	1	N/A	50.0	N/A	--	--	--	TEQ
Pentachlorophenol	255	950	6	1	6,088	16.7	Yes	Yes	N/A	Yes	Yes
Phenanthrene	204	360	6	5	500	83.3	Yes	Yes	N/A	Yes	Yes
Pyrene	195	310	6	1	1,129	16.7	Yes	Yes	N/A	Yes	Yes
Toluene	1,660	520	2	2	N/A	100	No	--	--	--	No
PCBs	40.0	500	N/A	N/A	500	N/A	Yes	N/A	N/A	Yes	Yes
PAHs	1,610	9,985	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	0.442	9	9	0.442	100	No	--	--	--	No
Gross Alpha	N/A	59.0	4	4	86.1	100	N/A	Yes	Yes	N/A	N/A
Gross Beta	N/A	46.0	4	4	67.5	100	N/A	Yes	No	--	N/A
Plutonium-239/240	5,860	2.20	9	9	2.39	100	No	--	--	--	No
Uranium-233/234	5,280	3.50	9	9	4.42	100	No	--	--	--	No
Uranium-235	3,730	0.405	9	7	0.474	77.8	No	--	--	--	No
Uranium-238	2,490	3.36	9	9	3.78	100	No	--	--	--	No

TEQ = Dioxin and furan cogeners were evaluated using a total equivalent using a total equivalent quotient. Summary values are provided in Tables A.26 and A.27.

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Table A8.21
Summary of ECOPC Screening Steps for Sediment ECOPCs for Pond C-2

Analyte	ESL	MDC	Number of Samples	Number of Detects	Pond UTL	% Detect	MDC > ESL?	Detection Frequency >5%	> Bkg	95th UTL > ESL?	ECOPC
Inorganics (mg/kg)											
Aluminum	15,900	22,000	11	11	27,078	100	Yes	Yes	Yes	Yes	Yes
Arsenic	9.79	9.80	11	11	10.2	100	Yes	Yes	Yes	Yes	Yes
Barium	189	226	11	11	272	100	Yes	Yes	Yes	Yes	Yes
Beryllium	N/A	1.20	10	9	1.57	90.0	N/A	--	--	--	N/A
Boron	N/A	10.0	8	8	11.5	100	N/A	--	--	--	N/A
Cadmium	0.990	0.130	10	1	0.950	10.0	No	--	--	--	No
Calcium	N/A	47,700	11	11	47,700	100	N/A	--	--	--	N/A
Chromium	43.4	25.0	11	11	28.3	100	No	--	--	--	No
Cobalt	N/A	12.0	11	11	14.3	100	N/A	--	--	--	N/A
Copper	31.6	35.9	11	11	37.8	100	Yes	Yes	Yes	Yes	Yes
Iron	20,000	29,000	11	11	31,283	100	Yes	Yes	Yes	Yes	Yes
Lead	35.8	34.6	11	11	37.3	100	No	--	--	--	No
Lithium	N/A	19.0	11	11	21.9	100	N/A	--	--	--	N/A
Magnesium	N/A	5,400	11	11	6,554	100	N/A	--	--	--	N/A
Manganese	630	602	11	11	710	100	No	--	--	--	No
Mercury	0.180	0.680	11	10	3.35	90.9	Yes	Yes	N/A	Yes	Yes
Molybdenum	N/A	1.10	10	7	2.25	70.0	N/A	--	--	--	No
Nickel	22.7	21.0	11	11	27.0	100	No	--	--	--	No
Nitrate / Nitrite	N/A	1.90	3	3		100	N/A	--	--	--	N/A
Potassium	N/A	3,900	11	11	4,469	100	N/A	--	--	--	N/A
Selenium	0.950	1.10	10	1	1.10	10.0	Yes	Yes	N/A	Yes	Yes
Silica	N/A	1,400	8	8	1,775	100	N/A	--	--	--	N/A
Sodium	N/A	460	11	9	457	81.8	N/A	--	--	--	No
Strontium	N/A	167	11	11	193	100	N/A	--	--	--	N/A
Titanium	N/A	160	8	8	194	100	N/A	--	--	--	N/A
Vanadium	N/A	50.0	11	11	59.0	100	N/A	--	--	--	N/A
Zinc	121	201	11	11	210	100	Yes	Yes	Yes	Yes	Yes
Organics (ug/kg)											
Benzoic Acid	N/A	240	2	1		50.0	N/A	--	--	--	N/A
Fluoranthene	423	140	2	1		50.0	No	--	--	--	No
Phenol	773	150	2	1		50.0	No	--	--	--	No
Toluene	1,660	410	3	3		100	No	--	--	--	No
Total PAHs	1,610	14,700	N/A	N/A	N/A	N/A	Yes	N/A	N/A	N/A	Yes
Radionuclides (pCi/g)											
Americium-241	5,150	0.727	11	9	0.717	81.8	No	--	--	--	No
Gross Alpha	N/A	59.0	3	3	59.0	100	N/A	--	--	--	N/A
Gross Beta	N/A	44.0	3	3	44.0	100	N/A	--	--	--	N/A
Plutonium-239/240	5,860	2.96	11	10	3.39	90.9	No	--	--	--	No
Uranium-233/234	5,280	1.40	8	8	1.62	100	No	--	--	--	No
Uranium-235	3,730	0.219	8	1	0.324	12.5	No	--	--	--	No
Uranium-238	2,490	1.79	8	8	1.79	100	No	--	--	--	No

Table A8.22
Total Maximum PCB Values by Pond for All Sediment

Pond	Location	Sample Number	Detected? (y/n)	PCB-1254
A-1	CR53-000	05F0792-001	No	20.5
A-1	CS53-000	05F0348-002	No	26
A-1	CS53-001	05F0792-002	No	26
A-1	CS53-002	05F0792-004	No	21
A-1	CS53-002	05F0792-005	Yes	5200
A-1	CS53-003	05F0792-006	No	22
A-1	CS53-003	05F0792-007	Yes	55
A-1	SED60092	SD00009ST	Yes	86
A-1	SED60092	SD60000WC	Yes	590
A-1	SED60192	SD00008ST	Yes	73
A-1	SED60192	SD60001WC	Yes	330
A-1	SED60292	SD00011ST	Yes	86
A-1	SED60292	SD60002WC	Yes	460
A-1	SED60392	SD00010ST	Yes	88
A-1	SED60392	SD60003WC	Yes	350
			Maximum	**5200**
A-2	CV54-000	05F0600-001	No	17.5
A-2	CW53-000	05F0599-008	No	41.5
A-2	CW53-000	05F0599-009	No	40
A-2	CW54-000	05F0275-001	No	70
A-2	CW54-000	05F0275-002	Yes	34
A-2	CW54-000	05F0275-003	Yes	36
A-2	CW54-002	05F0599-006	No	90
A-2	SED60692	SD00003ST	Yes	130
A-2	SED60692	SD60006WC	No	115
A-2	SED60792	SD00002ST	Yes	89
A-2	SED60792	SD60007WC	No	155
A-2	SED60892	SD60008WC	No	185
			Maximum	**185**
A-3	SED61092	SD00031ST	No	225
A-3	SED61092	SD60010WC	No	140
A-3	SED61192	SD00030ST	Yes	45
A-3	SED61192	SD60011WC	No	140
A-3	SED61292	SD00029ST	No	165
A-3	SED61292	SD60012WC	No	130
A-3	SED61392	SD00032ST	No	225
A-3	SED61392	SD60013WC	No	140
			Maximum	**225**
A-4	A4	NP50590WC	No	210
A-4	SED61592	SD00050ST	No	130
A-4	SED61592	SD60015WC	No	120
A-4	SED61692	SD00049ST	No	265
A-4	SED61692	SD60016WC	No	160
A-4	SED61792	SD00047ST	No	120
A-4	SED61792	SD60017WC	No	115
A-4	SED61892	SD00048ST	No	230
A-4	SED61892	SD60018WC	No	240
			Maximum	**265**
A-5	SED64592	SD60045WC	No	130
A-5	SED64692	SD60046WC	No	120
A-5	SED64792	SD60047WC	No	145
A-5	SED64892	SD60048WC	No	130
A-5	SED64992	SD60049WC	No	125
			Maximum	**145**
B-2	SED11004	04D1170-005	No	22
B-4	DB47-000	05F0618-001	No	31
B-4	DB47-001	05F0597-001	No	22.5

Table A8.22
Total Maximum PCB Values by Pond for All Sediment

Pond	Location	Sample Number	Detected? (y/n)	PCB-1254
B-4	DB47-001	05F0597-002	Yes	210
B-4	DB47-001	05F0597-003	No	23.5
B-4	DB47-002	05F0599-001	Yes	160
B-4	DB47-002	05F0599-002	Yes	220
B-4	DB47-002	05F0599-003	Yes	3100
B-4	DB47-002	05F0599-004	No	20.5
B-4	DB47-002	05F0599-005	No	20
B-4	DB47-003	05F0618-003	No	27.5
B-4	DB47-004	05F0618-005	No	35
B-4	DB47-004	05F0618-006	No	27
B-4	DB47-004	05F0618-007	Yes	820
B-4	DB47-005	05F0597-004	No	37.5
B-4	SED63592	SD00014ST	Yes	210
B-4	SED63592	SD60035WC	Yes	230
B-4	SED63592	SD60111WC	No	115
B-4	SED63692	SD00012ST	Yes	120
B-4	SED63692	SD60036WC	No	110
B-4	SED63792	SD00015ST	Yes	190
B-4	SED63792	SD60037WC	Yes	440
B-4	SED63792	SD60114WC	Yes	560
B-4	SED63892	SD00016ST	Yes	200
B-4	SED63892	SD60038WC	No	150
B-4	SED63892	SD60110WC	Yes	1100
B-4	SED63992	SD00013ST	Yes	220
B-4	SED63992	SD60039WC	Yes	300
			Maximum	**3100**
B-5	B5	NP50591WC	No	205
B-5	SED64092	SD00018ST	No	115
B-5	SED64092	SD60040WC	No	110
B-5	SED64192	SD00019ST	No	125
B-5	SED64192	SD60041WC	No	125
B-5	SED64292	SD00021ST	No	140
B-5	SED64292	SD60042WC	No	135
B-5	SED64392	SD60043WC	No	185
B-5	SED64492	SD00017ST	No	120
B-5	SED64492	SD60044WC	No	120
			Maximum	**215**
C-1	C1	NP50593WC	No	265
C-1	CR31-005	05F0600-002	No	36.5
C-1	CR31-006	05F0600-003	No	38
C-1	CR31-006	05F0600-004	No	30
C-1	CR31-007	05F0600-006	No	29
C-1	CR31-008	05F0630-001	Yes	94
C-1	SED510	SD50017WC	No	500
			Maximum	**500**
C-2	C2	NP50592WC	No	325
C-2	SED511	SD50023WC	No	335
C-2	SED512	SD50024WC	No	500
			Maximum	**500**

For the non-detected values, 1/2 of the reported value (detection limit) was provided

Table A8.23

Total Maximum PCB Values by Pond for Surface Sediment

Pond	Location	Sample Number	Detected ? (yes/no)	Aroclor-1254
A-1	CR53-000	05F0792-001	No	20.5
A-1	CS53-001	05F0792-002	No	26
A-1	CS53-002	05F0792-004	No	21
A-1	CS53-003	05F0792-006	No	22
A-1	SED60092	SD00009ST	Yes	86
A-1	SED60192	SD00008ST	Yes	73
A-1	SED60292	SD00011ST	Yes	86
A-1	SED60392	SD00010ST	Yes	88
		Maximum Detected Value		**88**
A-2	CV54-000	05F0600-001	No	17.5
A-2	CW53-000	05F0599-008	No	41.5
A-2	CW54-000	05F0275-001	No	70
A-2	CW54-002	05F0599-006	No	90
A-2	SED60692	SD00003ST	Yes	130
A-2	SED60692	SD60006WC	No	115
A-2	SED60792	SD00002ST	Yes	89
A-2	SED60792	SD60007WC	No	155
		Maximum Detected Value		**130**
A-3	SED61092	SD00031ST	No	225
A-3	SED61192	SD00030ST	Yes	45
A-3	SED61292	SD00029ST	No	165
A-3	SED61292	SD60012WC	No	130
A-3	SED61392	SD00032ST	No	225
		Maximum Detected Value		**45**
A-4	SED61592	SD00050ST	No	130
A-4	SED61592	SD60015WC	No	120
A-4	SED61692	SD00049ST	No	265
A-4	SED61692	SD60016WC	No	160
A-4	SED61792	SD00047ST	No	120
A-4	SED61792	SD60017WC	No	115
A-4	SED61892	SD00048ST	No	230
A-4	SED61892	SD60018WC	No	240
		Maximum Detected Value		**ND**
A-5	SED64592	SD60045WC	No	130
A-5	SED64792	SD60047WC	No	145
A-5	SED64892	SD60048WC	No	130
A-5	SED64992	SD60049WC	No	125
		Maximum Detected Value		**ND**
B-4	DB47-000	05F0618-001	No	31
B-4	DB47-001	05F0597-001	No	22.5
B-4	DB47-002	05F0599-001	Yes	160
B-4	DB47-003	05F0618-003	No	27.5
B-4	DB47-004	05F0618-005	No	35
B-4	DB47-005	05F0597-004	No	37.5
B-4	SED63592	SD00014ST	Yes	210
B-4	SED63692	SD00012ST	Yes	120
B-4	SED63792	SD00015ST	Yes	190
B-4	SED63892	SD00016ST	Yes	200
B-4	SED63992	SD00013ST	Yes	220
		Maximum Detected Value		**220**
B-5	B5	NP50591WC	No	205
B-5	SED64092	SD00018ST	No	115
B-5	SED64092	SD60040WC	No	110
B-5	SED64192	SD00019ST	No	125
B-5	SED64192	SD60041WC	No	125

Table A8.23

Total Maximum PCB Values by Pond for Surface Sediment

Pond	Location	Sample Number	Detected ? (yes/no)	Aroclor-1254
B-5	SED64292	SD00021ST	No	140
B-5	SED64292	SD60042WC	No	135
B-5	SED64392	SD00020ST	No	215
B-5	SED64392	SD60043WC	No	185
B-5	SED64492	SD00017ST	No	120
B-5	SED64492	SD60044WC	No	120
		Maximum Detected Value		**ND**
C-1	C1	NP50593WC	No	265
C-1	CR31-005	05F0600-002	No	36.5
C-1	CR31-006	05F0600-003	No	38
C-1	CR31-007	05F0600-006	No	29
C-1	CR31-008	05F0630-001	Yes	94
C-1	SED510	SD50017WC	No	500
		Maximum Detected Value		**94**
C-2	C2	NP50592WC	No	325
C-2	SED511	SD50023WC	No	335
C-2	SED512	SD50024WC	No	500
		Maximum Detected Value		**ND**

ND = Not detected.

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Table A8.24
Total PAH Values for All Sediment by Sample

Pond	Location	Sample Number	Total PAH Value	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd)pyrene	Phenanthrene	Pyrene
A-1	CR53-000	05F0792-001	2,985	205	205	120	150	180	100	100	150	415	300	415	90	140	415
A-1	CS53-000	05F0348-002	6,230	260	260	500	500	500	500	500	500	500	500	500	210	500	500
A-1	CS53-001	05F0792-002	2,940	255	255	92	110	120	77	72	110	500	200	500	62	87	500
A-1	CS53-002	05F0792-004	4,428	245	245	73	485	130	485	485	82	485	170	485	485	88	485
A-1	CS53-002	05F0792-005	3,892	250	52	190	210	260	160	120	220	500	510	500	140	280	500
A-1	CS53-003	05F0792-006	2,681	235	235	75	83	83	60	63	87	470	190	470	50	110	470
A-1	CS53-003	05F0792-007	5,590	215	215	430	430	430	430	430	430	430	430	430	430	430	430
A-1	SED60092	SD60000WC	4,999	89	310	270	310	420	210	200	350	310	790	310	200	520	710
A-1	SED60192	SD60001WC	3,952	305	88	190	190	305	305	99	210	305	590	305	150	480	430
A-1	SED60292	SD60002WC	4,208	310	68	220	240	300	150	180	270	310	600	310	310	390	550
A-1	SED60392	SD60003WC	3,650	300	300	170	190	240	150	110	220	300	510	300	140	300	420
A-2	CV54-000	05F0600-001	2,856	180	210	52	51	64	350	350	60	350	89	350	210	190	350
A-2	CW53-000	05F0599-008	11,030	415	415	850	850	850	850	850	850	850	850	850	850	850	850
A-2	CW53-000	05F0599-009	7,600	400	400	800	80	800	800	800	81	800	140	800	800	99	800
A-2	CW54-000	05F0275-001	18,800	700	700	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450
A-2	CW54-000	05F0275-002	12,990	495	495	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
A-2	CW54-000	05F0275-003	19,500	750	750	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
A-2	CW54-002	05F0599-006	22,800	900	900	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
A-2	SED60692	SD60006WC	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-2	SED60792	SD60007WC	4,231	320	320	320	320	320	320	320	320	320	320	320	320	320	71
A-2	SED60892	SD60008WC	5,088	385	385	385	385	385	385	385	385	385	385	385	385	385	83
A-3	SED61092	SD60010WC	3,840	290	290	290	150	260	290	290	180	290	400	290	290	200	330
A-3	SED61192	SD60011WC	4,480	295	295	295	240	370	295	295	250	295	540	295	295	260	460
A-3	SED61292	SD60012WC	3,710	275	275	275	170	240	275	275	170	275	390	275	275	200	340
A-3	SED61392	SD60013WC	3,885	295	295	295	295	240	295	295	170	295	360	295	295	170	290
A-4	SED61592	SD60015WC	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-4	SED61692	SD60016WC	4,480	320	320	320	320	320	320	320	320	320	320	320	320	320	320
A-4	SED61792	SD60017WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
A-4	SED61892	SD60018WC	6,930	495	495	495	495	495	495	495	495	495	495	495	495	495	495
A-5	SED64592	SD60045WC	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64692	SD60046WC	3,570	255	255	255	255	255	255	255	255	255	255	255	255	255	255
A-5	SED64792	SD60047WC	4,200	300	300	300	300	300	300	300	300	300	300	300	300	300	300
A-5	SED64892	SD60048WC	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64992	SD60049WC	3,570	255	255	255	255	255	255	255	255	255	255	255	255	255	255
B-4	DB47-000	05F0618-001	15,600	600	600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
B-4	DB47-001	05F0597-001	23,400	900	900	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
B-4	DB47-001	05F0597-002	6,415	225	60	330	430	810	310	450	470	450	880	450	250	430	870
B-4	DB47-001	05F0597-003	12,350	700	420	330	450	630	1,400	1,400	480	1,400	1,000	1,400	1,400	420	920
B-4	DB47-002	05F0599-001	4,328	310	73	240	290	270	200	270	330	65	580	600	150	370	580
B-4	DB47-002	05F0599-002	6,915	270	75	360	490	560	320	540	610	110	1,200	550	280	550	1,000
B-4	DB47-002	05F0599-003	3,457	260	260	98	150	180	95	200	210	500	450	500	84	160	310
B-4	DB47-002	05F0599-004	5,270	205	205	405	405	405	405	405	405	405	405	405	405	405	405
B-4	DB47-002	05F0599-005	5,200	200	200	400	400	400	400	400	400	400	400	400	400	400	400
B-4	DB47-003	05F0618-003	3,744	275	275	100	100	180	90	550	110	550	230	550	74	110	550
B-4	DB47-004	05F0618-005	6,734	350	350	80	700	700	700	700	74	700	170	700	700	110	700
B-4	DB47-004	05F0618-006	5,380	270	270	200	270	530	230	550	340	550	690	550	190	290	450
B-4	DB47-004	05F0618-007	7,830	440	440	220	300	720	290	900	460	900	1,100	900	260	370	530
B-4	DB47-005	05F0597-004	4,496	110	140	300	320	230	270	310	350	92	750	94	200	630	700
B-4	SED63592	SD60035WC	5,989	235	79	350	420	660	200	280	490	235	1,100	235	235	580	890
B-4	SED63592	SD60111WC	6,690	245	100	370	460	740	245	350	530	245	1,200	245	200	760	1,000

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Table A8.24
Total PAH Values for All Sediment by Sample

Pond	Location	Sample Number	Total PAH Value	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,l) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno (1,2,3-cd)pyrene	Phenanthrene	Pyrene
B-4	SED63692	SD60036WC	4,660	235	235	240	290	440	235	200	330	235	750	235	235	420	580
B-4	SED63792	SD60037WC	6,745	330	85	340	420	1,000	330	290	500	330	1,100	330	330	500	860
B-4	SED63792	SD60114WC	8,329	295	84	430	570	1,500	270	350	650	295	1,400	295	300	690	1,200
B-4	SED63892	SD60038WC	6,145	315	315	315	370	660	315	220	470	315	950	315	315	450	820
B-4	SED63892	SD60110WC	6,945	315	315	315	400	770	315	360	520	315	1,100	315	315	590	1,000
B-4	SED63992	SD60039WC	6,279	250	99	350	440	710	250	290	490	250	1,100	250	250	580	970
B-5	SED64092	SD60040WC	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
B-5	SED64192	SD60041WC	3,640	260	260	260	260	260	260	260	260	260	260	260	260	260	260
B-5	SED64292	SD60042WC	3,789	285	285	285	285	285	285	285	285	285	84	285	285	285	285
B-5	SED64392	SD60043WC	5,030	390	390	390	390	390	390	390	390	390	190	390	390	390	160
B-5	SED64492	SD60044WC	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
C-1	CR31-005	05F0600-002	4,710	360	440	190	170	170	150	150	190	530	120	700	500	340	700
C-1	CR31-006	05F0600-003	9,985	395	450	800	800	800	800	800	800	800	800	800	800	340	800
C-1	CR31-006	05F0600-004	6,093	360	410	83	79	700	700	700	81	700	130	700	400	350	700
C-1	CR31-007	05F0600-006	5,240	320	350	69	66	600	600	600	65	600	120	600	340	310	600
C-1	CR31-008	05F0630-001	5,814	74	90	140	700	180	700	700	130	700	330	700	700	360	310
C-1	SED510	SD50017WC	6,500	500	500	500	500	500	500	500	500		500	500	500	500	500
C-2	SED511	SD50023WC	9,240	700	700	700	700	700	700	700	700	700	140	700	700	700	700
C-2	SED512	SD50024WC	14,700	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050

Table A8.25
Total PAH Values for Surface Sediment by Location

Pond	Location	Total PAH Value	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(g,h,i) perylene	Benzo(k) fluoranthene	Chrysene	Dibenz(a,h) anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
A-1	CR53-000	2,985	205	205	120	150	180	100	100	150	415	300	415	90	140	415
A-1	CS53-001	2,940	255	255	92	110	120	77	72	110	500	200	500	62	87	500
A-1	CS53-002	4,428	245	245	73	485	130	485	485	82	485	170	485	485	88	485
A-1	CS53-003	2,681	235	235	75	83	83	60	63	87	470	190	470	50	110	470
A-2	CV54-000	2,856	180	210	52	51	64	350	350	60	350	89	350	210	190	350
A-2	CW53-000	11,030	415	415	850	850	850	850	850	850	850	850	850	850	850	850
A-2	CW54-000	18,800	700	700	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450	1,450
A-2	CW54-002	22,800	900	900	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
A-2	SED60692	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-2	SED60792	4,231	320	320	320	320	320	320	320	320	320	320	320	320	320	71
A-3	SED61292	3,710	275	275	275	170	240	275	275	170	275	390	275	275	200	340
A-4	SED61592	3,360	240	240	240	240	240	240	240	240	240	240	240	240	240	240
A-4	SED61692	4,480	320	320	320	320	320	320	320	320	320	320	320	320	320	320
A-4	SED61792	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
A-4	SED61892	6,930	495	495	495	495	495	495	495	495	495	495	495	495	495	495
A-5	SED64592	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64792	4,200	300	300	300	300	300	300	300	300	300	300	300	300	300	300
A-5	SED64892	3,710	265	265	265	265	265	265	265	265	265	265	265	265	265	265
A-5	SED64992	3,570	255	255	255	255	255	255	255	255	255	255	255	255	255	255
B-4	DB47-000	15,600	600	600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
B-4	DB47-001	23,400	900	900	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
B-4	DB47-002	4,328	310	73	240	290	270	200	270	330	65	580	600	150	370	580
B-4	DB47-003	3,744	275	275	100	100	180	90	550	110	550	230	550	74	110	550
B-4	DB47-004	6,734	350	350	80	700	700	700	700	74	700	170	700	700	110	700
B-4	DB47-005	4,496	110	140	300	320	230	270	310	350	92	750	94	200	630	700
B-5	SED64092	3,290	235	235	235	235	235	235	235	235	235	235	235	235	235	235
B-5	SED64192	3,640	260	260	260	260	260	260	260	260	260	260	260	260	260	260
B-5	SED64292	3,789	285	285	285	285	285	285	285	285	285	84	285	285	285	285
B-5	SED64392	5,030	390	390	390	390	390	390	390	390	390	190	390	390	390	160
B-5	SED64492	3,430	245	245	245	245	245	245	245	245	245	245	245	245	245	245
C-1	CR31-005	4,710	360	440	190	170	170	150	150	190	530	120	700	500	340	700
C-1	CR31-006	9,985	395	450	800	800	800	800	800	800	800	800	800	800	340	800
C-1	CR31-007	5,240	320	350	69	66	600	600	600	65	600	120	600	340	310	600
C-1	CR31-008	5,814	74	90	140	700	180	700	700	130	700	330	700	700	360	310
C-1	SED510	6,500	500	500	500	500	500	500	500	500		500	500	500	500	500
C-2	SED511	9,240	700	700	700	700	700	700	700	700	700	140	700	700	700	700
C-2	SED512	14,700	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050

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Table A8.26
Summary of Dioxin TEQ Values by Pond for All Sediment

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic TEF [a]	Aquatic TEQ Concentration [b]
Sediment (ug/kg)								
CR31-004	05F0140-005	C-1	1234678-HpCDF	0.000807	Yes	V	0.01	0.00000807
CR31-004	05F0140-005	C-1	1234789-HpCDF	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123478-HxCDD	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	123478-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123678-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123789-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123789-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	12378-PeCDF	0.00271	No	V	0.05	0
CR31-004	05F0140-005	C-1	234678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	23478-PeCDF	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	2378-TCDD	0.00108	No	V	1	0
CR31-004	05F0140-005	C-1	2378-TCDF	0.00108	No	V	0.05	0
CR31-004	05F0140-005	C-1	Heptachlorodibenzo-p-dioxin	0.00509	Yes	V	0.001	0.00000509
CR31-004	05F0140-005	C-1	OCDD	0.0306	Yes	V	0.0001	0.00000306
CR31-004	05F0140-005	C-1	OCDF	0.00128	Yes	V	0.0001	0.000000128
CR31-004	05F0140-005	C-1	Pentachlorodibenzo-p-dioxin	0.00271	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0140-005:[c]								**0.000016348**
CR31-004	05F0140-006	C-1	1234678-HpCDF	0.00158	Yes	V	0.01	0.0000158
CR31-004	05F0140-006	C-1	1234789-HpCDF	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123478-HxCDD	0.00226	No	V	0.5	0
CR31-004	05F0140-006	C-1	123478-HxCDF	0.00127	Yes	V	0.1	0.000127
CR31-004	05F0140-006	C-1	123678-HxCDD	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123678-HxCDF	0.000562	Yes	V	0.1	0.0000562
CR31-004	05F0140-006	C-1	123789-HxCDD	0.00226	No	V	0.01	0
CR31-004	05F0140-006	C-1	123789-HxCDF	0.00226	No	V	0.1	0
CR31-004	05F0140-006	C-1	12378-PeCDF	0.00226	No	V	0.05	0
CR31-004	05F0140-006	C-1	234678-HxCDF	0.000781	Yes	V	0.1	0.0000781
CR31-004	05F0140-006	C-1	23478-PeCDF	0.00143	Yes	V	0.5	0.000715
CR31-004	05F0140-006	C-1	2378-TCDD	0.000904	No	V	1	0
CR31-004	05F0140-006	C-1	2378-TCDF	0.000904	No	V	0.05	0
CR31-004	05F0140-006	C-1	Heptachlorodibenzo-p-dioxin	0.00285	Yes	V	0.001	0.00000285
CR31-004	05F0140-006	C-1	OCDD	0.0133	Yes	V	0.0001	0.00000133
CR31-004	05F0140-006	C-1	OCDF	0.00176	Yes	V	0.0001	0.000000176
CR31-004	05F0140-006	C-1	Pentachlorodibenzo-p-dioxin	0.000372	Yes	V	1	0.000372
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0140-006:[c]								**0.001368456**
CS53-000	05F0348-002	A-1	1234678-HpCDF	0.0298	Yes	V1	0.01	0.000298
CS53-000	05F0348-002	A-1	1234789-HpCDF	0.00243	Yes	V1	0.01	0.0000243
CS53-000	05F0348-002	A-1	123478-HxCDD	0.00126	Yes	V1	0.5	0.00063
CS53-000	05F0348-002	A-1	123478-HxCDF	0.00371	Yes	V1	0.1	0.000371
CS53-000	05F0348-002	A-1	123678-HxCDD	0.00455	Yes	V1	0.01	0.0000455
CS53-000	05F0348-002	A-1	123678-HxCDF	0.0025	Yes	V1	0.1	0.00025
CS53-000	05F0348-002	A-1	123789-HxCDD	0.00329	Yes	V1	0.01	0.0000329
CS53-000	05F0348-002	A-1	123789-HxCDF	0.00184	No	V1	0.1	0

Table A8.26
Summary of Dioxin TEQ Values by Pond for All Sediment

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic TEF[a]	Aquatic TEQ Concentration[b]
CS53-000	05F0348-002	A-1	12378-PeCDF	0.00197	Yes	V1	0.05	0.0000985
CS53-000	05F0348-002	A-1	234678-HxCDF	0.00199	Yes	V1	0.1	0.000199
CS53-000	05F0348-002	A-1	23478-PeCDF	0.00429	Yes	V1	0.5	0.002145
CS53-000	05F0348-002	A-1	2378-TCDD	0.00278	Yes	V1	1	0.00278
CS53-000	05F0348-002	A-1	2378-TCDF	0.00612	Yes	J1	0.05	0.000306
CS53-000	05F0348-002	A-1	Heptachlorodibenzo-p-dioxin	0.0946	Yes	V1	0.001	0.0000946
CS53-000	05F0348-002	A-1	OCDD	0.539	Yes	V1	0.0001	0.0000539
CS53-000	05F0348-002	A-1	OCDF	0.0409	Yes	V1	0.0001	0.00000409
CS53-000	05F0348-002	A-1	Pentachlorodibenzo-p-dioxin	0.00184	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0348-002:[c]								**0.00733279**
CW54-000	05F0275-001	A-2	1234678-HpCDF	0.00251	Yes	V1	0.01	0.0000251
CW54-000	05F0275-001	A-2	1234789-HpCDF	0.00286	No	V1	0.01	0
CW54-000	05F0275-001	A-2	123478-HxCDD	0.00286	No	V1	0.5	0
CW54-000	05F0275-001	A-2	123478-HxCDF	0.000566	Yes	V1	0.1	0.0000566
CW54-000	05F0275-001	A-2	123678-HxCDD	0.00122	Yes	V1	0.01	0.0000122
CW54-000	05F0275-001	A-2	123678-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	123789-HxCDD	0.00106	Yes	V1	0.01	0.0000106
CW54-000	05F0275-001	A-2	123789-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	12378-PeCDF	0.00286	No	V1	0.05	0
CW54-000	05F0275-001	A-2	234678-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	23478-PeCDF	0.00286	No	V1	0.5	0
CW54-000	05F0275-001	A-2	2378-TCDD	0.00114	No	V1	1	0
CW54-000	05F0275-001	A-2	2378-TCDF	0.00114	No	V1	0.05	0
CW54-000	05F0275-001	A-2	Heptachlorodibenzo-p-dioxin	0.0199	Yes	V1	0.001	0.0000199
CW54-000	05F0275-001	A-2	OCDD	0.161	Yes	V1	0.0001	0.0000161
CW54-000	05F0275-001	A-2	OCDF	0.00883	Yes	V1	0.0001	0.000000883
CW54-000	05F0275-001	A-2	Pentachlorodibenzo-p-dioxin	0.00286	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-001:[c]								**0.000141383**
CW54-000	05F0275-002	A-2	1234678-HpCDF	0.00419	No	V1	0.01	0
CW54-000	05F0275-002	A-2	1234789-HpCDF	0.00074	Yes	V1	0.01	0.0000074
CW54-000	05F0275-002	A-2	123478-HxCDD	0.00419	No	V1	0.5	0
CW54-000	05F0275-002	A-2	123478-HxCDF	0.00419	No	V1	0.1	0
CW54-000	05F0275-002	A-2	123678-HxCDD	0.00419	No	V1	0.01	0
CW54-000	05F0275-002	A-2	123678-HxCDF	0.00419	No	V1	0.1	0
CW54-000	05F0275-002	A-2	123789-HxCDD	0.00419	No	V1	0.01	0
CW54-000	05F0275-002	A-2	123789-HxCDF	0.000553	Yes	V1	0.1	0.0000553
CW54-000	05F0275-002	A-2	12378-PeCDF	0.00419	No	V1	0.05	0
CW54-000	05F0275-002	A-2	234678-HxCDF	0.00419	No	V1	0.1	0
CW54-000	05F0275-002	A-2	23478-PeCDF	0.00419	No	V1	0.5	0
CW54-000	05F0275-002	A-2	2378-TCDD	0.00168	No	V1	1	0
CW54-000	05F0275-002	A-2	2378-TCDF	0.00168	No	V1	0.05	0
CW54-000	05F0275-002	A-2	Heptachlorodibenzo-p-dioxin	0.00419	No	V1	0.001	0
CW54-000	05F0275-002	A-2	OCDD	0.0178	Yes	V1	0.0001	0.00000178
CW54-000	05F0275-002	A-2	OCDF	0.00838	No	V1	0.0001	0
CW54-000	05F0275-002	A-2	Pentachlorodibenzo-p-dioxin	0.00419	No	V1	1	0

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Table A8.26
Summary of Dioxin TEQ Values by Pond for All Sediment

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic TEF[a]	Aquatic TEQ Concentration[b]
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-002:[c]								**0.00006448**
CW54-000	05F0275-003	A-2	1234678-HpCDF	0.00283	Yes	V1	0.01	0.0000283
CW54-000	05F0275-003	A-2	1234789-HpCDF	0.00077	Yes	V1	0.01	0.0000077
CW54-000	05F0275-003	A-2	123478-HxCDD	0.00474	No	V1	0.5	0
CW54-000	05F0275-003	A-2	123478-HxCDF	0.00055	Yes	V1	0.1	0.000055
CW54-000	05F0275-003	A-2	123678-HxCDD	0.00474	No	V1	0.01	0
CW54-000	05F0275-003	A-2	123678-HxCDF	0.00474	No	V1	0.1	0
CW54-000	05F0275-003	A-2	123789-HxCDD	0.00474	No	V1	0.01	0
CW54-000	05F0275-003	A-2	123789-HxCDF	0.00474	No	V1	0.1	0
CW54-000	05F0275-003	A-2	12378-PeCDF	0.00474	No	V1	0.05	0
CW54-000	05F0275-003	A-2	234678-HxCDF	0.00474	No	V1	0.1	0
CW54-000	05F0275-003	A-2	23478-PeCDF	0.00474	No	V1	0.5	0
CW54-000	05F0275-003	A-2	2378-TCDD	0.0019	No	V1	1	0
CW54-000	05F0275-003	A-2	2378-TCDF	0.0019	No	V1	0.05	0
CW54-000	05F0275-003	A-2	Heptachlorodibenzo-p-dioxin	0.0198	Yes	V1	0.001	0.0000198
CW54-000	05F0275-003	A-2	OCDD	0.114	Yes	V1	0.0001	0.0000114
CW54-000	05F0275-003	A-2	OCDF	0.00583	Yes	V1	0.0001	0.000000583
CW54-000	05F0275-003	A-2	Pentachlorodibenzo-p-dioxin	0.00474	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-003:[c]								**0.000122783**
2,3,7,8-TCDD TEQ Concentration used in Sediment ESL Screen[c]:								**0.00733279**

[a] Toxicity Equivalency Factor (WHO, 1997).

[b] TEQ (Toxicity Equivalence) Concentration = Sediment Concentration x TEF. For non-detects, the TEQ Concentration equals zero.

[c] The TEQ concentration used in the ESL screen is the maximum of all sampling locations for the medium.

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Table A8.27
Summary of Dioxin TEQ Values by Pond for Surface Sediment

Sampling Location	Sample Number	Pond	Congener	Result	Detect?	Validation Qualifier	Aquatic TEF [a]	Aquatic TEQ Concentration [b]
Sediment (ug/kg)								
CR31-004	05F0140-005	C-1	1234678-HpCDF	0.000807	Yes	V	0.01	0.00000807
CR31-004	05F0140-005	C-1	1234789-HpCDF	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123478-HxCDD	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	123478-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123678-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	123789-HxCDD	0.00271	No	V	0.01	0
CR31-004	05F0140-005	C-1	123789-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	12378-PeCDF	0.00271	No	V	0.05	0
CR31-004	05F0140-005	C-1	234678-HxCDF	0.00271	No	V	0.1	0
CR31-004	05F0140-005	C-1	23478-PeCDF	0.00271	No	V	0.5	0
CR31-004	05F0140-005	C-1	2378-TCDD	0.00108	No	V	1	0
CR31-004	05F0140-005	C-1	2378-TCDF	0.00108	No	V	0.05	0
CR31-004	05F0140-005	C-1	Heptachlorodibenzo-p-dioxin	0.00509	Yes	V	0.001	0.00000509
CR31-004	05F0140-005	C-1	OCDD	0.0306	Yes	V	0.0001	0.00000306
CR31-004	05F0140-005	C-1	OCDF	0.00128	Yes	V	0.0001	0.000000128
CR31-004	05F0140-005	C-1	Pentachlorodibenzo-p-dioxin	0.00271	No	V	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0140-005:[c]								**0.000016348**
CW54-000	05F0275-001	A-2	1234678-HpCDF	0.00251	Yes	V1	0.01	0.0000251
CW54-000	05F0275-001	A-2	1234789-HpCDF	0.00286	No	V1	0.01	0
CW54-000	05F0275-001	A-2	123478-HxCDD	0.00286	No	V1	0.5	0
CW54-000	05F0275-001	A-2	123478-HxCDF	0.000566	Yes	V1	0.1	0.0000566
CW54-000	05F0275-001	A-2	123678-HxCDD	0.00122	Yes	V1	0.01	0.0000122
CW54-000	05F0275-001	A-2	123678-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	123789-HxCDD	0.00106	Yes	V1	0.01	0.0000106
CW54-000	05F0275-001	A-2	123789-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	12378-PeCDF	0.00286	No	V1	0.05	0
CW54-000	05F0275-001	A-2	234678-HxCDF	0.00286	No	V1	0.1	0
CW54-000	05F0275-001	A-2	23478-PeCDF	0.00286	No	V1	0.5	0
CW54-000	05F0275-001	A-2	2378-TCDD	0.00114	No	V1	1	0
CW54-000	05F0275-001	A-2	2378-TCDF	0.00114	No	V1	0.05	0
CW54-000	05F0275-001	A-2	Heptachlorodibenzo-p-dioxin	0.0199	Yes	V1	0.001	0.0000199
CW54-000	05F0275-001	A-2	OCDD	0.161	Yes	V1	0.0001	0.0000161
CW54-000	05F0275-001	A-2	OCDF	0.00883	Yes	V1	0.0001	0.000000883
CW54-000	05F0275-001	A-2	Pentachlorodibenzo-p-dioxin	0.00286	No	V1	1	0
Total 2,3,7,8-TCDD TEQ Concentration for Sample 05F0275-001:[c]								**0.000141383**
2,3,7,8-TCDD TEQ Concentration used in Sediment ESL Screen[c]:								**0.000141383**

[a] Toxicity Equivalency Factor (WHO, 1997).

[b] TEQ (Toxicity Equivalence) Concentration = Sediment Concentration x TEF. For non-detects, the TEQ Concentration equals zero.

[c] The TEQ concentration used in the ESL screen is the maximum of all sampling locations for the medium.

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Table A8.28
Pond A-1 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Units	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			A-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	A-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	25,000	2	0	29,000	2	1	21,415	1	0	18,588	1	0
Antimony	2.00	3.20	mg/kg	ND	--	--	30.4	15	10	*	--	--	26.1	13	8
Barium	189	287	mg/kg	220	1	1	230	1	1	*	--	--	180	1	1
Cadmium	0.990	4.98	mg/kg	1.30	1	<1	8.30	8	2	4.21	4	1	1.22	1	<1
Copper	31.6	149	mg/kg	27.0	<1	<1	43.0	1	<1	30.4	<1	<1	23.3	<1	<1
Iron	20,000	280,000	mg/kg	24,000	1	<1	24,000	1	<1	21,340	1	<1	20,573	1	<1
Lead	35.8	128	mg/kg	29.0	<1	<1	39.0	1	<1	32.6	<1	<1	25.5	<1	<1
Mercury	0.180	1.06	mg/kg	0.180	1	<1	0.470	3	<1	0.315	2	<1	0.116	<1	<1
Nickel	22.7	48.6	mg/kg	22.0	<1	<1	26.4	1	1	22.3	<1	<1	19.4	<1	<1
Selenium	0.950	1.73	mg/kg	1.80	2	1	1.80	2	1	1.44	2	<1	1.66	2	<1
Silver	1.00	1.60	mg/kg	0.810	<1	<1	2.00	2	1	1.16	1	<1	1.26	1	<1
Zinc	121	459	mg/kg	140	1	<1	140	1	<1	122	1	<1	115	<1	<1
Organics															
Acenaphthene	6.71	89.0	ug/kg	ND	--	--	89.0	13	1	*	--	--	135.0	20	2
Anthracene	57.2	845	ug/kg	ND	--	--	88.0	2	<1	*	--	--	105.0	2	<1
Benzo(a)anthracene	108	1,050	ug/kg	120	1	<1	270	3	<1	*	--	--	145.0	1	<1
Benzo(a)pyrene	150	1,450	ug/kg	150	1	<1	310	2	<1	*	--	--	165.0	1	<1
Benzo(g,h,i)perylene	13.0	280	ug/kg	100	8	<1	210	16	1	*	--	--	126.0	10	<1
Chrysene	166	1,290	ug/kg	150	<1	<1	350	2	<1	315	2	<1	174.0	1	<1
Fluoranthene	423	2,230	ug/kg	300	<1	<1	790	2	<1	544	1	<1	385.0	<1	<1
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	90	5	<1	210	12	1	*	--	--	139.0	8	<1
Phenanthrene	204	1,170	ug/kg	140	<1	<1	520	3	<1	397	2	<1	237.0	1	<1
Pyrene	195	1,520	ug/kg	ND	--	--	710	4	<1	538	3	<1	368.0	2	<1
Aroclor 1254	60.0	300	ug/kg	88	1	<1	5,200	87	17	1,835	31	6	510.0	9	2
Aroclor 1260	5.00	200	ug/kg	ND	--	--	150	30	1	*	--	--	150.0	30	<1
Total PCBs	40.0	676	ug/kg	88	2	<1	5,200	130	<1	*	--	--	1204	30	2
Total PAHs	1,610	22,800	ug/kg	1050	<1	<1	6,230	5	<1	NA	--	--	N/A	--	--
TEQ - Dioxins	8.50E-04	0.022	ug/kg	NA	--	--	0.007	9	<1	NA	--	--	NA	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for, due to lack of data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

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Table A8.29

Pond A-2 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			A-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	A-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	26,000	2	<1	49,000	3	1	27,153	2	<1	18,588	1	<1
Arsenic	9.79	33.0	mg/kg	11.0	1	<1	12.0	1	<1	9.54	1	<1	6.93	<1	<1
Barium	189	287	mg/kg	260	1	<1	390	2	1	267	1	1	180	<1	<1
Cadmium	0.990	4.98	mg/kg	0.950	<1	<1	3.20	3	<1	1.66	2	<1	1.22	1	<1
Chromium	43.4	111	mg/kg	26.0	<1	<1	44.0	1	<1	28.5	1	<1	19.8	<1	<1
Copper	31.6	149	mg/kg	30.0	<1	<1	56.0	2	<1	36.1	1	<1	23.3	<1	<1
Iron	20,000	280,000	mg/kg	28,000	1	<1	39,000	2	<1	26,681	1	<1	20,573	1	<1
Lead	35.8	128	mg/kg	33.0	<1	<1	45.0	1	<1	34.2	1	<1	25.5	<1	<1
Manganese	630	1,700	mg/kg	1,100	2	<1	1,100	2	<1	713	1	<1	399	<1	<1
Nickel	22.7	48.6	mg/kg	22.0	<1	<1	34.0	1	<1	24.6	1	1	19.4	<1	<1
Silver	1.00	1.60	mg/kg	0.098	<1	<1	3.90	4	2	2.08	2	1	1.26	1	<1
Zinc	121	459	mg/kg	110	1	<1	170	1	<1	125	1	<1	115	<1	<1
Organics															
Acenaphthene	6.71	89.0	ug/kg	180	27	2	180	27	2	*	--	--	135	20	2
Anthracene	57.2	845	ug/kg	210	4	<1	210	4	<1	*	--	--	105	2	<1
Bis(2-ethylhexyl)phthlate	24,900	NA	ug/kg	4,200	<1	--	47,000	2	--	28,796	1	--	4,037	<1	--
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	210	12	<1	210	12	<1	*	--	--	139	8	<1
Aroclor-1254	60.0	300	ug/kg	130	2	<1	130	2	<1	111.0	2	<1	510	9	2
Total PCBs	40.0	676	ug/kg	130	3	<1	185	5	<1	NA	--	--	1,204	30	2
Total PAHs	1,610	22,800	ug/kg	652	<1	<1	22,800	14	<1	N/A	--	--	N/A	--	--
TEQ - Dioxins	8.50E-04	0.022	ug/kg	1.41E-04	<1	<1	1.41E-04	<1	<1	NA	--	--	NA	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA -Not analyzed for due to lack of data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

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Table A8.30
Pond A-3 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			A-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	A-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	25,000	2	<1	27,400	2	<1	24,743	2	<1	18,588	1	<1
Antimony	2.00	3.20	mg/kg	26	13	8	26.0	13	8	16.1	8	5	26.1	13	8
Barium	189	287	mg/kg	200	1	<1	200	1	<1	188	<1	<1	180	<1	<1
Iron	20,000	280,000	mg/kg	22,000	1	<1	25,000	1	<1	23,302	1	<1	20,573	1	<1
Nickel	22.7	48.6	mg/kg	21	<1	<1	25.6	1	<1	21.8	<1	<1	19.4	<1	<1
Selenium	0.950	1.73	mg/kg	1.8	2	1	1.8	2	1	1.1	1	<1	1.66	2	<1
Zinc	121	459	mg/kg	540	4	1	540	4	1	287.0	2	<1	115	<1	<1
Organics															
Benzo(a)pyrene	150	1,450	ug/kg	170	1	<1	240	2	<1	*	--	--	165	1	<1
Chrysene	166	1,290	ug/kg	170	1	<1	250	2	<1	*	--	--	174	1	<1
Fluoranthene	423	2,230	ug/kg	390	1	<1	540	1	<1	517.0	1	<1	385	1	<1
Phenanthrene	204	1,170	ug/kg	200	1	<1	260	1	<1	252.0	1	<1	237	1	<1
Pyrene	195	1,520	ug/kg	340	2	<1	460	2	<1	441.0	2	<1	368	2	<1
Aroclor 1254	60.0	300	ug/kg	45	<1	<1	45	1	<1	*	--	--	510	9	2
Total PAHs	1610.0	22800	ug/kg	1270	1	<1	4480	3	<1	N/A	--	--	N/A	--	--
Total PCBs	40.0	676	ug/kg	45	1	<1	225	6	<1	*	--	--	1,204	30	2

95UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

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Table A8.31
Pond A-4 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			A-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	A-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	26,000	2	<1	26,000	2	<1	19,604	1	<1	18,588	1	<1
Antimony	2.00	3.20	mg/kg	41.4	21	13	41.4	21	13	*	--	--	26.1	13	8
Arsenic	9.79	33.0	mg/kg	10.2	1	<1	10.2	1	<1	7.26	<1	<1	180	18	5
Barium	189	287	mg/kg	206	1	<1	206	1	<1	182	<1	<1	180	<1	<1
Cadmium	0.990	4.98	mg/kg	3.10	3	<1	3.10	3	<1	1.81	2	<1	1.22	1	<1
Copper	31.6	149	mg/kg	33.4	1	<1	33.4	1	<1	21.4	<1	<1	23.3	<1	<1
Iron	20,000	280,000	mg/kg	22,900	1	<1	55,000	3	<1	26,996	1	<1	20,573	1	<1
Nickel	22.7	48.6	mg/kg	25.5	1	<1	25.5	1	<1	20.0	<1	<1	19.4	<1	<1
Selenium	0.950	1.73	mg/kg	1.90	2	1	1.90	2	1	1.52	2	<1	1.66	2	<1
Zinc	121	459	mg/kg	169	1	<1	169	1	<1	103	<1	<1	115	<1	<1
Organics															
Atrazine	16.8	230.4	ug/kg	ND	--	--	120	7	1	NA	--	--	120.0	7	1
Total PAHs	1,610	22,800	ug/kg	ND	--	--	6930	4	<1	N/A	--	--	N/A	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for due to lack of data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

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Table A8.32
Pond A-5 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			A-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	A-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	21,000	1	<1	21,000	1	<1	15,334	1	<1	18,588	1	<1
Barium	189	287	mg/kg	220	1	<1	220	1	<1	178	1	<1	180	<1	<1
Iron	20,000	280,000	mg/kg	22,000	1	<1	22,000	1	<1	17,616	1	<1	20,573	1	<1
Silver	1	1.6	mg/kg	1.2	1	<1	1.2	1	<1	1.1	1	<1	1.3	1	<1
Zinc	121	459	mg/kg	130	1	<1	130	1	<1	89.5	1	<1	115.0	<1	<1
Organics															
Total PAHs	1610	22800	ug/kg	ND	--	--	4200	3	<1	NA	--	--	NA	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
• If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

Table A8.33
Pond B-4 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			B-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	B-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	29,000	2	<1	29,000	2	<1	17,687	1	<1	15,376	1	<1
Antimony	2.00	3.20	mg/kg	2.60	1	<1	25.6	13	8	23.3	12	7	10.9	5	3
Barium	189	287	mg/kg	220	1	<1	230	1	<1	182	<1	<1	171	1	<1
Cadmium	0.990	4.98	mg/kg	1.80	2	<1	44.0	44	9	22.6	23	5	3.77	4	<1
Chromium	43.4	111	mg/kg	29.0	1	<1	140	3	1	48.1	1	<1	23.0	1	<1
Copper	31.6	149	mg/kg	32.0	1	<1	120	4	<1	37.0	1	<1	29.2	1	<1
Iron	20,000	280,000	mg/kg	24,000	1	<1	24,000	1	<1	18,423	<1	<1	17,043	1	<1
Lead	35.8	128	mg/kg	39.0	1	<1	110	3	<1	46.6	1	<1	38.1	1	<1
Mercury	0.180	1.06	mg/kg	0.091	1	<1	1.70	9	2	0.880	5	<1	0.186	1	<1
Nickel	22.7	48.6	mg/kg	23.0	1	<1	31.0	1	<1	18.9	<1	<1	17.4	1	<1
Selenium	0.950	1.73	mg/kg	1.80	2	1	3.60	4	2	1.46	2	<1	2.30	2	1
Silver	1.00	1.60	mg/kg	3.10	3	2	3,100	3100	1938	1,548	1548	968	296	296	185
Zinc	121	459	mg/kg	510	4	1	510	4	1	255	2	<1	205	2	<1
Organics															
Anthracene	57.2	845	ug/kg	140	2	<1	420	7	<1	339	6	<1	122	2	<1
Benzo(a)anthracene	108	1,050	ug/kg	300	3	<1	430	4	<1	*	--	--	266	2	<1
Benzo(a)pyrene	150	1,450	ug/kg	320	2	<1	570	4	<1	*	--	--	359	2	<1
Benzo(g,h,i)perylene	13.0	280	ug/kg	270	21	<1	320	25	1	*	--	--	228	18	<1
Benzo(k)fluoranthene	240	750	ug/kg	310	1	<1	540	2	<1	*	--	--	302	1	<1
Bis(2-ethylhexyl)phthalate	24,900		ug/kg	710	<1	--	25,000	1	--	4,783	<1	--	3,341	<1	--
Chrysene	166	1,290	ug/kg	350	2	<1	650	4	<1	*	--	--	407	2	<1
Dibenz(a,h)anthracene	33.0	240	ug/kg	92.0	3	<1	110	3	<1	*	--	--	89.0	3	<1
Fluoranthene	423	2,230	ug/kg	750	2	<1	1,400	3	<1	1,037	2	<1	830	2	<1
gamma-BHC	2.37		ug/kg	ND	--	--	25.0	11	--	20.7	9	1	25.0	11	13
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	200	12	<1	300	18	1	*	--	--	199	12	<1
Phenanthrene	204	1,170	ug/kg	630	3	<1	760	4	<1	684	3	<1	437	2	<1
Pyrene	195	1,520	ug/kg	700	4	<1	1,200	6	<1	931	5	<1	779	4	<1
Aroclor-1254	60.0	300	ug/kg	220	4	<1	3,100	52	10	696	12	2	539	9	2
Total PAHs	1,610	22,800	ug/kg	3,620	2	<1	23,400	15	1	N/A	--	--	N/A	--	--
Total PCBs	40.0	676	ug/kg	220	6	<1	3,100	78	5	1,230	31	2	1,658	41	2

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for due to lack of available data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

Table A8.34
Pond B-5 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			B-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	B-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	24,000	1	<1	24,000	1	<1	21,415	1	<1	15,376	<1	<1
Barium	189	287	mg/kg	240	1	1	240	1	<1	*	--	--	171	<1	<1
Iron	20,000	280,000	mg/kg	22,000	1	<1	22,000	1	<1	21,340	1	<1	17,043	<1	<1
Lead	35.8	128	mg/kg	36.8	1	<1	36.8	1	<1	32.6	<1	<1	38.1	1	<1
Nickel	22.7	48.6	mg/kg	23.8	1	<1	23.8	1	<1	22.3	<1	<1	17.4	<1	<1
Selenium	0.950	1.73	mg/kg	1.6	2	<1	1.60	2	<1	1.44	2	<1	2.30	2	1
Silver	1.00	1.60	mg/kg	1.4	1	<1	1.40	1	<1	1.16	1	<1	296	296	185
Zinc	121	459	mg/kg	240	2	<1	240	2	<1	122	1	<1	205	2	<1

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for due to lack of available data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

Table A8.35
Pond C-1 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			C-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	C-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	31,000	2	<1	32,000	2	<1	29,035	2	<1	17,181	1	<1
Barium	189	287	mg/kg	330	2	1	330	2	1	305	2	1	201	1	<1
Iron	20,000	280,000	mg/kg	31,000	2	<1	31,000	<1	<1	28,990	1	<1	21,488	1	<1
Lead	35.8	128	mg/kg	38.0	1	<1	38.0	1	<1	33.2	1	<1	23.9	1	<1
Manganese	630	1,700	mg/kg	970	2	<1	970	2	<1	588	1	<1	418	1	<1
Mercury	0.180	1.06	mg/kg	1.600	9	1	1.60	9	2	*	--	--	0.308	2	<1
Nickel	22.7	48.6	mg/kg	24.0	1	<1	24.0	1	<1	22.2	1	<1	17.3	1	<1
Selenium	0.950	1.73	mg/kg	2.80	3	2	2.80	3	2	2.4	2	1	2.03	2	1
Zinc	121	459	mg/kg	140	1	<1	140	1	<1	120.0	1	<1	93.8	1	<1
Organics															
Acenaphthene	6.71	89.0	ug/kg	320	48	4	360	54	4	*	--	--	251	37	3
Anthracene	57.2	845	ug/kg	450	8	<1	450	8	<1	*	--	--	348	6	<1
Benzo(a)anthracene	108	1,050	ug/kg	190	2	<1	190	2	<1	*	--	--	121	1	<1
Benzo(a)pyrene	150	1,450	ug/kg	170	1	<1	170	1	<1	*	--	--	105	1	<1
Benzo(g,h,i)perylene	13.0	280	ug/kg	150	12	<1	150	12	<1	*	--	--	150	12	<1
Chrysene	166	1,290	ug/kg	190	1	<1	190	1	<1	*	--	--	117	1	<1
Dibenz(a,h)anthracene	33.0	240	ug/kg	530	16	2	530	16	2	*	--	--	530	16	2
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	500	29	2	500	29	2	*	--	--	413	24	2
Pentachlorophenol	255	360	ug/kg	950	4	3	950	4	3	*	--	--	950	4	3
Phenanthrene	204	1,170	ug/kg	360	2	<1	360	2	<1	*	--	--	340	2	<1
Pyrene	195	1,520	ug/kg	310	2	<1	310	2	<1	*	--	--	310	2	<1
Aroclor 1254	60.0	300	ug/kg	94.0	2	<1	94.0	2	<1	*	--	--	94.0	2	<1
Total PCBs	40.0	676	ug/kg	94.0	2	<1	94.0	2	<1	*	--	--	94.0	2	<1
Total PAHs	1,610	22,800	ug/kg	3,460	2	<1	9,985	6	<1	N/A	--	--	500	13	1
TEQ - Dioxins	8.50E-04	0.022	ug/kg	1.60E-05	<1	<1	0.001	2	<1	NA	--	--	NA	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for due to lack of available data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

Table A8.36
Pond C-2 Hazard Quotients for Sediment ECOPCs

ECOPC	ESL	AT Threshold	Unit	MDC Surface Sediment HQs			MDC All Sediment HQs			95 UCL All Sediment HQs			C-Series Mean All Sediment HQs		
				MDC	ESL-HQ	AT-HQ	MDC	ESL-HQ	AT-HQ	95 UCL	ESL-HQ	AT-HQ	C-Series Mean	ESL-HQ	AT-HQ
Inorganics															
Aluminum	15,900	58,000	mg/kg	22,000	1	<1	22,000	1	<1	16,434	1	<1	17,181	1	<1
Arsenic	9.79	33.0	mg/kg	9.80	1	<1	9.80	1	<1	6.81	<1	<1	6.02	<1	<1
Barium	189	287	mg/kg	226	1	<1	226	1	<1	181	<1	1	201	1	<1
Copper	31.6	149	mg/kg	35.9	1	<1	35.9	1	<1	22.9	<1	<1	21.5	<1	<1
Iron	20,000	280,000	mg/kg	29,000	1	<1	29,000	1	<1	21,617	1	<1	21,488	1	<1
Mercury	0.180	1.06	mg/kg	0.680	4	<1	0.68	4	<1	*	--	--	0.3	2	<1
Selenium	0.950	1.73	mg/kg	1.10	1	<1	1.1	1	<1	0.7	<1	<1	2.0	2	1
Zinc	121	459	mg/kg	201	2	<1	201	2	<1	115.0	<1	<1	93.8	<1	<1
Organics															
Total PAHs	1,610	22,800	ug/kg	ND	--	--	14,700	9	1	N/A	--	--	N/A	--	--

95 UCLs based on proxy values which include NDs at 1/2 DL.
HQ = Hazard Quotient, rounded to nearest whole number
ND - Not Detected in this media
NA - Not analyzed for due to lack of available data
* If the 95 UCL was > MDC, HQs were not calculated for the 95 UCL.

FIGURES

913

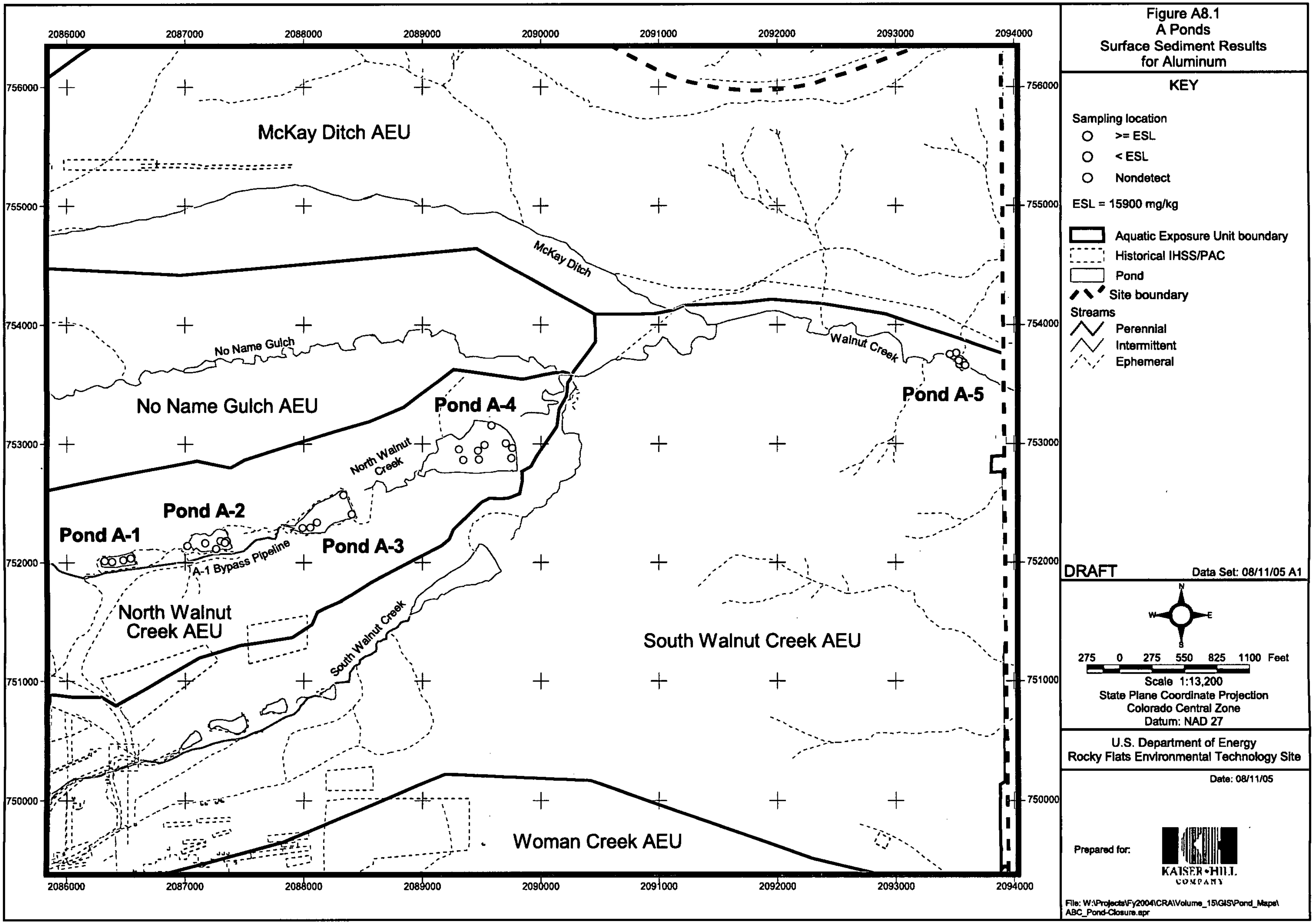
Figure A8.1
A Ponds
Surface Sediment Results
for Aluminum
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 15900 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
N
W
E
S
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-4
Pond A-5
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
2089000
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755000
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750000

915

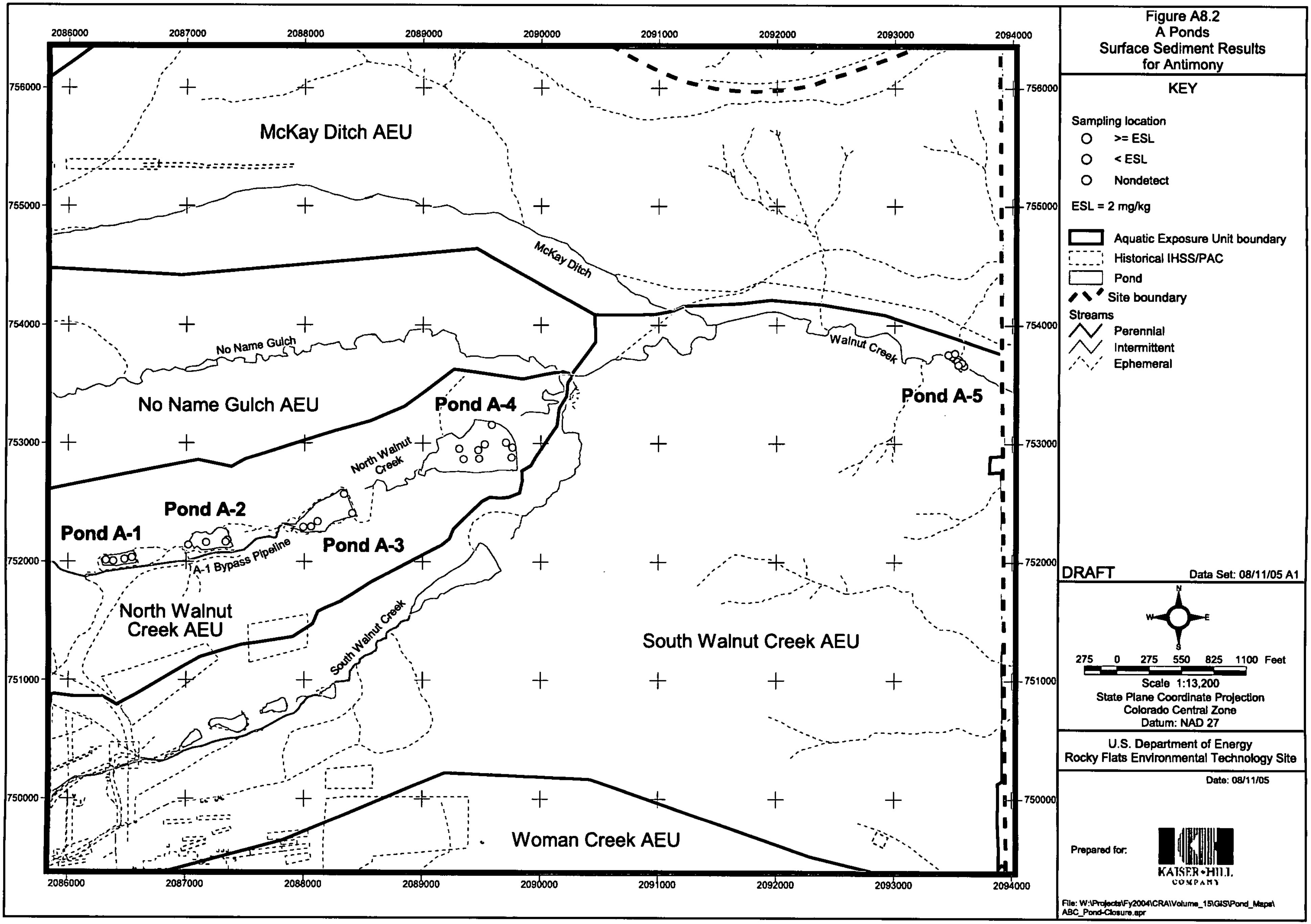
Figure A8.2
A Ponds
Surface Sediment Results
for Antimony
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 2 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Pond A-4
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Walnut Creek
Pond A-5
Woman Creek AEU
2086000
2087000
2088000
2089000
2090000
2091000
2092000
2093000
2094000
756000
755000
754000
753000
752000
751000
750000

9/6

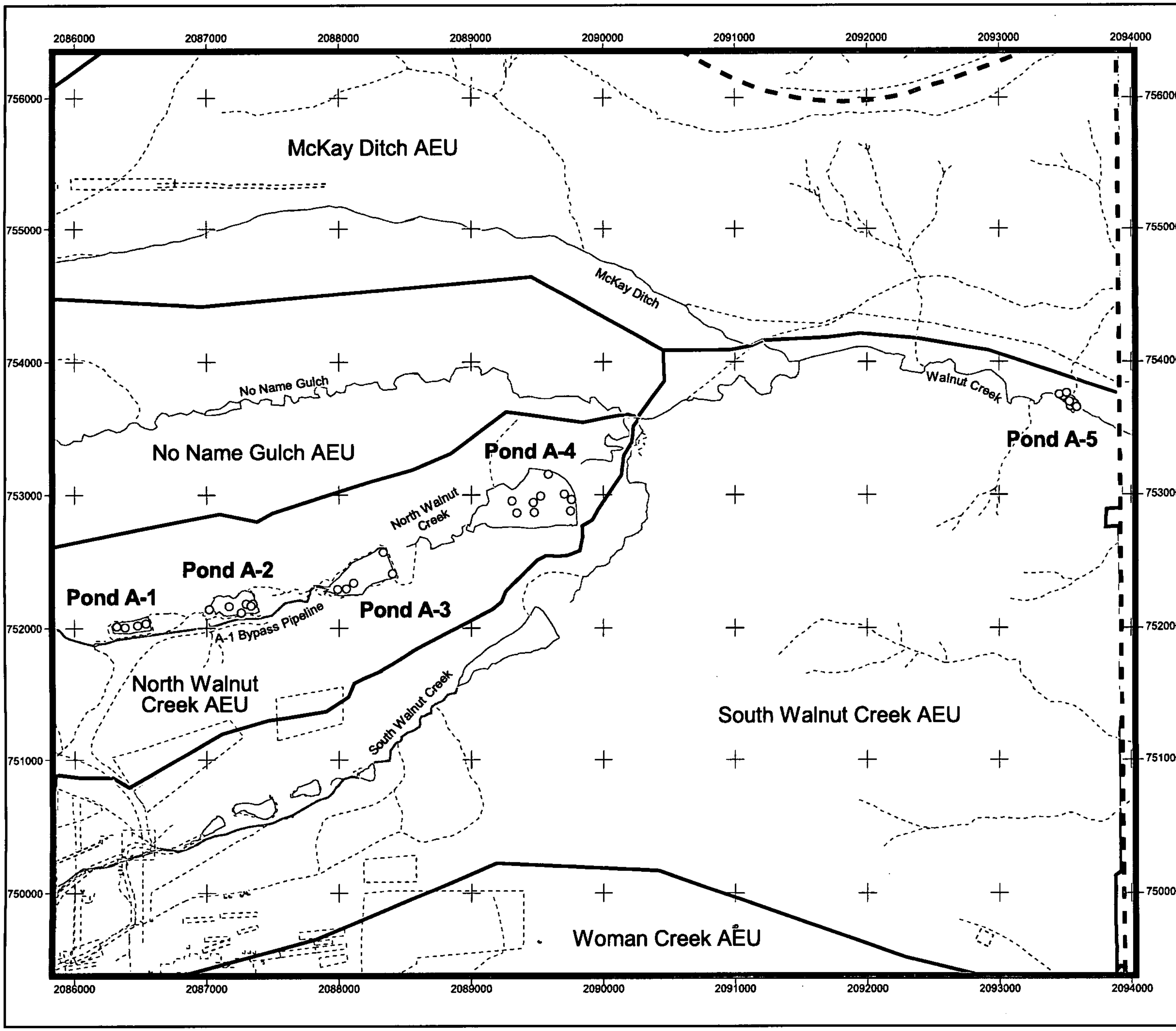

Figure A8.3
A Ponds
Surface Sediment Results
for Arsenic

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 9.79 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 08/11/05

Prepared for:

KAISER-HILL COMPANY

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr.

917

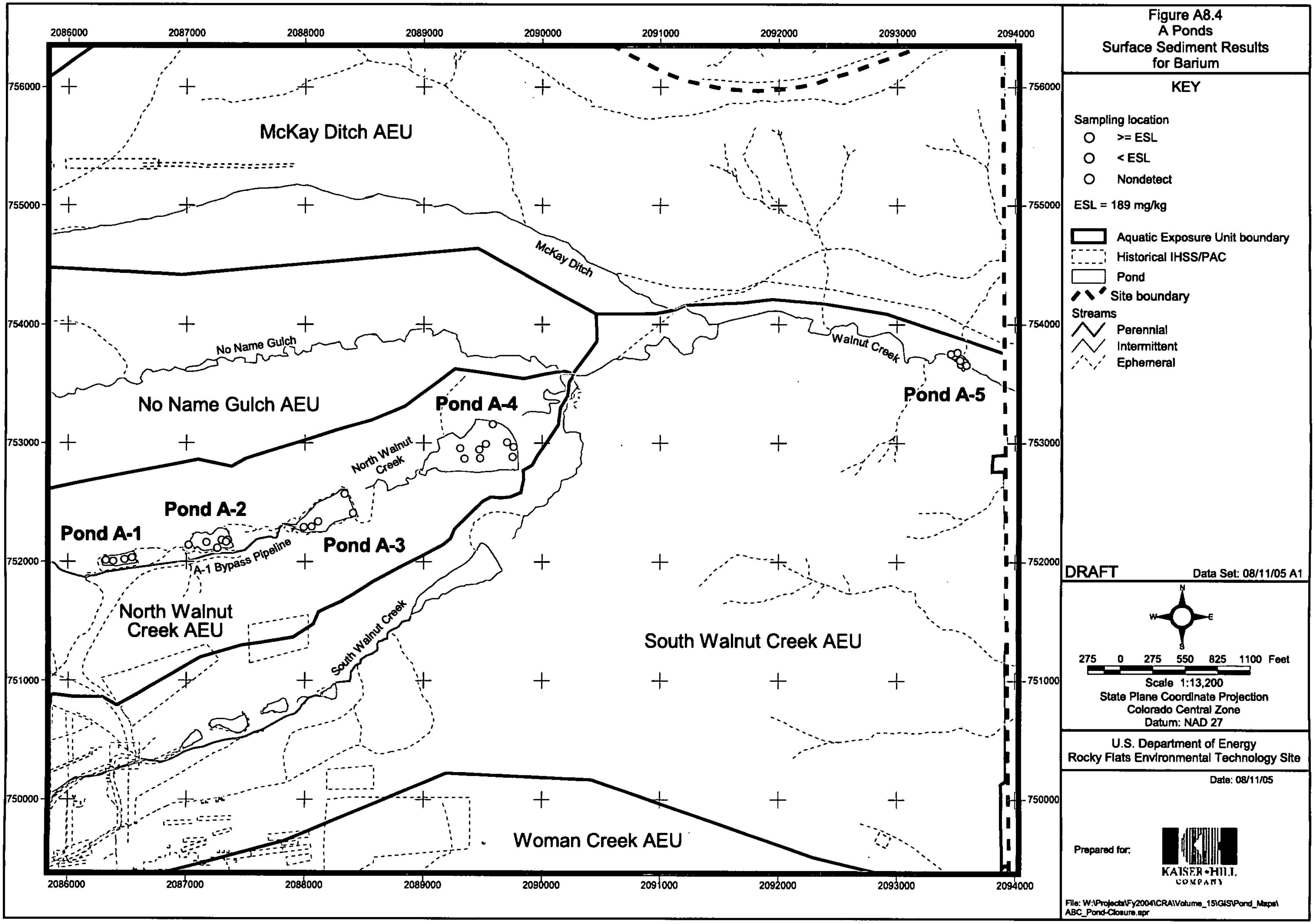

Figure A8.4
A Ponds
Surface Sediment Results
for Barium

918

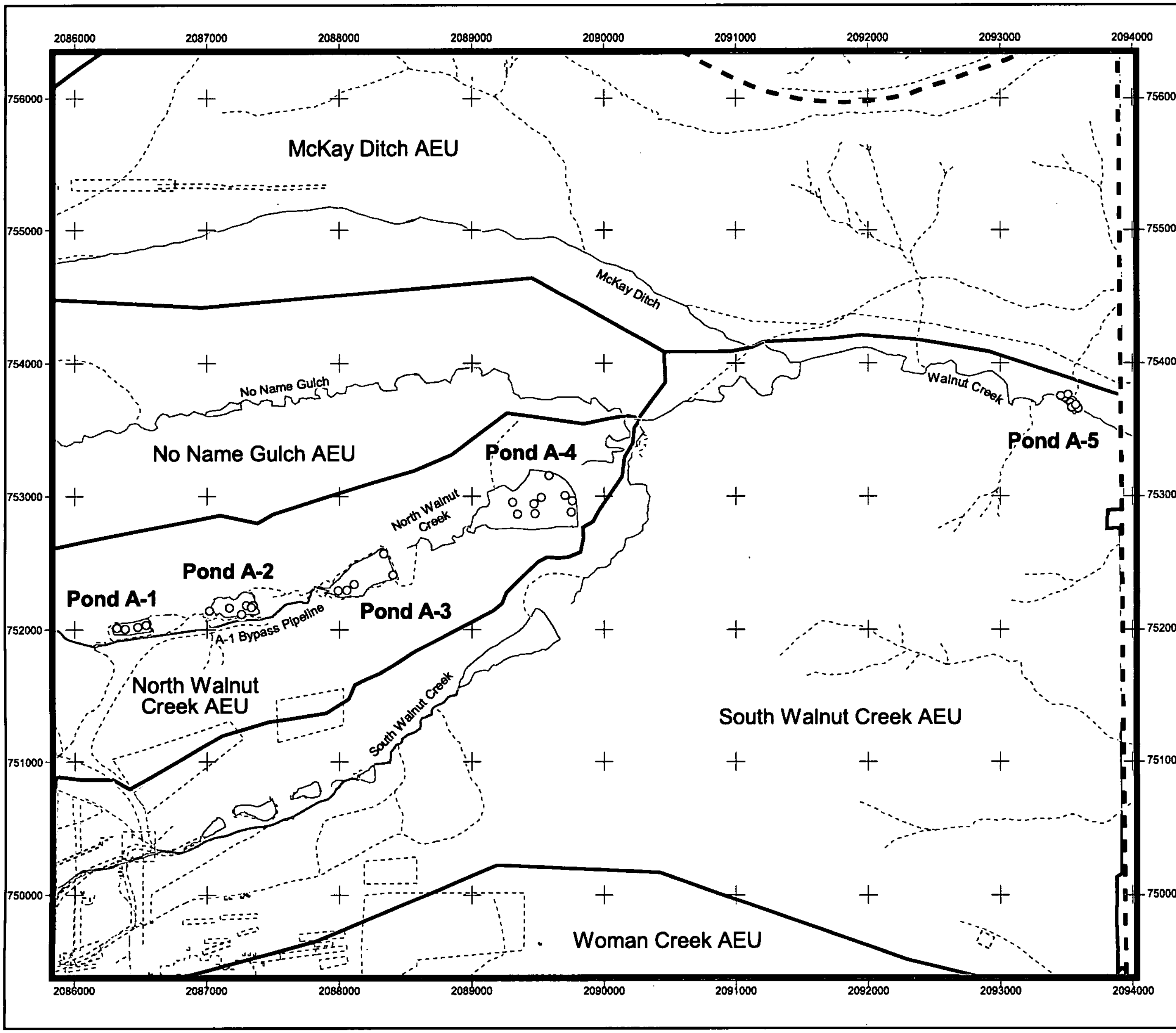

Figure A8.5
A Ponds
Surface Sediment Results
for Cadmium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 0.99 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 08/11/05

Prepared for:

KAISER-HILL COMPANY

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

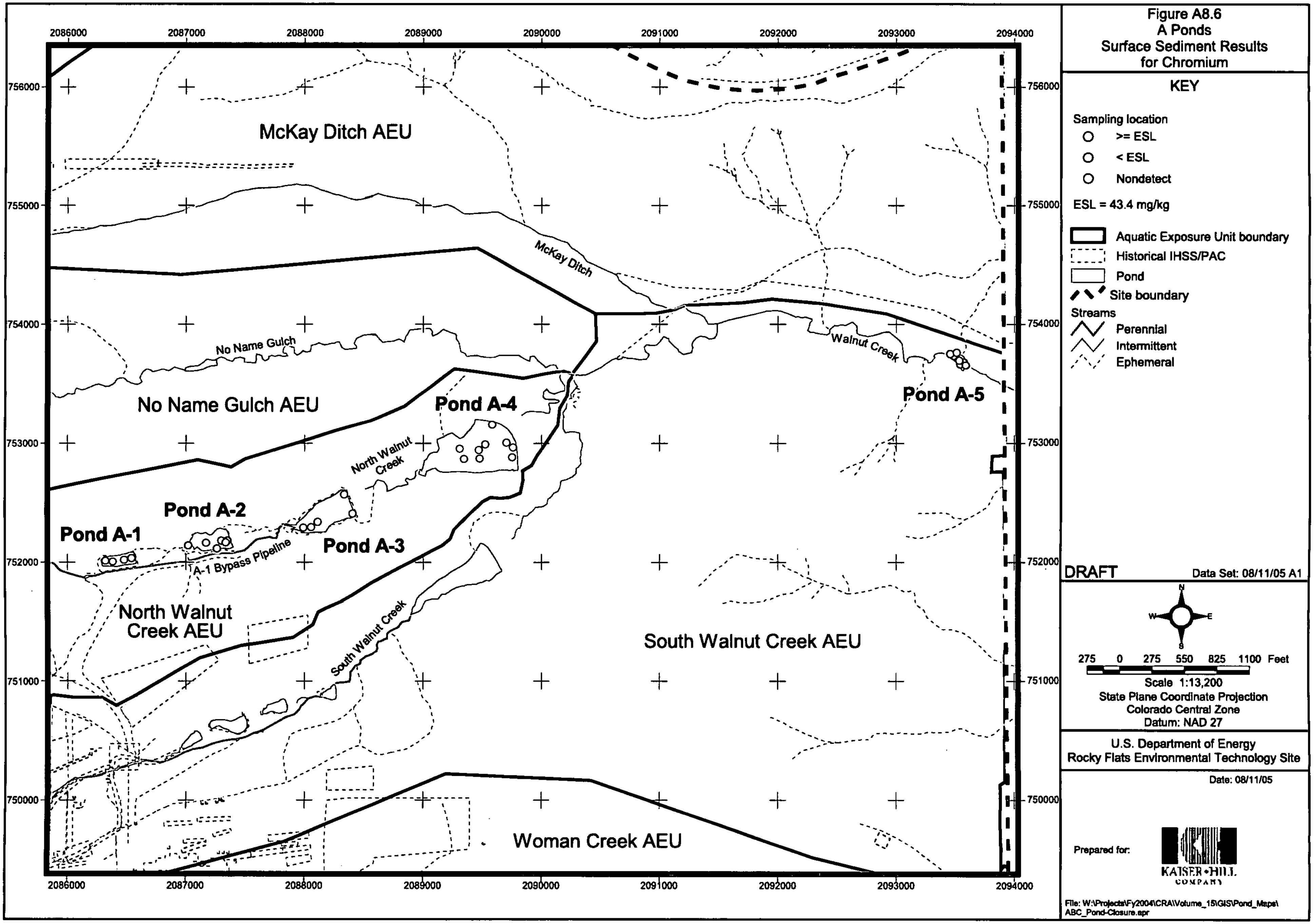

Figure A8.6
A Ponds
Surface Sediment Results
for Chromium

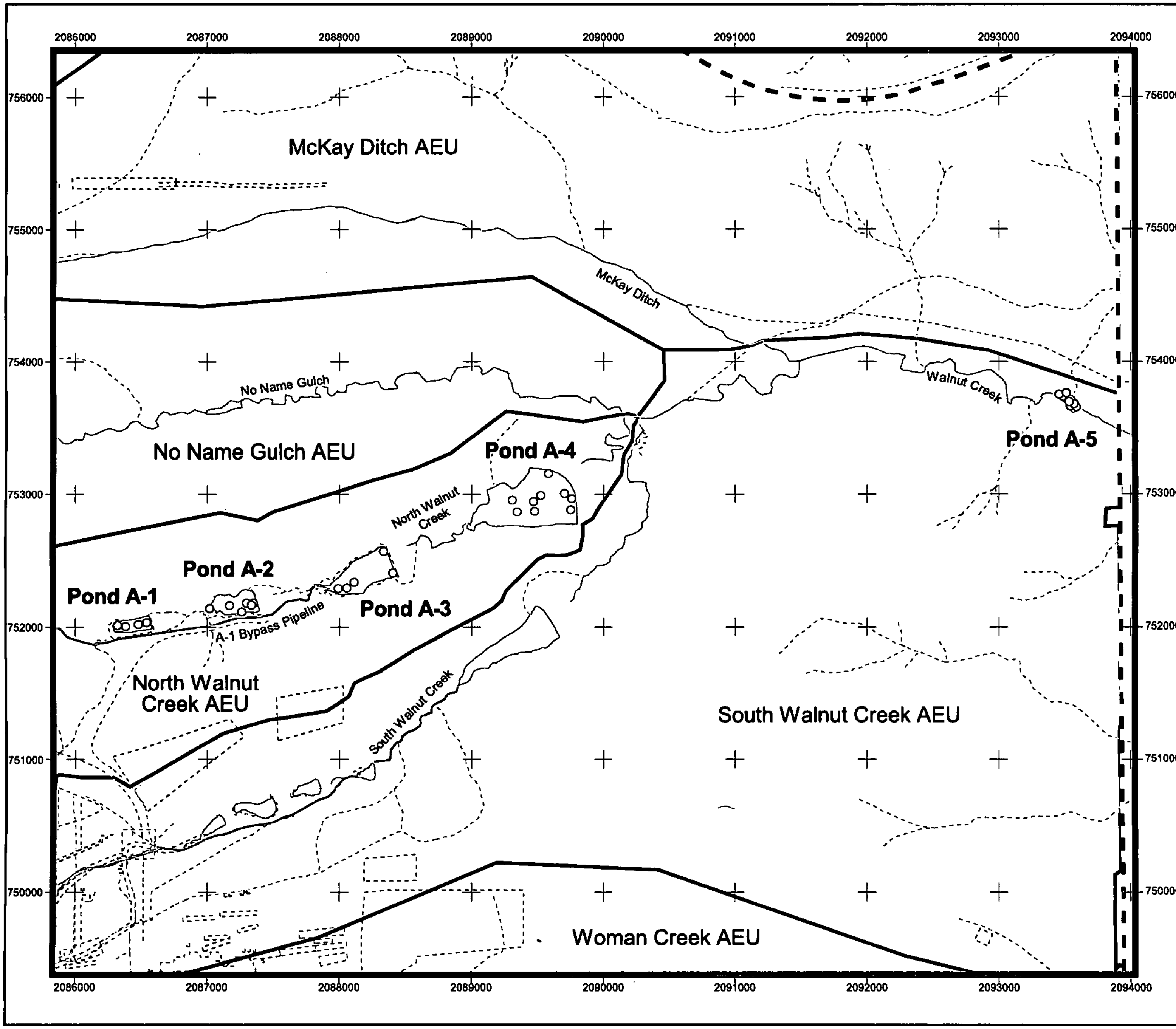

Figure A8.7
A Ponds
Surface Sediment Results
for Copper

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 31.6 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 08/11/05

Prepared for:

KAISER-HILL COMPANY

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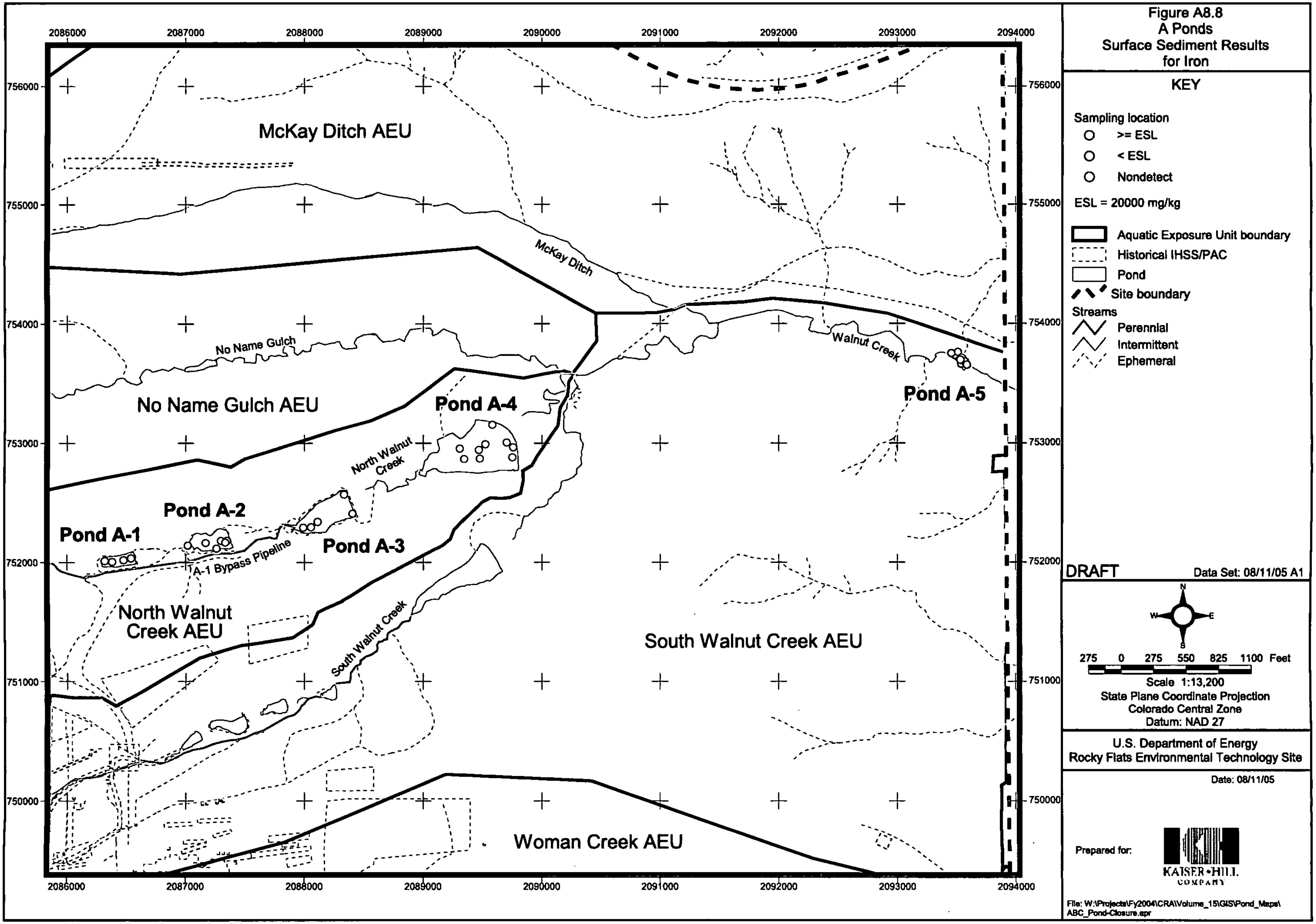
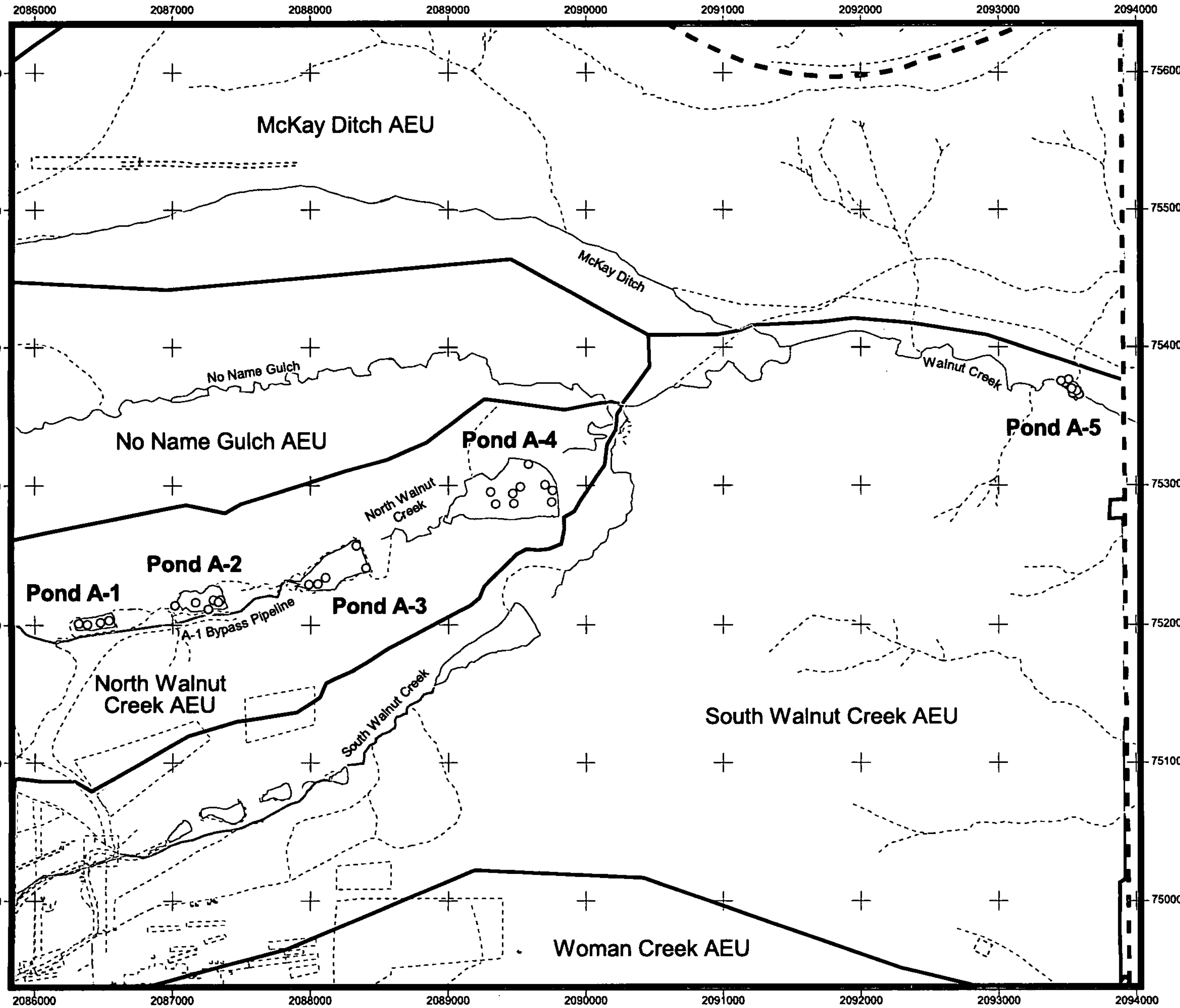


Figure A8.8
A Ponds
Surface Sediment Results
for Iron
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 20000 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
N
W
E
S
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-5
Pond A-4
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
2089000
2090000
2091000
2092000
2093000
2094000
756000
755000
754000
753000
752000
751000
750000

Figure A8.9
A Ponds
Surface Sediment Results
for Lead



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 35.8 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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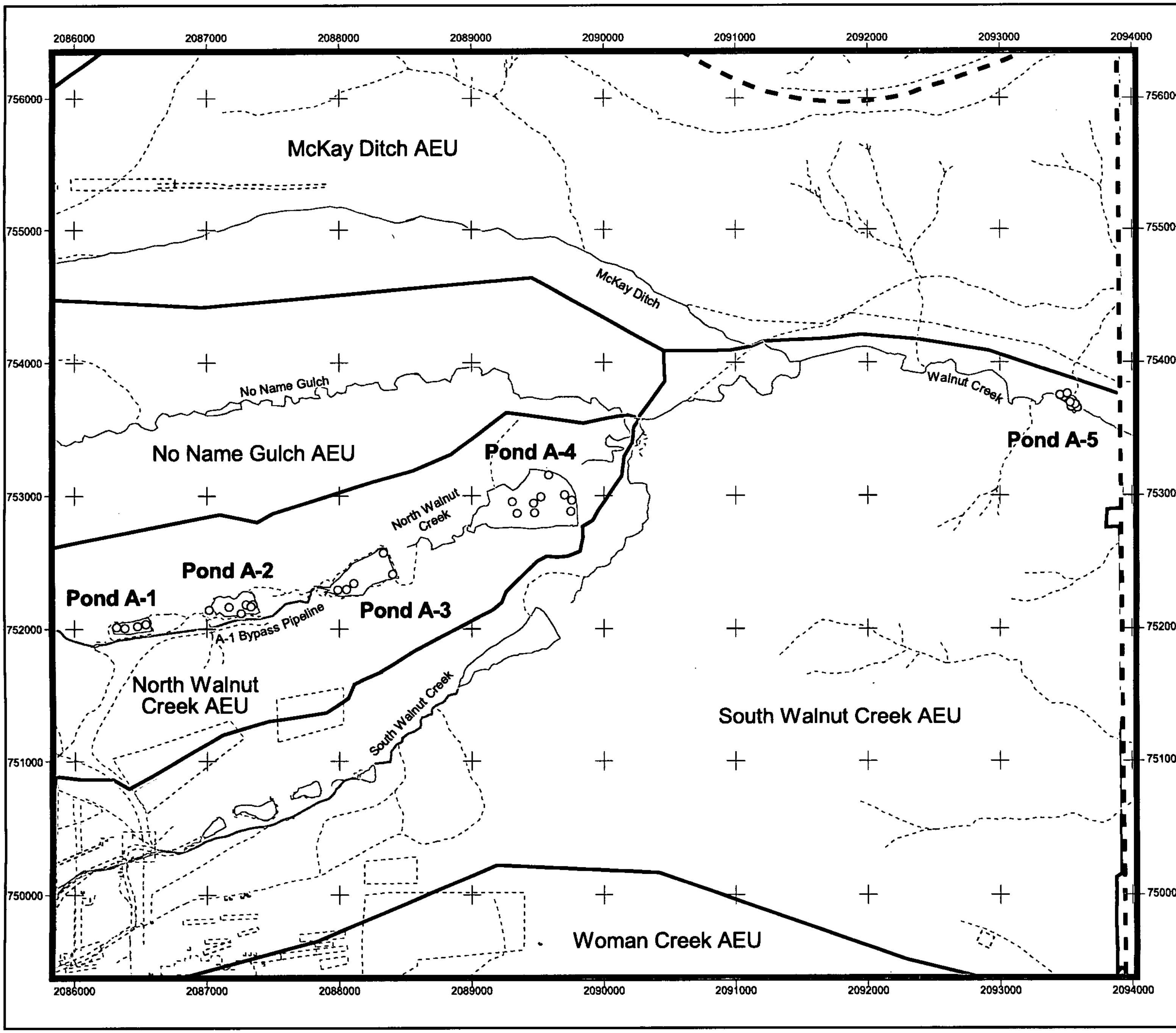
Figure A8.10
A Ponds
Surface Sediment Results for Manganese



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 630 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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924

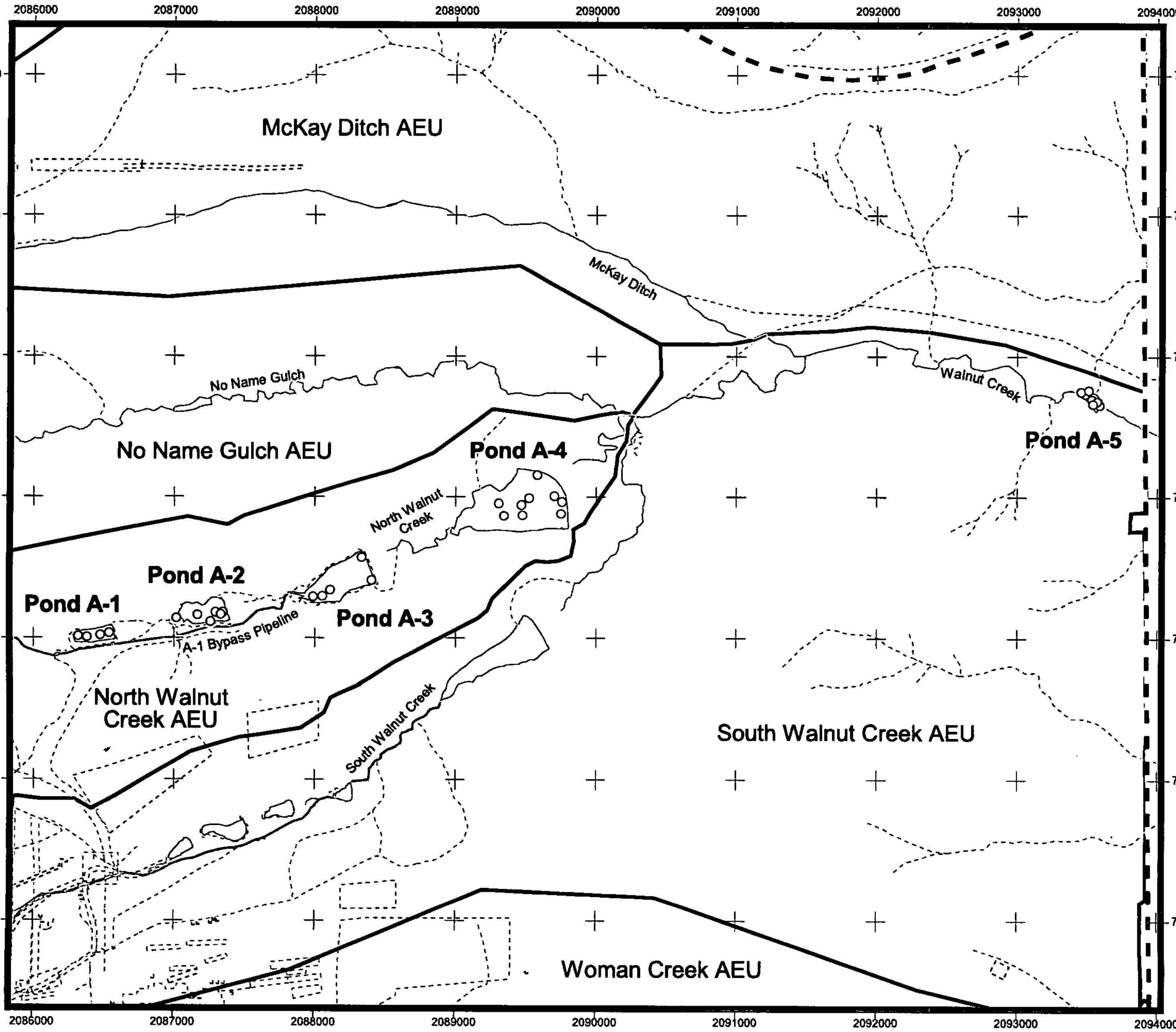

Figure A8.11
A Ponds
Surface Sediment Results
for Mercury

KEY

Sampling location
>= ESL
< ESL
Nondetect

ESL = 0.18 mg/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

DRAFT

Data Set: 08/11/05 A1

N S W E

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

Prepared for:

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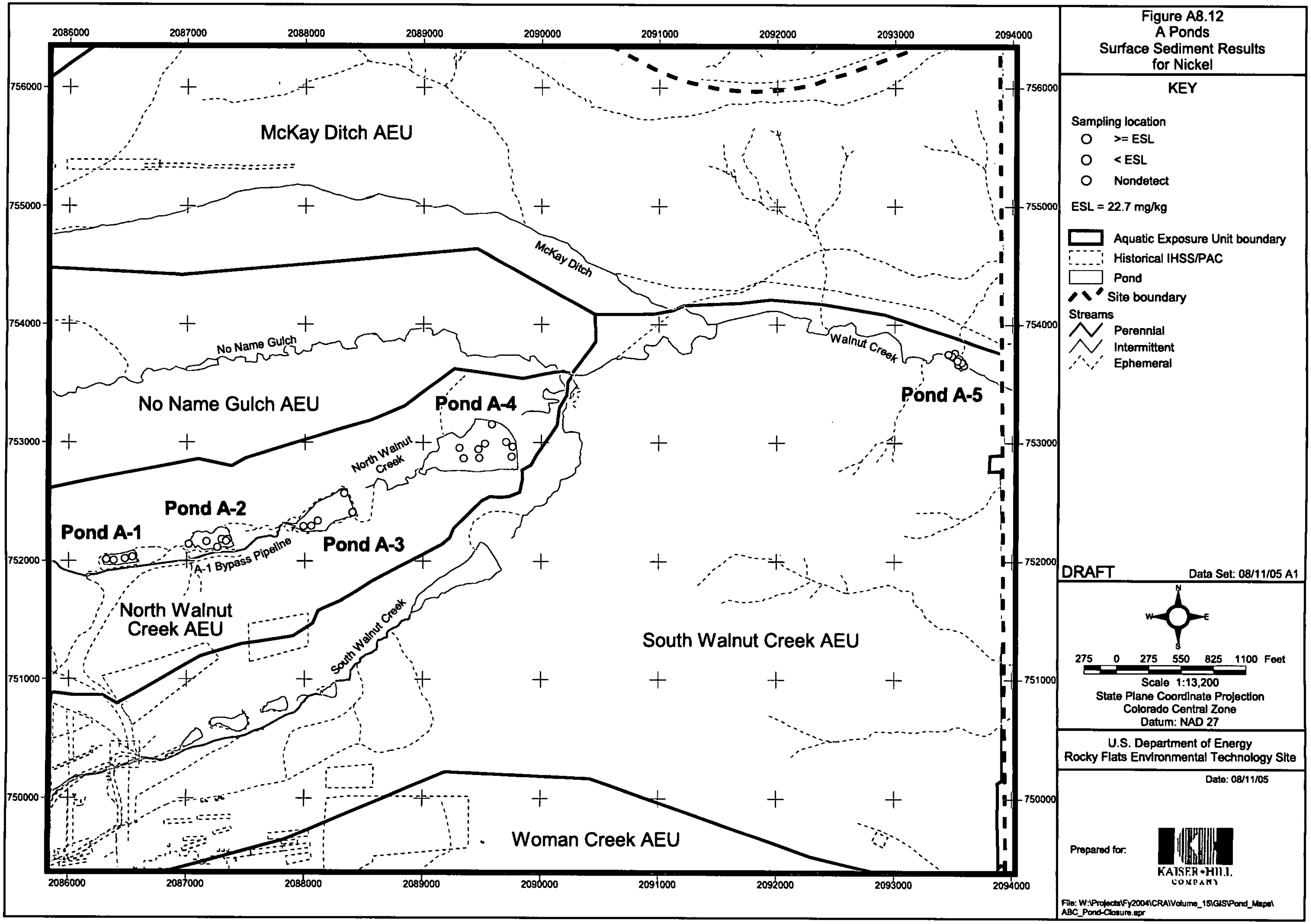

Figure A8.12
A Ponds
Surface Sediment Results
for Nickel
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 22.7 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-4
Pond A-5
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
2089000
2090000
2091000
2092000
2093000
2094000
756000
755000
754000
753000
752000
751000
750000

926

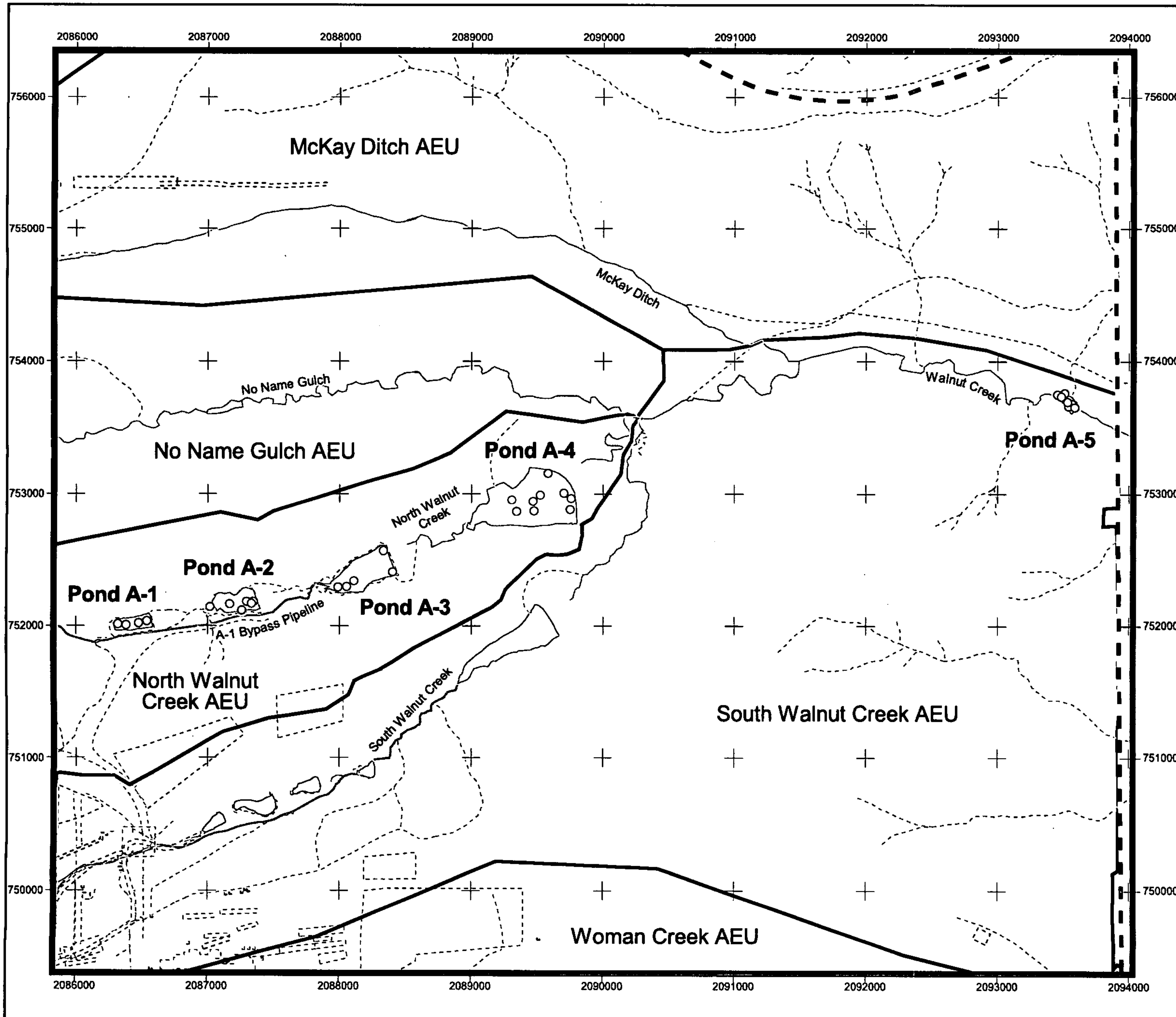

Figure A8.13
A Ponds
Surface Sediment Results
for Selenium

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 0.95 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

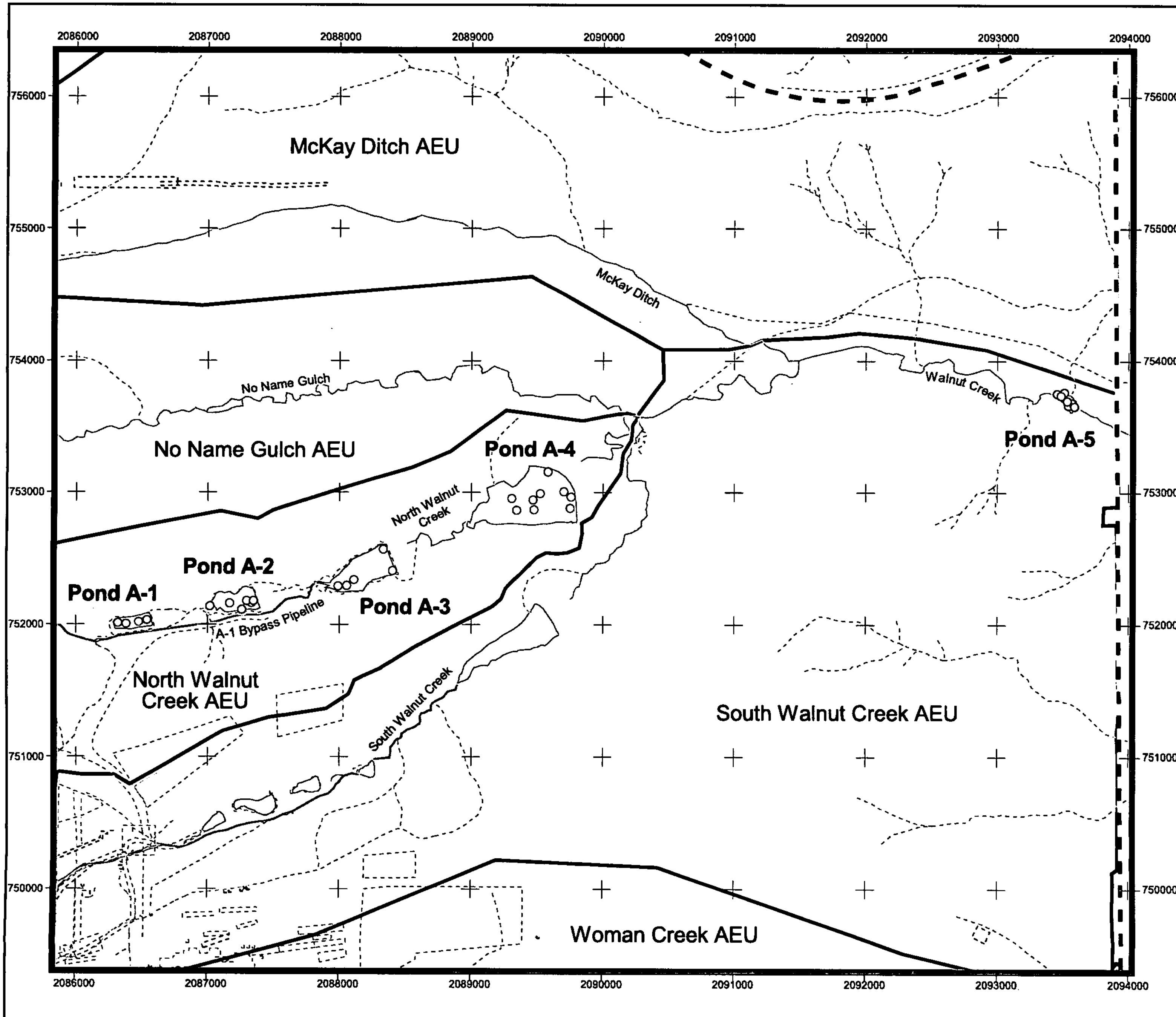

Figure A8.14
A Ponds
Surface Sediment Results for Silver

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 1 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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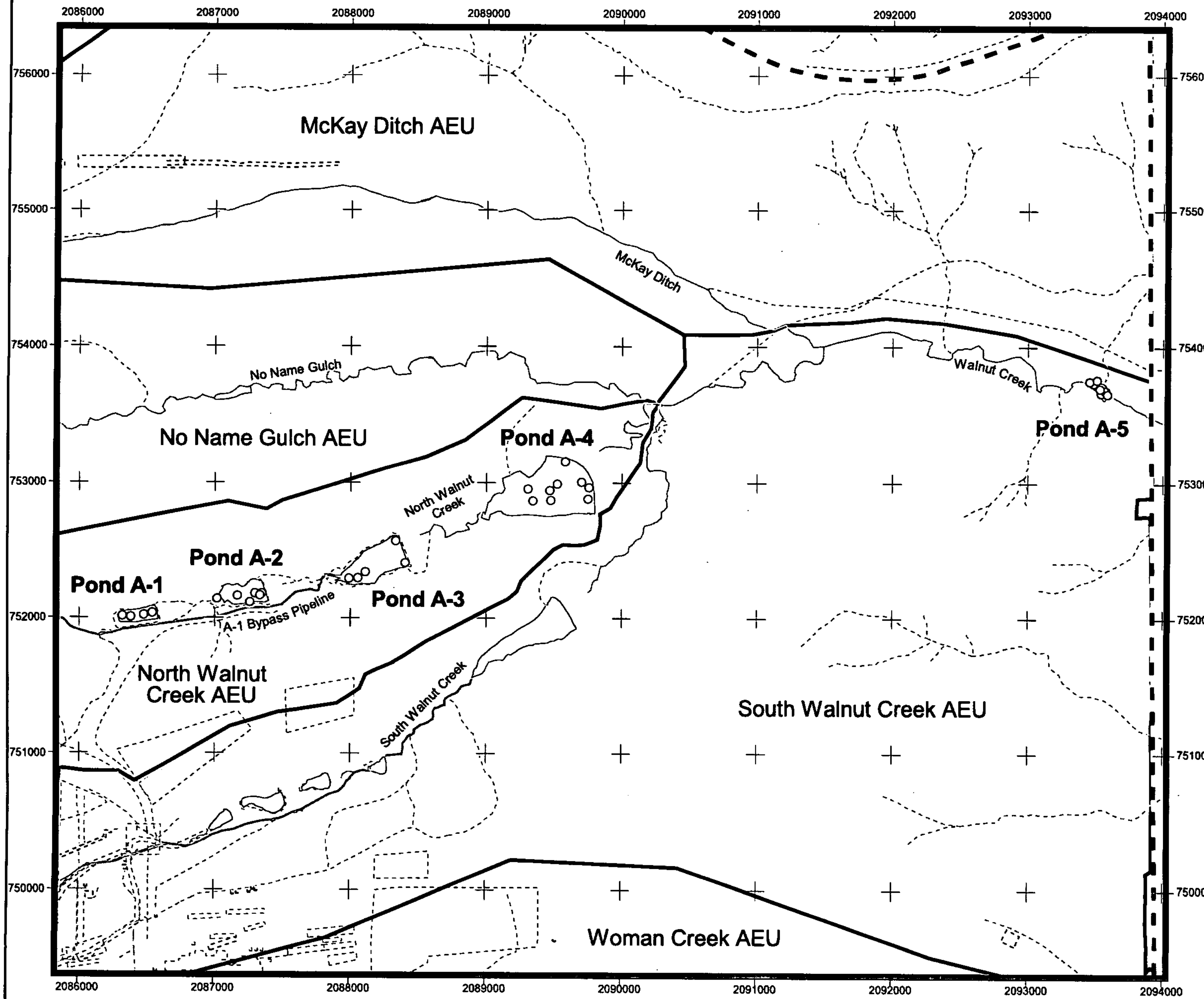
Figure A8.15
A Ponds
Surface Sediment Results for Zinc



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 121 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N, S, E, W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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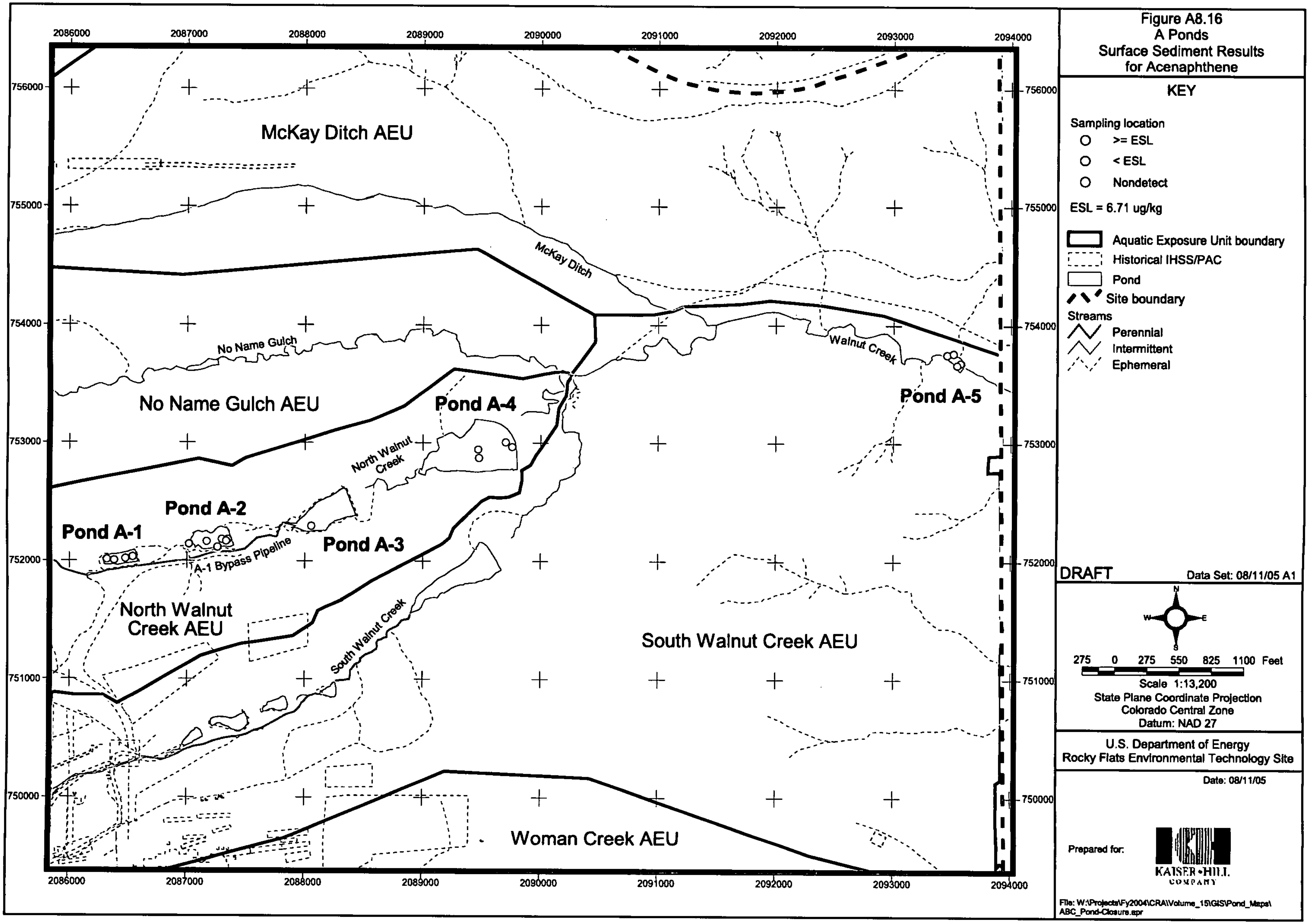
Figure A8.16
A Ponds
Surface Sediment Results
for Acenaphthene
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 6.71 ug/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-5
Pond A-4
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
2089000
2090000
2091000
2092000
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2094000
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752000
751000
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930

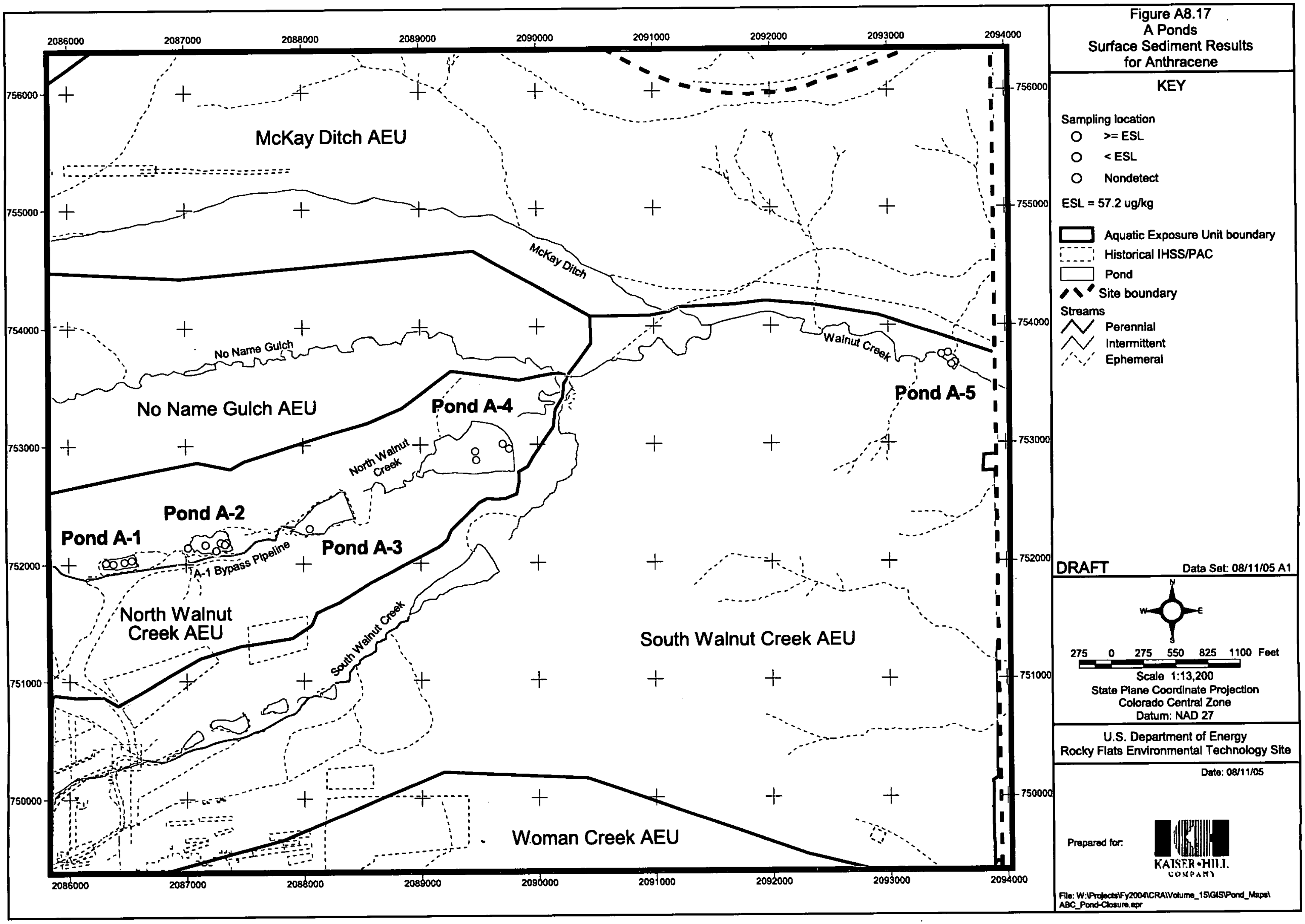
Figure A8.17
A Ponds
Surface Sediment Results
for Anthracene
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 57.2 ug/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
N
E
S
W
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Pond A-4
Pond A-5
Walnut Creek
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
2089000
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2093000
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931

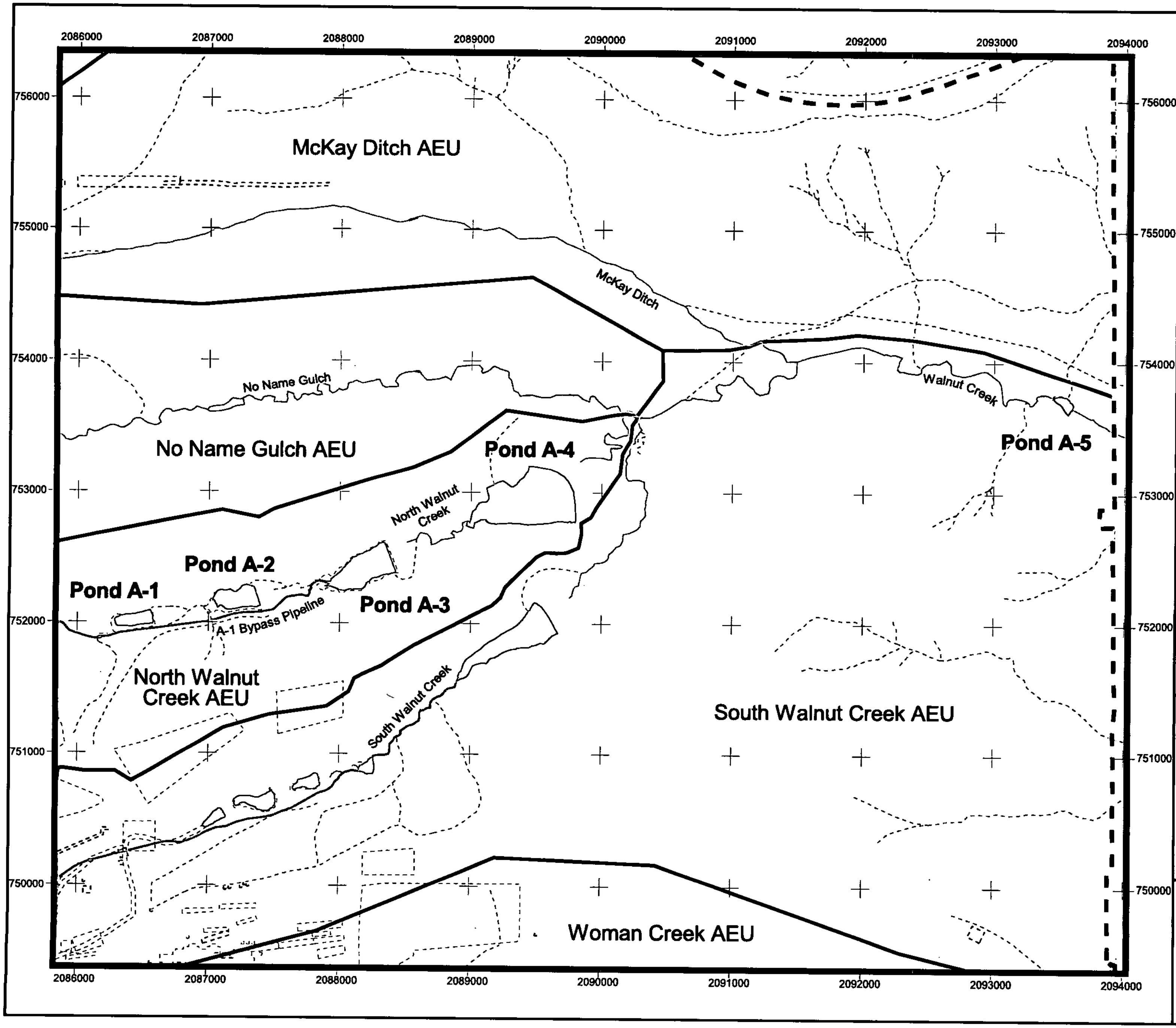

Figure A8.18
A Ponds
Surface Sediment Results
for Atrazine

KEY

Sample location
O >= ESL
O < ESL
O Nondetect

ESL = 16.8192 ug/kg

Note:
Atrazine was only detected in subsurface sediment samples so no data points are shown on this map.

Standard Map Features
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Perennial stream
Intermittent stream
Ephemeral stream
Site boundary

N W E S

0 550 1100 Feet

Scale 1:13,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Technology Site

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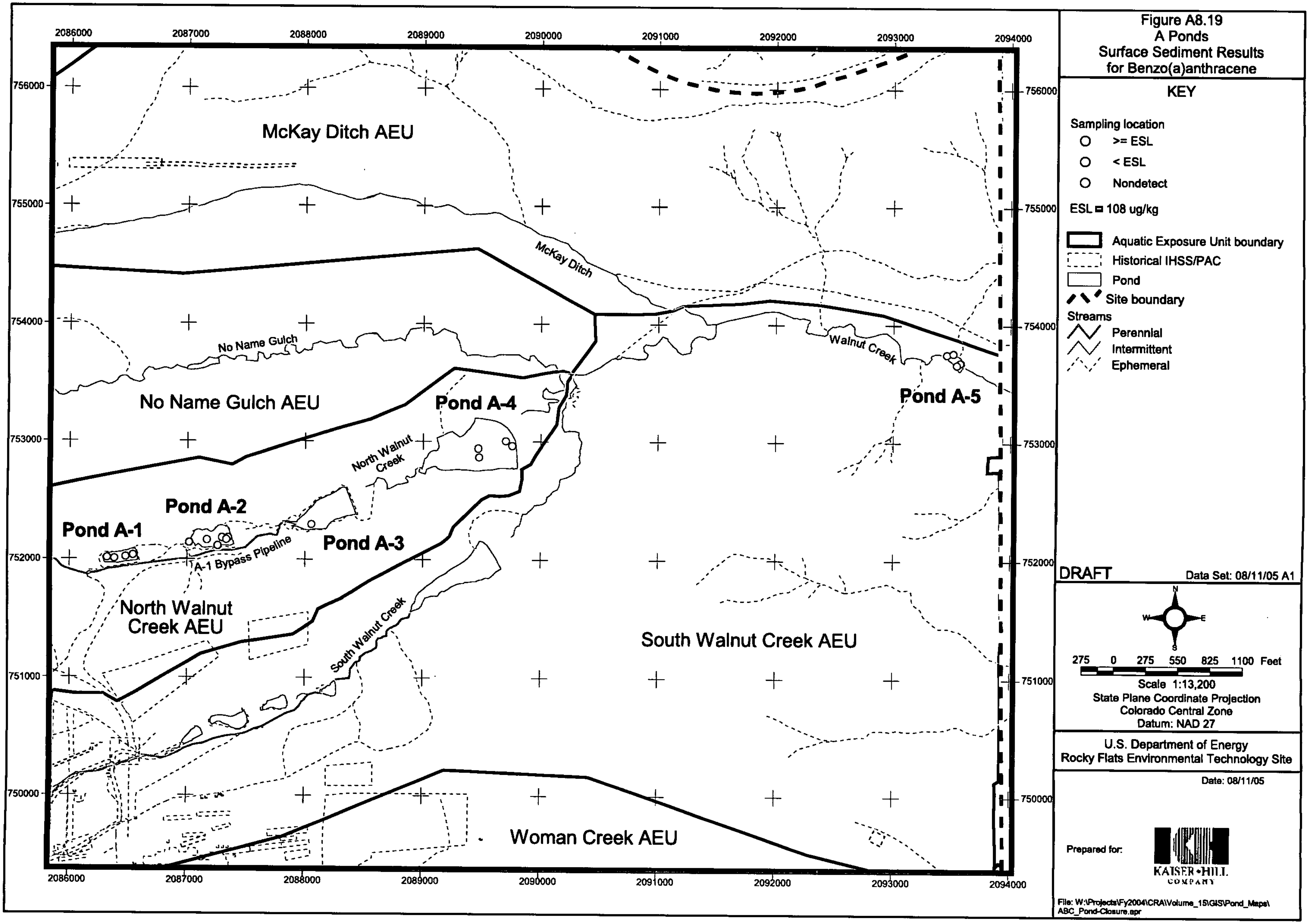

Figure A8.19
A Ponds
Surface Sediment Results
for Benzo(a)anthracene
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 108 ug/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
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Date: 08/11/05
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KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-4
Pond A-5
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
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933

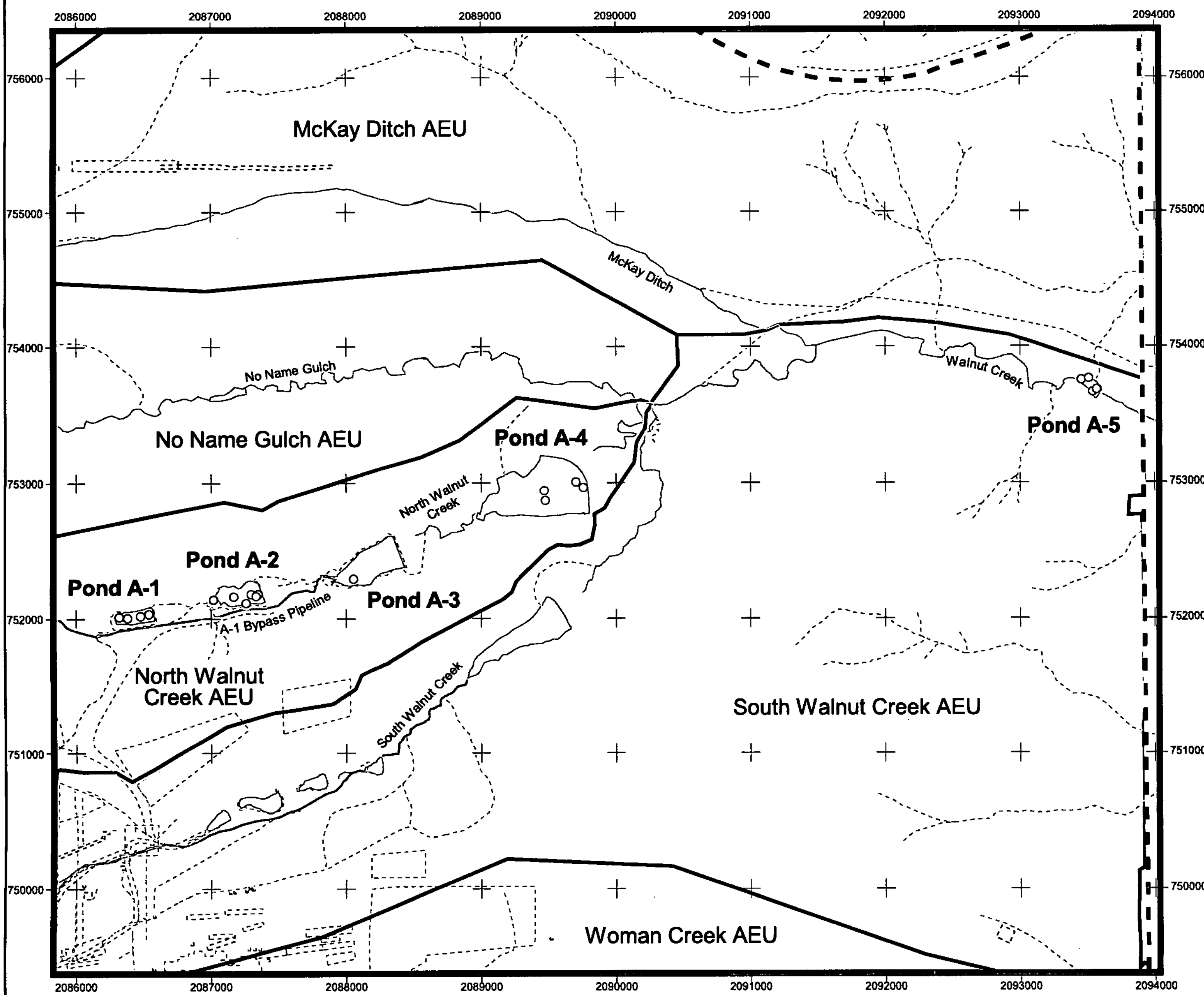

Figure A8.20
A Ponds
Surface Sediment Results for Benzo(a)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 150 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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934

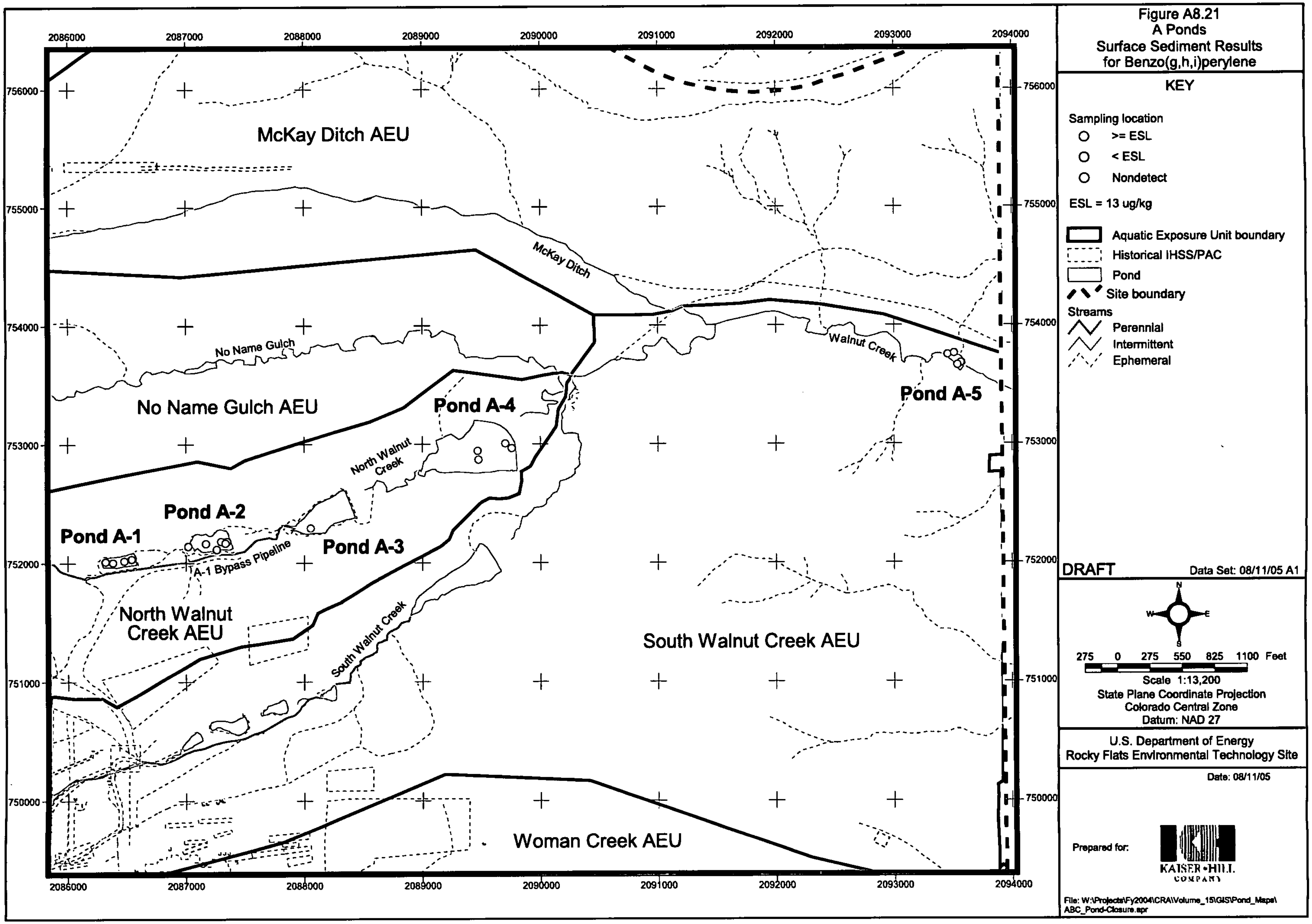
Figure A8.21
A Ponds
Surface Sediment Results
for Benzo(g,h,i)perylene
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 13 ug/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
N
S
E
W
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
McKay Ditch AEU
McKay Ditch
No Name Gulch
No Name Gulch AEU
Walnut Creek
Pond A-5
Pond A-4
North Walnut Creek
Pond A-2
Pond A-1
Pond A-3
A-1 Bypass Pipeline
North Walnut Creek AEU
South Walnut Creek
South Walnut Creek AEU
Woman Creek AEU
2086000
2087000
2088000
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935

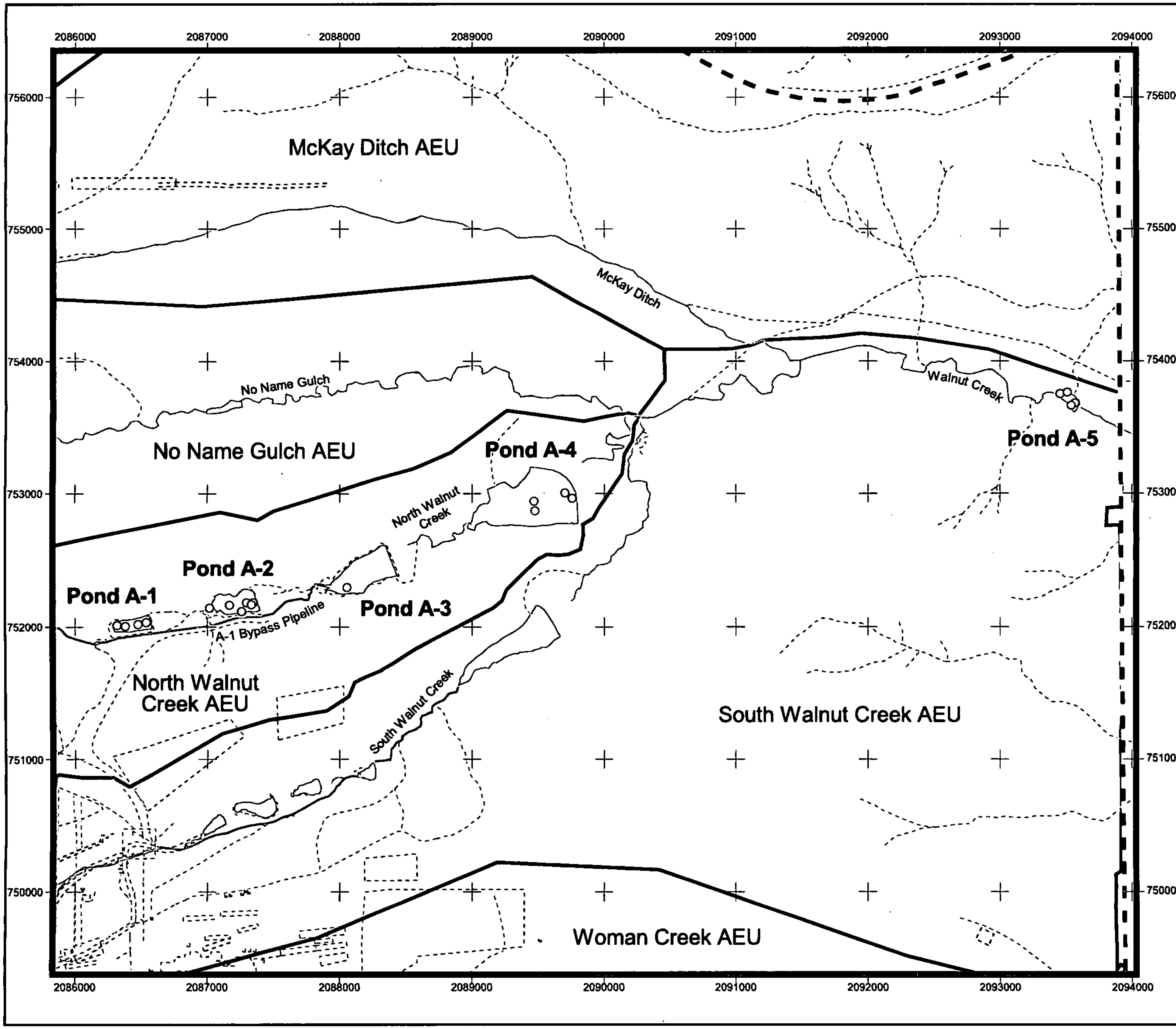

Figure A8.22
A Ponds
Surface Sediment Results
for bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 24900 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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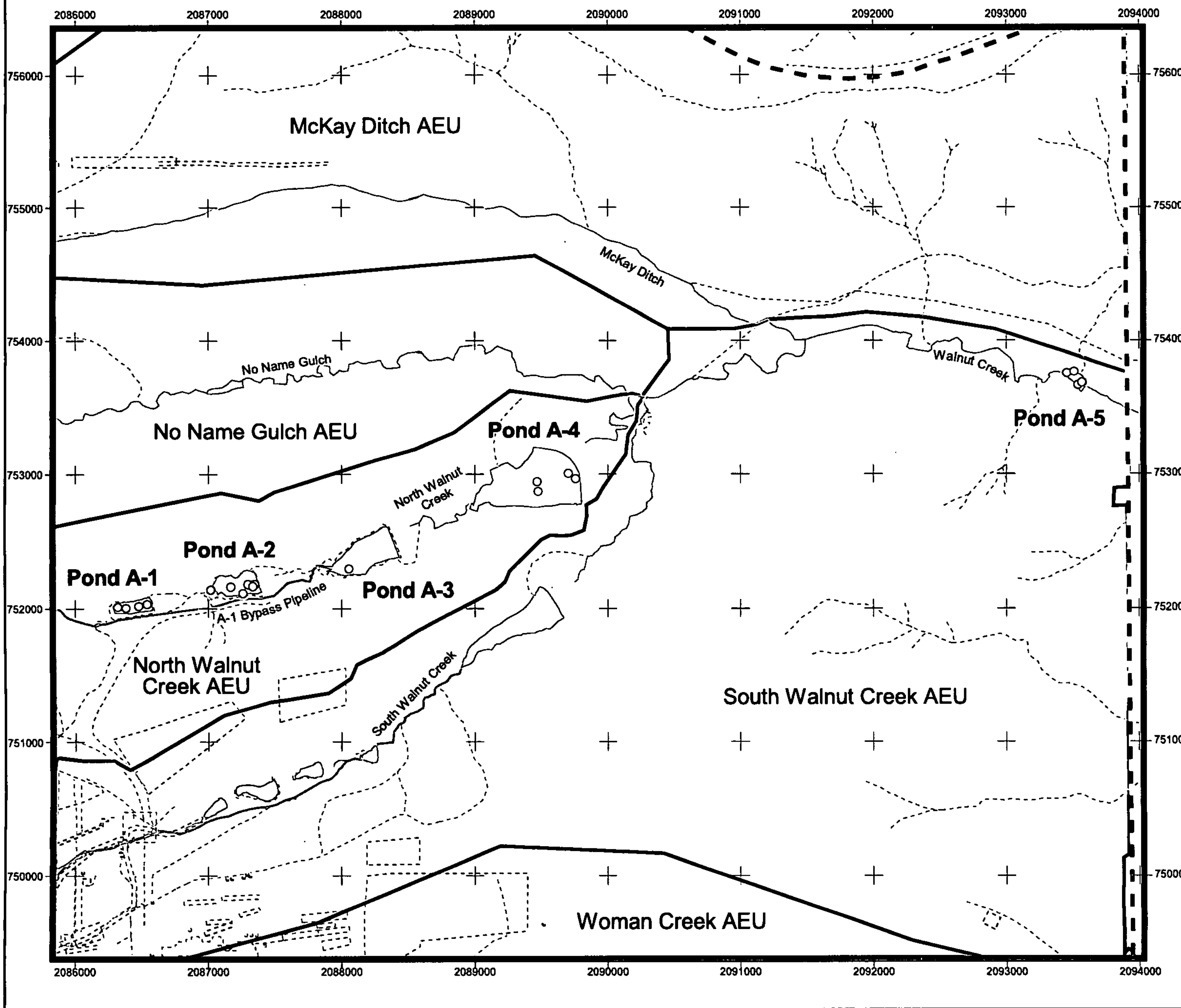
936

Figure A8.23
A Ponds
Surface Sediment Results
for Chrysene



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 166 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

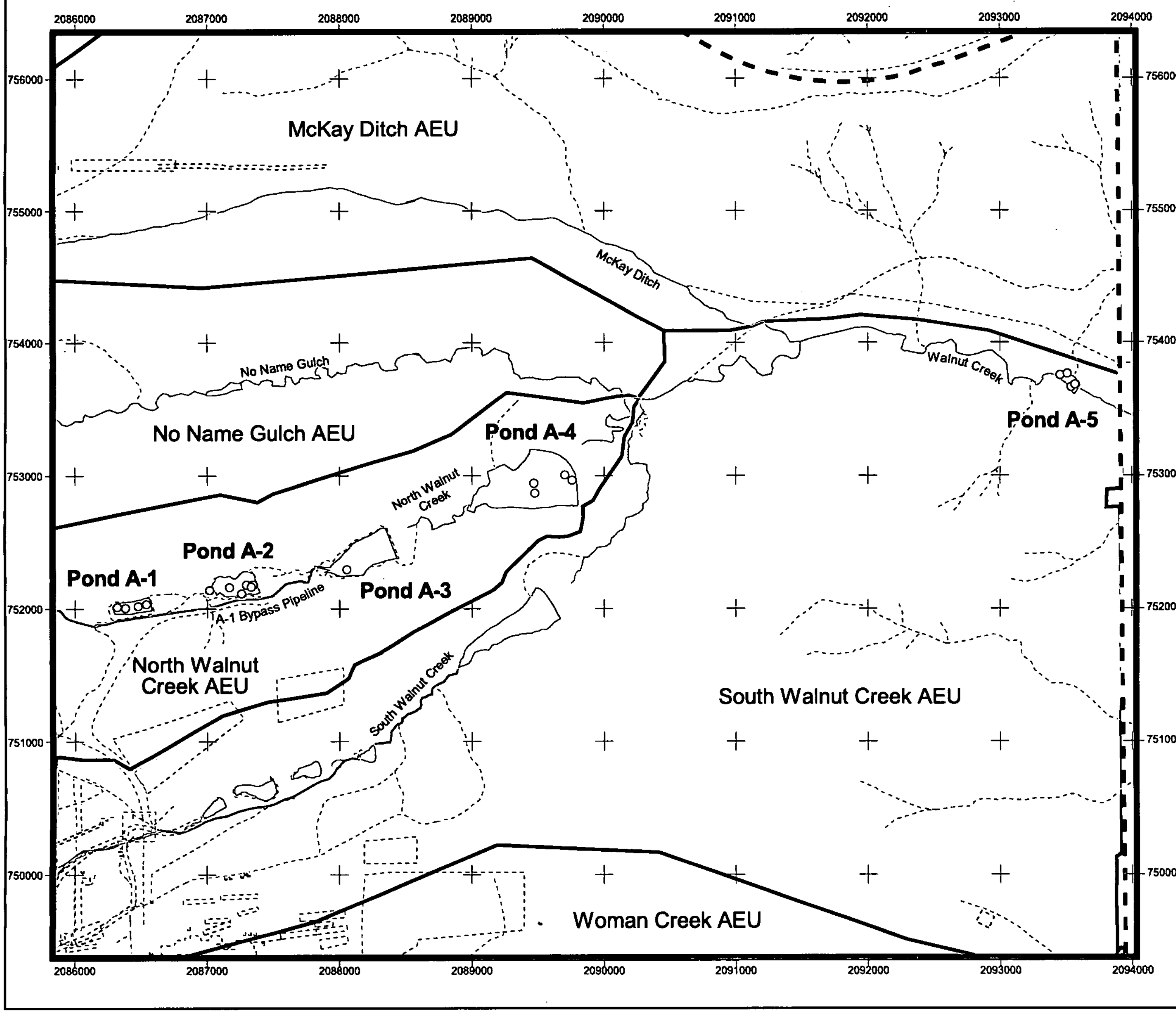

Figure A8.24
A Ponds
Surface Sediment Results
for Fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 423 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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938

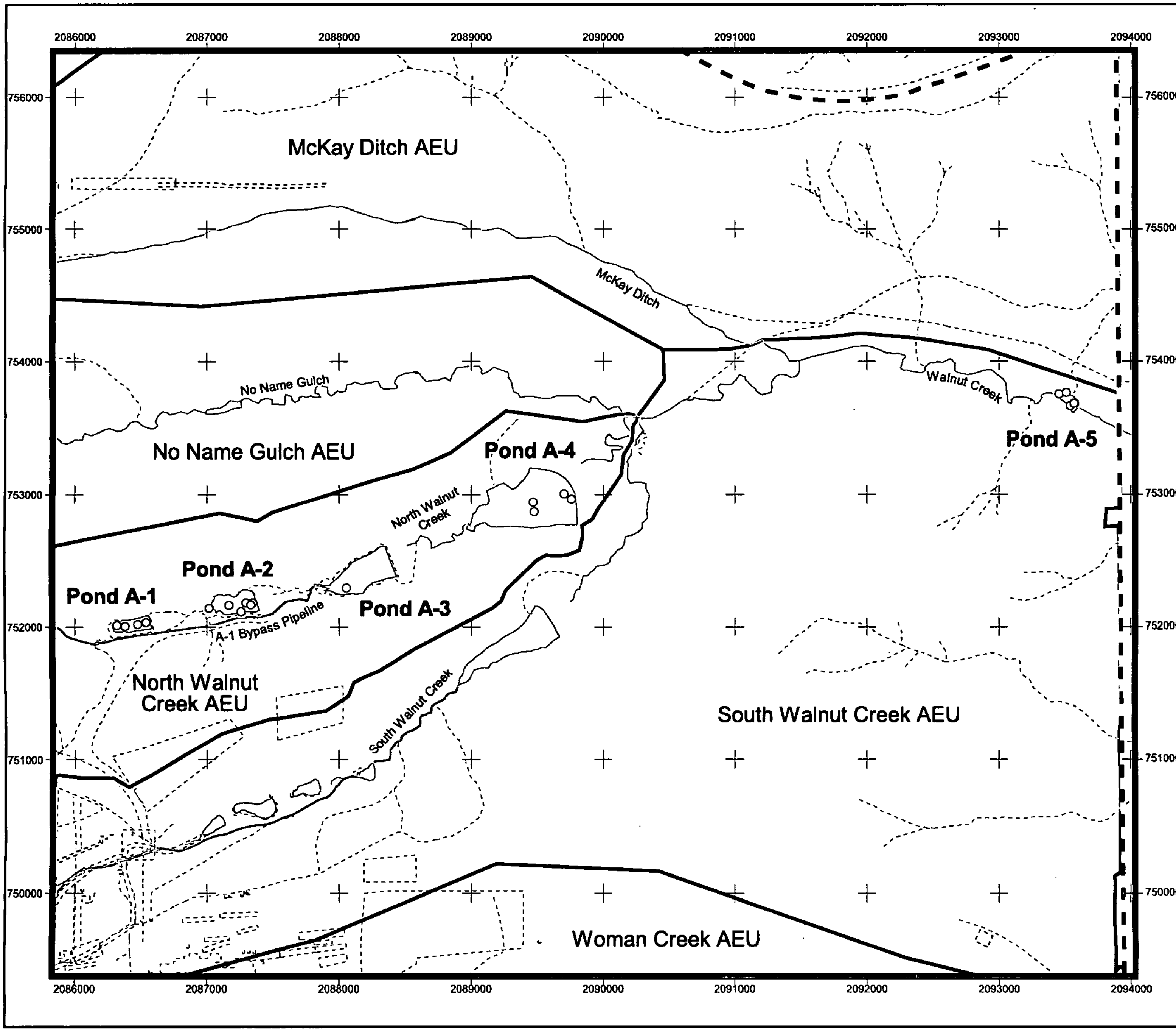

Figure A8.25
A Ponds
Surface Sediment Results for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 17 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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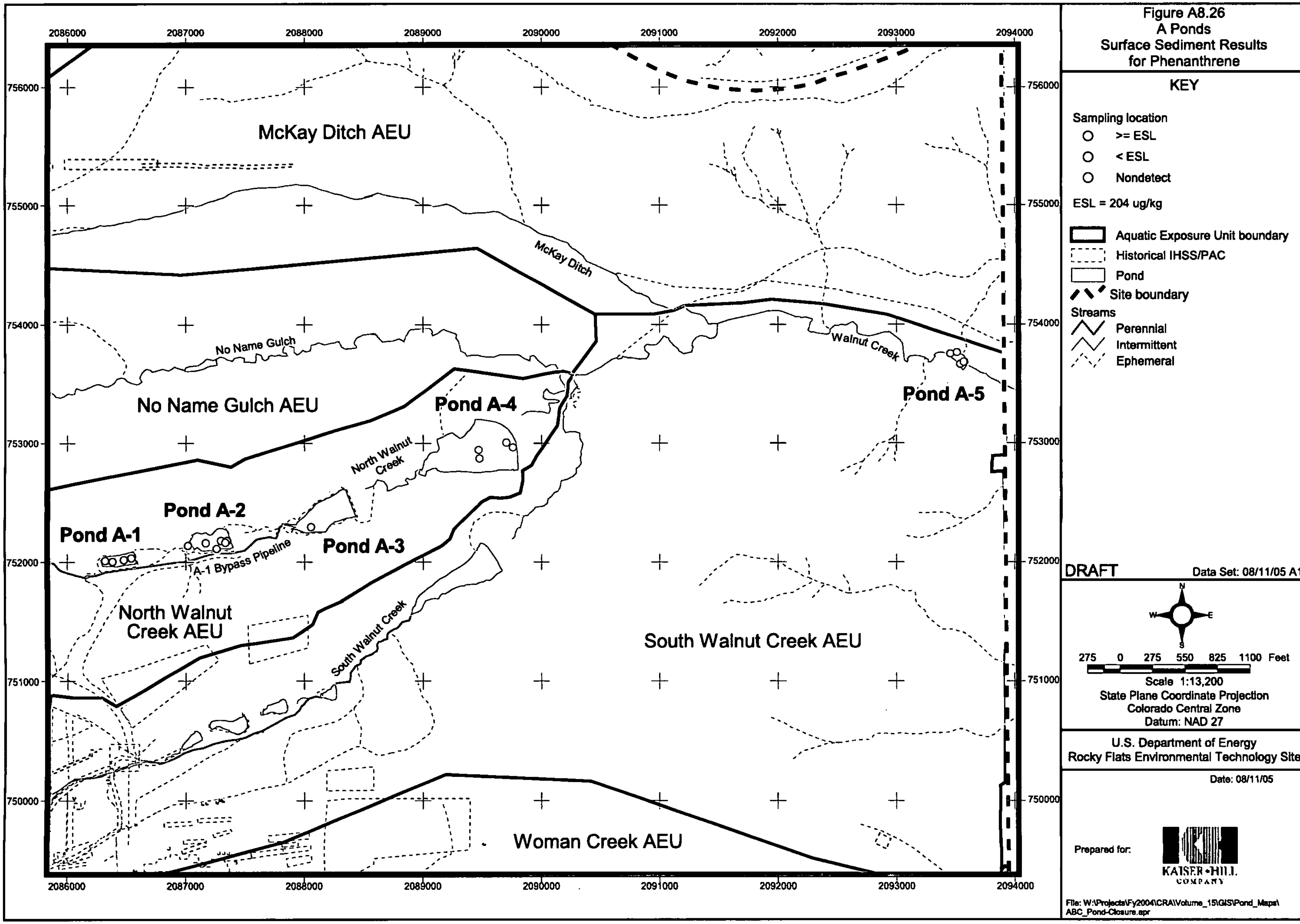
939

Figure A8.26
A Ponds
Surface Sediment Results
for Phenanthrene



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940

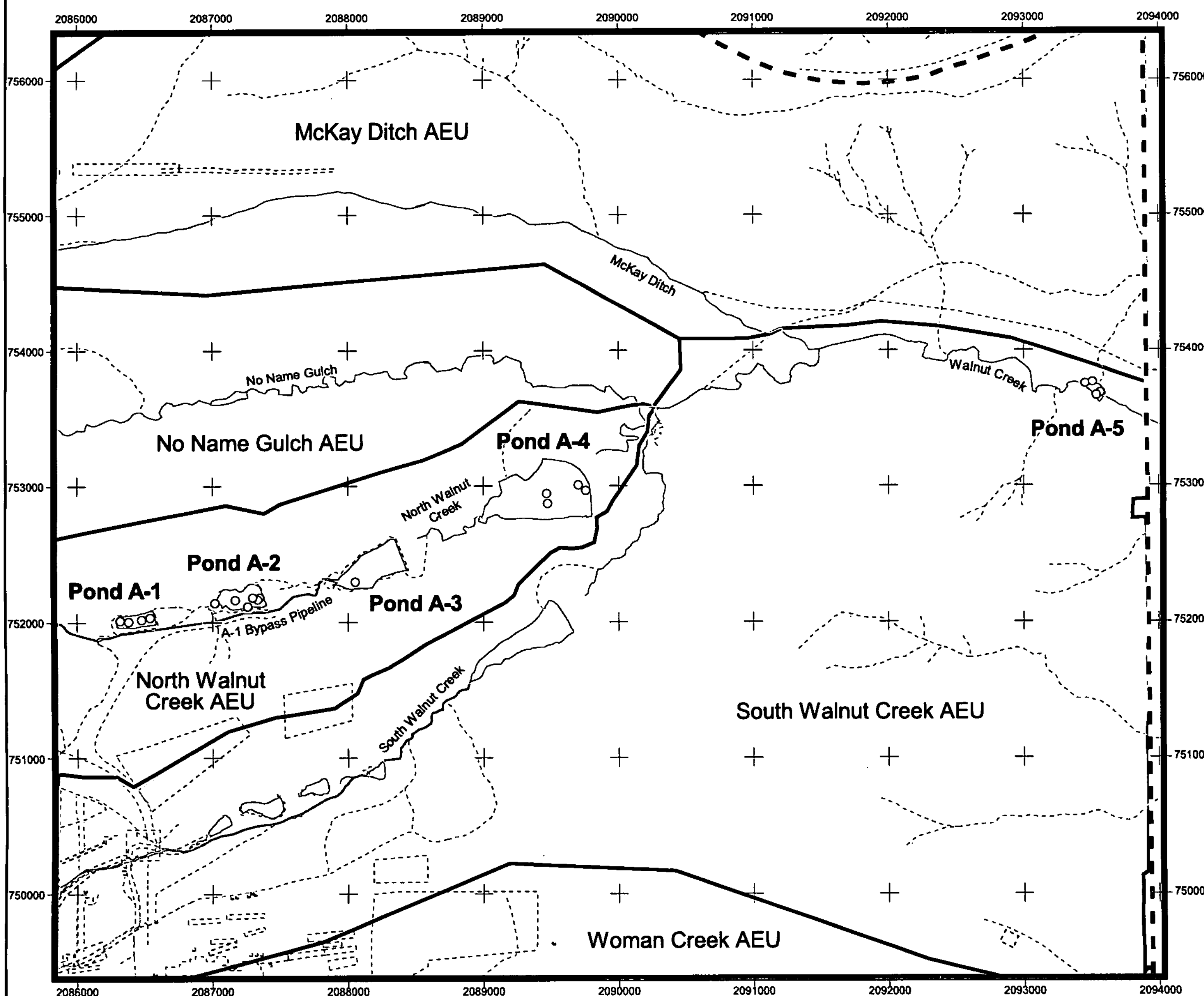

Figure A8.27
A Ponds
Surface Sediment Results
for Pyrene

KEY

Sampling location
>= ESL
< ESL
Nondetect

ESL = 195 ug/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

DRAFT

Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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146

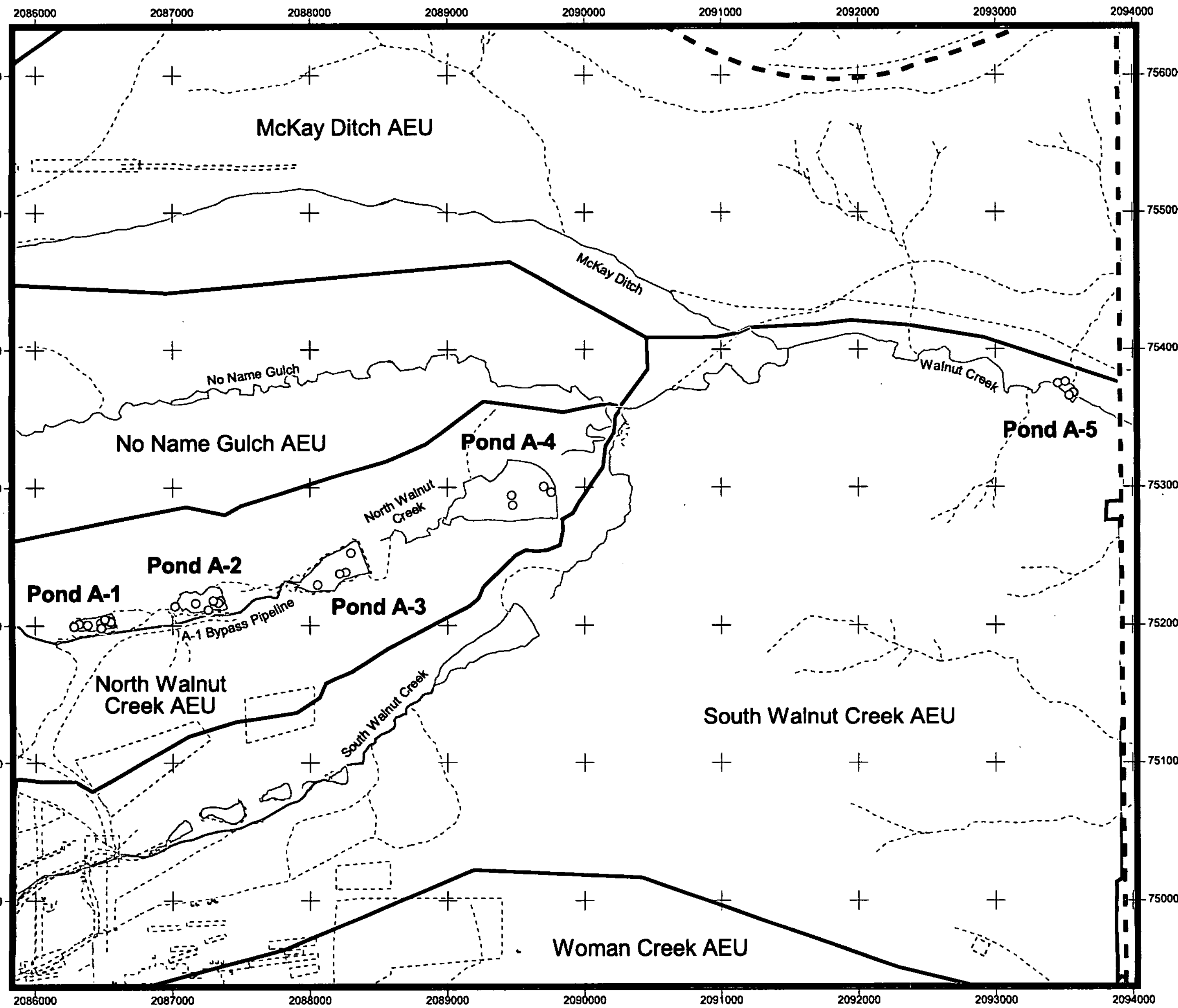

Figure A8.28
A Ponds
Surface Sediment Results
for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 40 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

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KAISER-HILL COMPANY

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

942

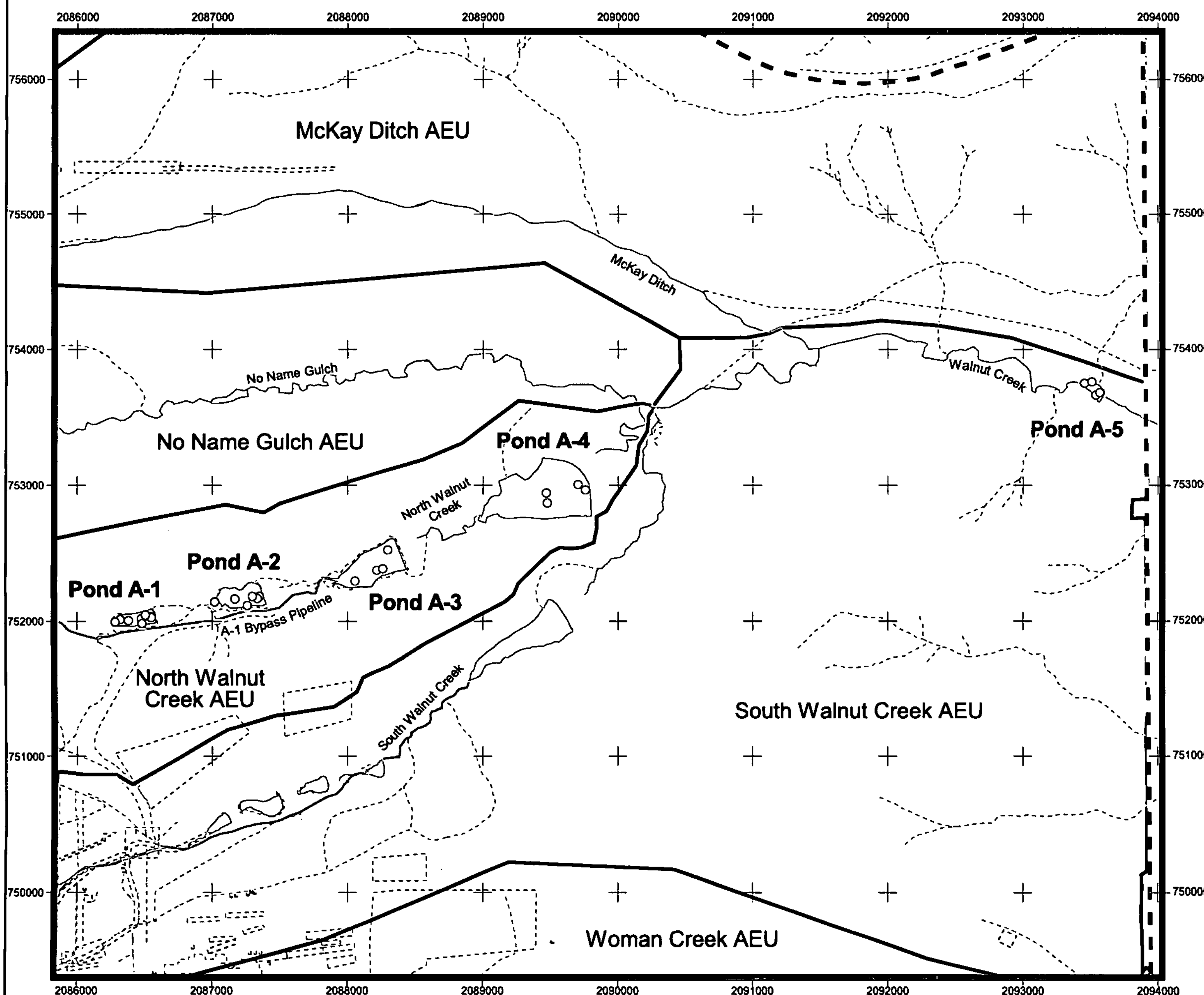

Figure A8.29
A Ponds Surface Sediment Results for Aroclor-1260

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 40 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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943

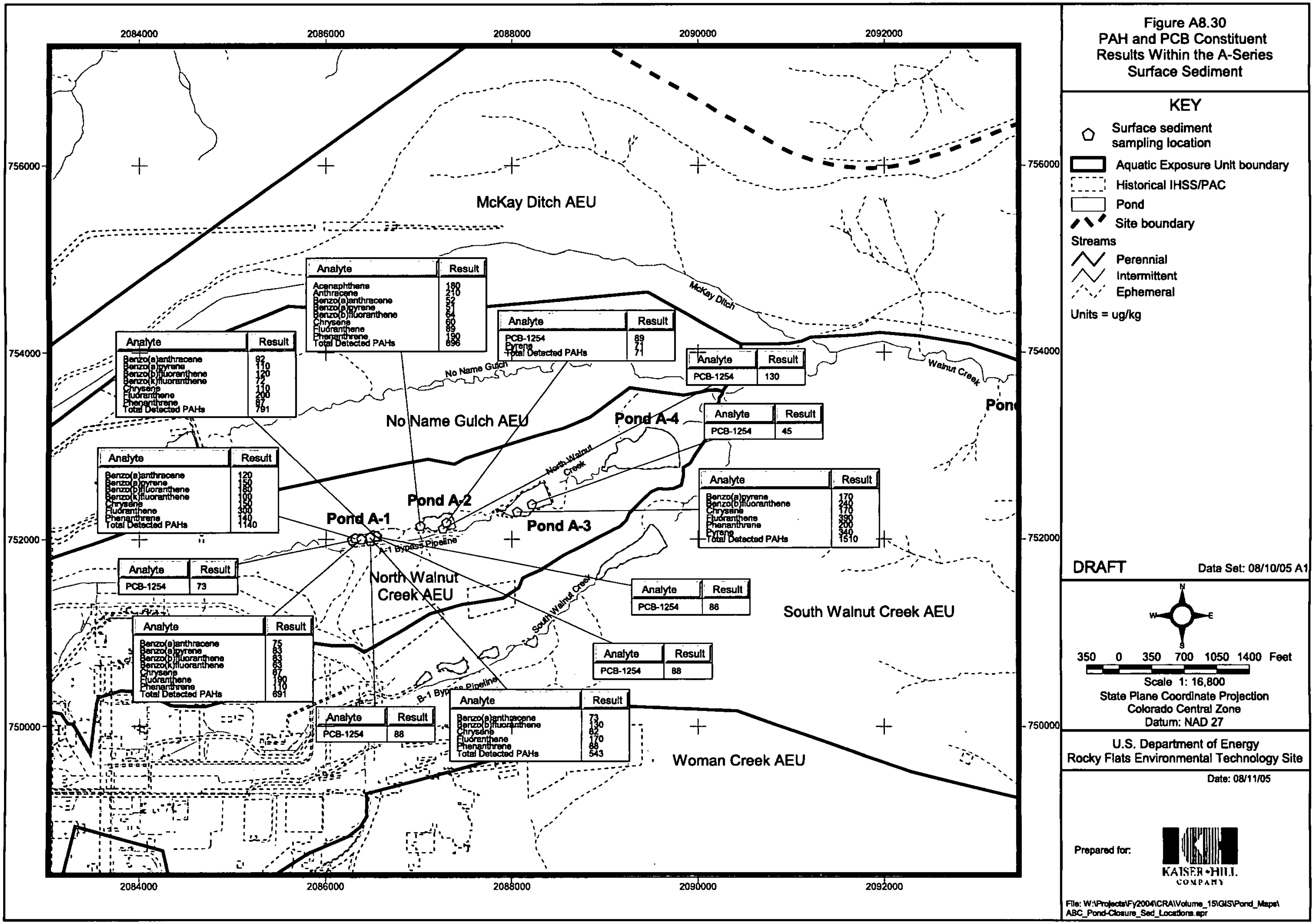

Figure A8.30
PAH and PCB Constituent Results Within the A-Series Surface Sediment

944

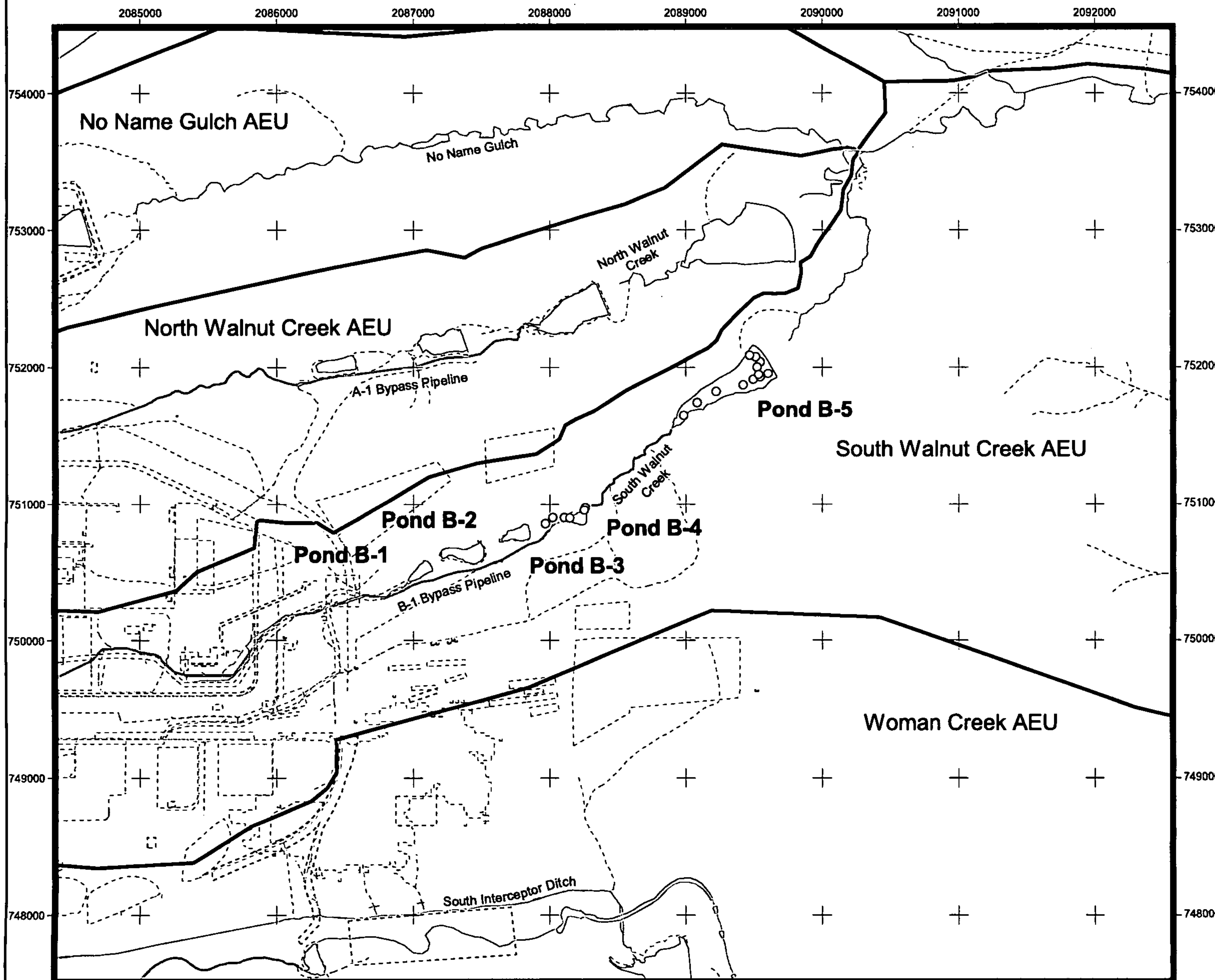

Figure A8.31
B Ponds
Surface Sediment Results
for Aluminum

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 15900 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

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945

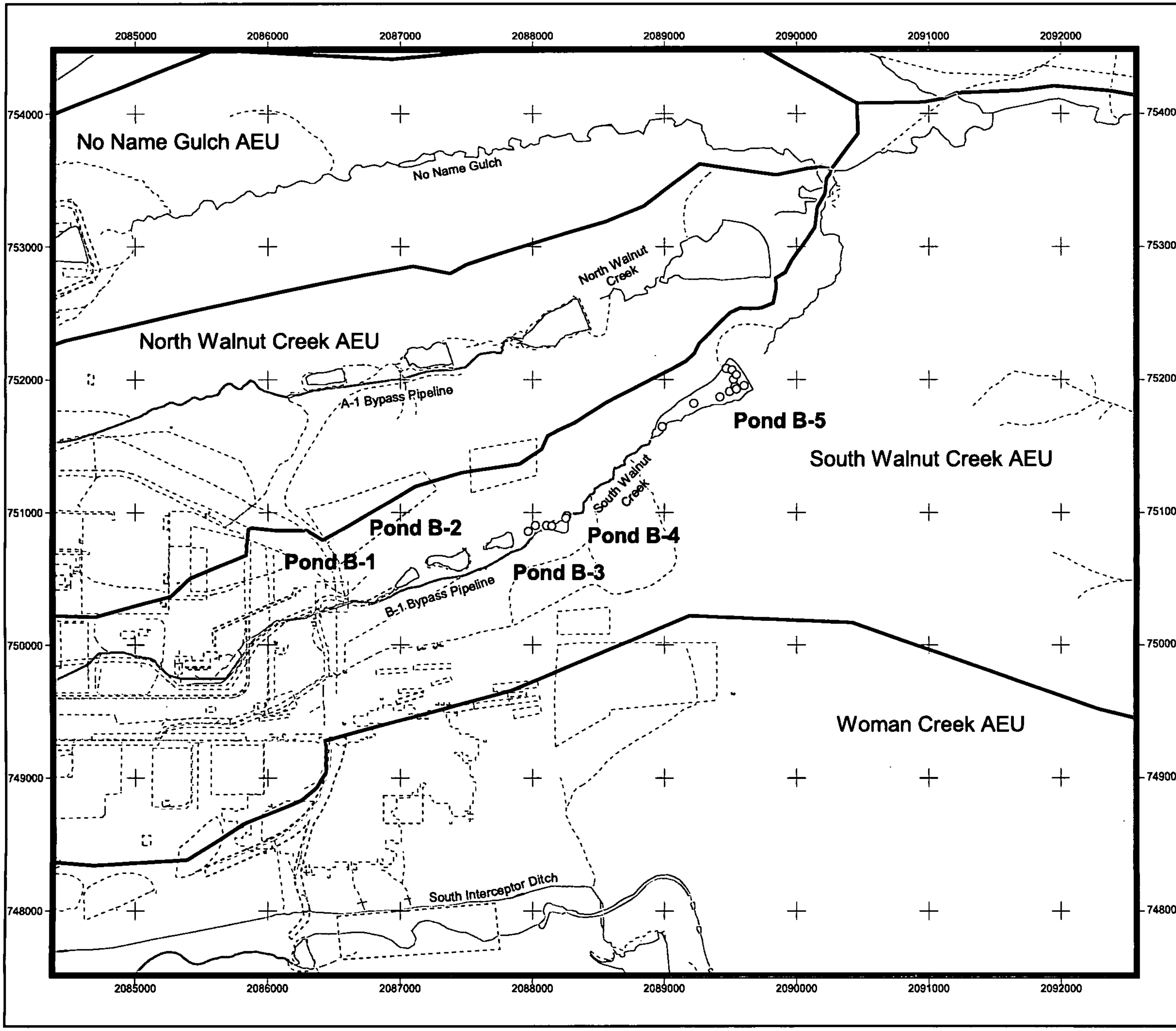

Figure A8.32
B Ponds
Surface Sediment Results for Antimony

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 2 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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946

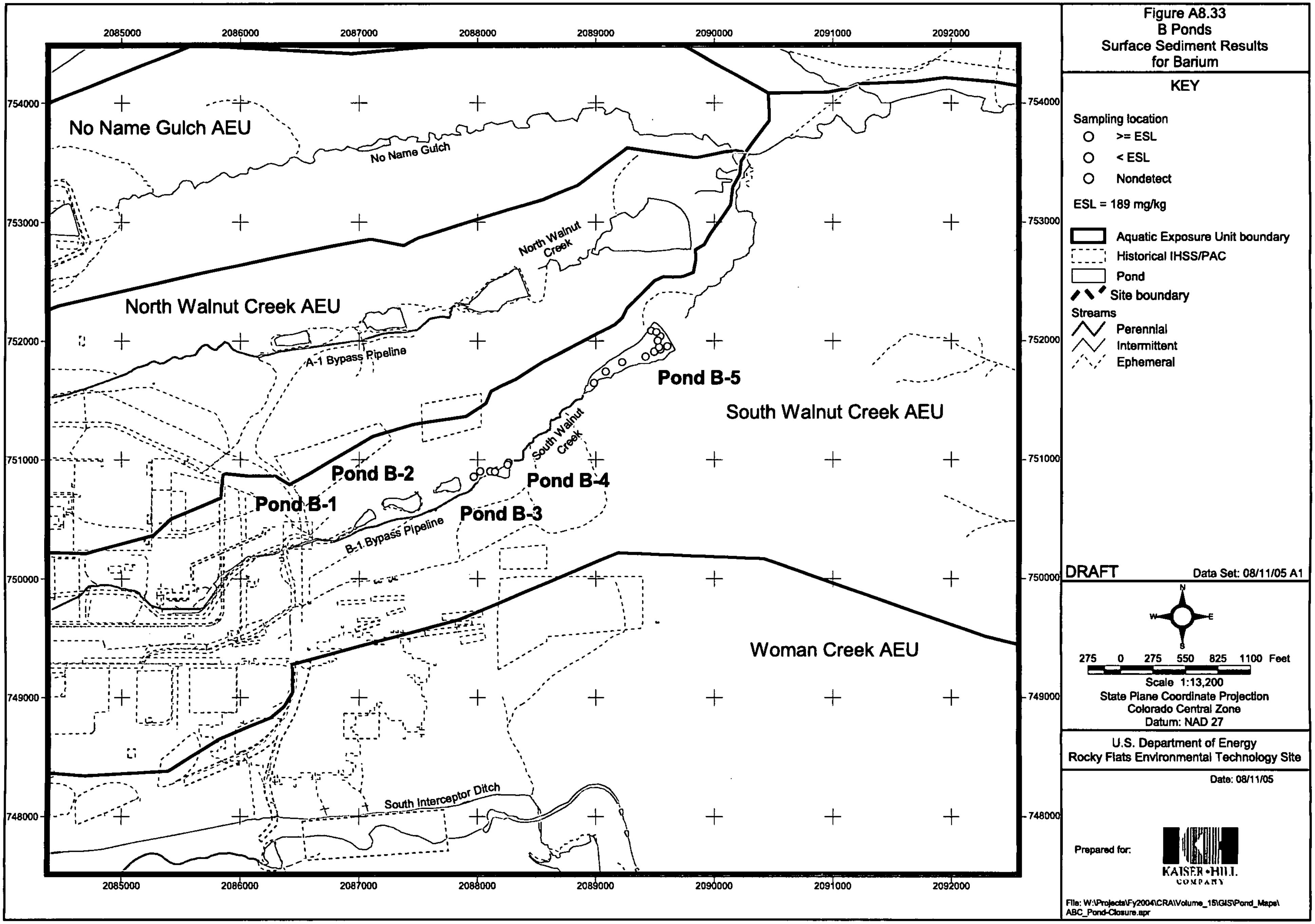
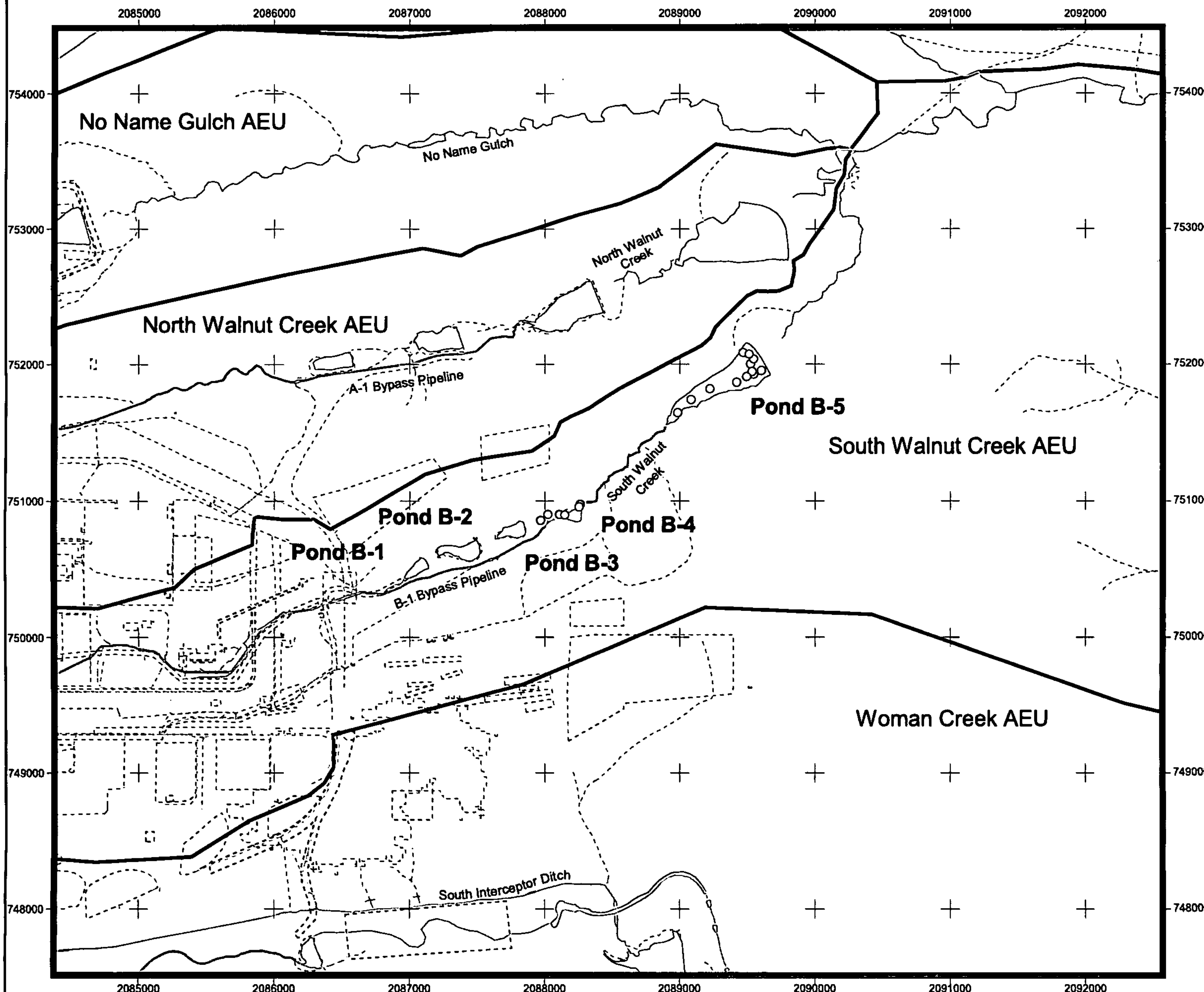


Figure A8.33
B Ponds
Surface Sediment Results
for Barium

947

Figure A8.34
B Ponds
Surface Sediment Results
for Cadmium



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 0.99 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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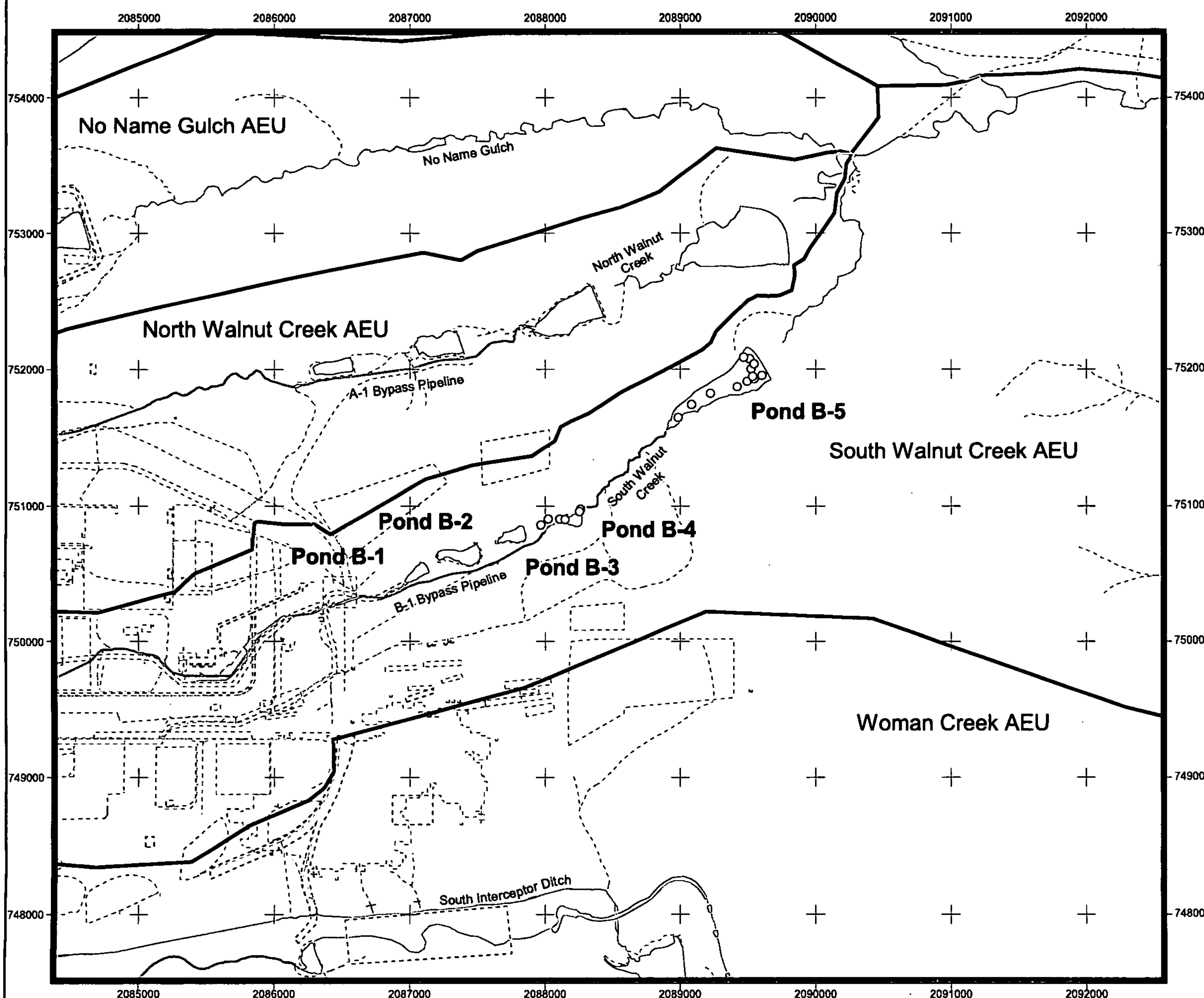
Figure A8.35
B Ponds
Surface Sediment Results
for Chromium



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 43.4 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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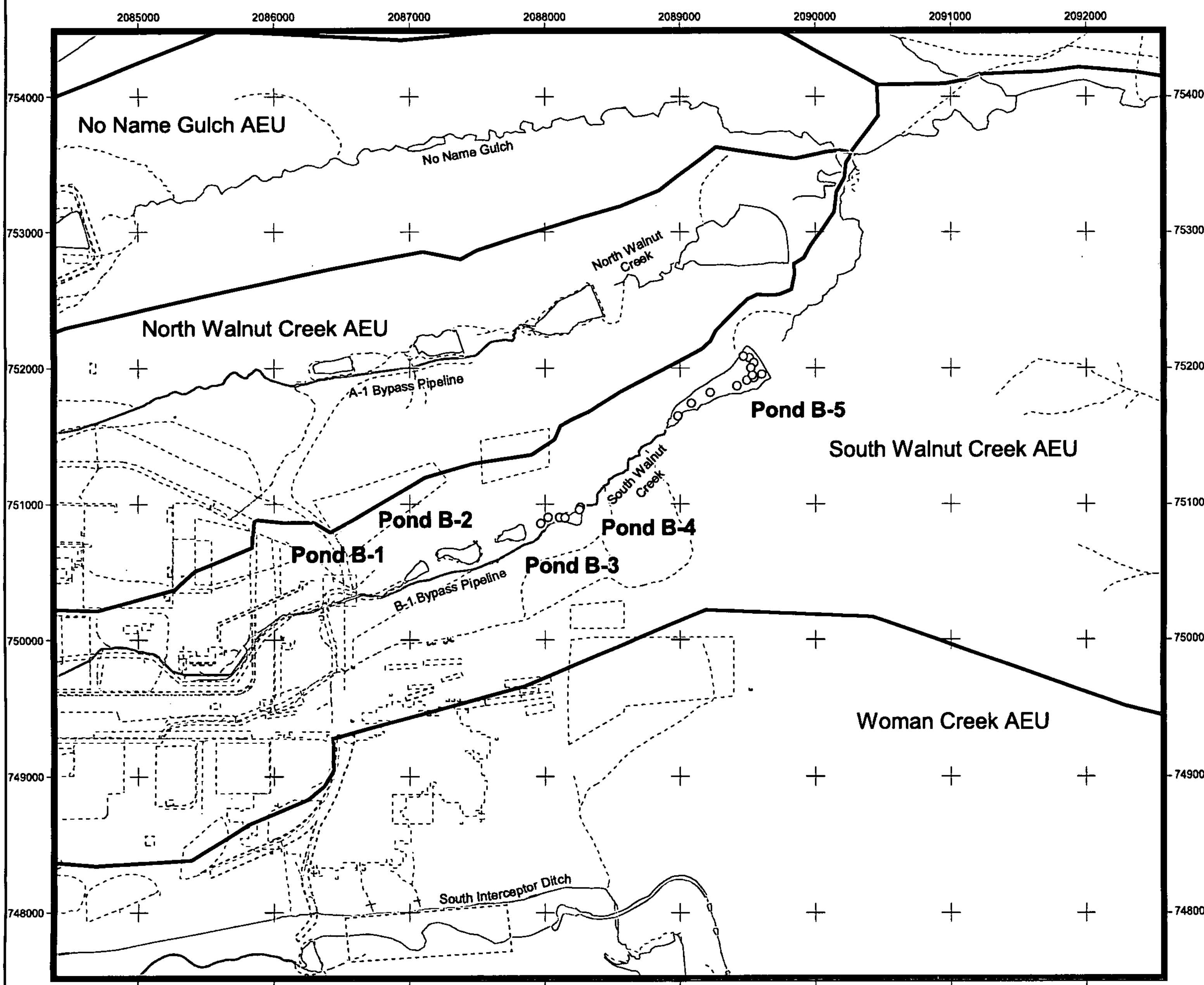
Figure A8.36
B Ponds
Surface Sediment Results
for Copper



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 31.6 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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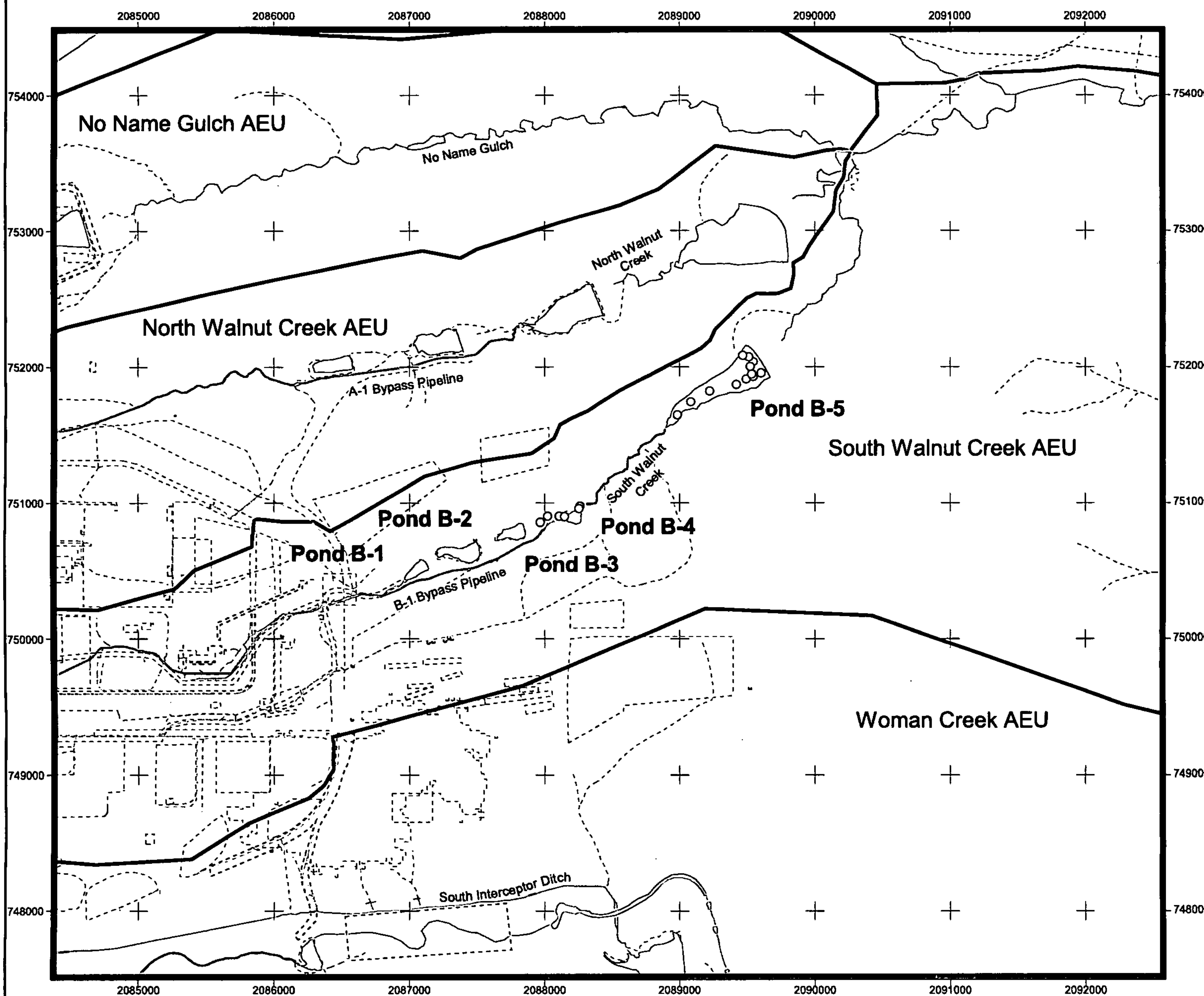
Figure A8.37
B Ponds
Surface Sediment Results for Iron



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 20000 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200

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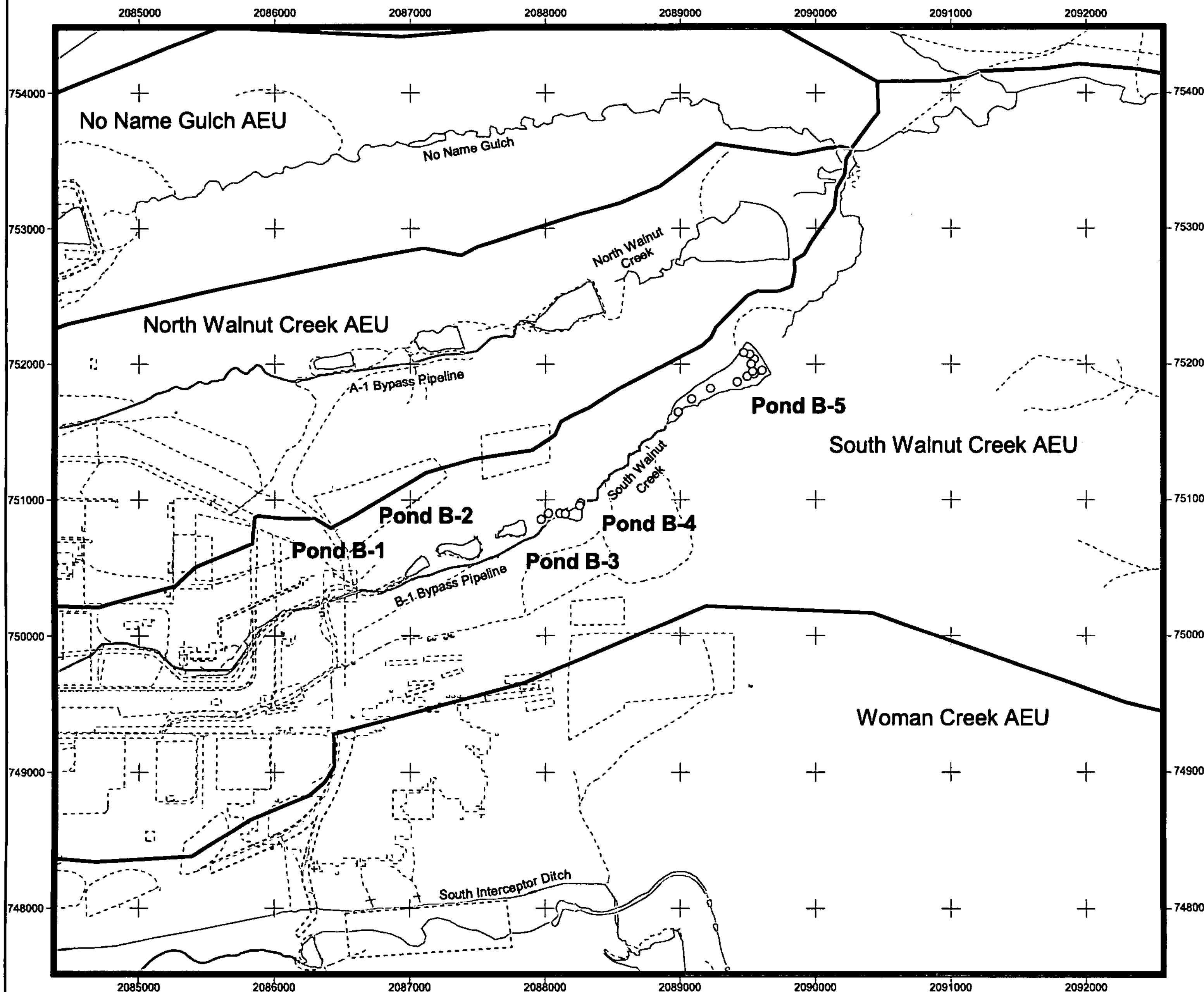
Figure A8.38
B Ponds
Surface Sediment Results
for Lead



KEY

Sampling location
>= ESL
< ESL
Nondetect

ESL = 35.8 mg/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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952

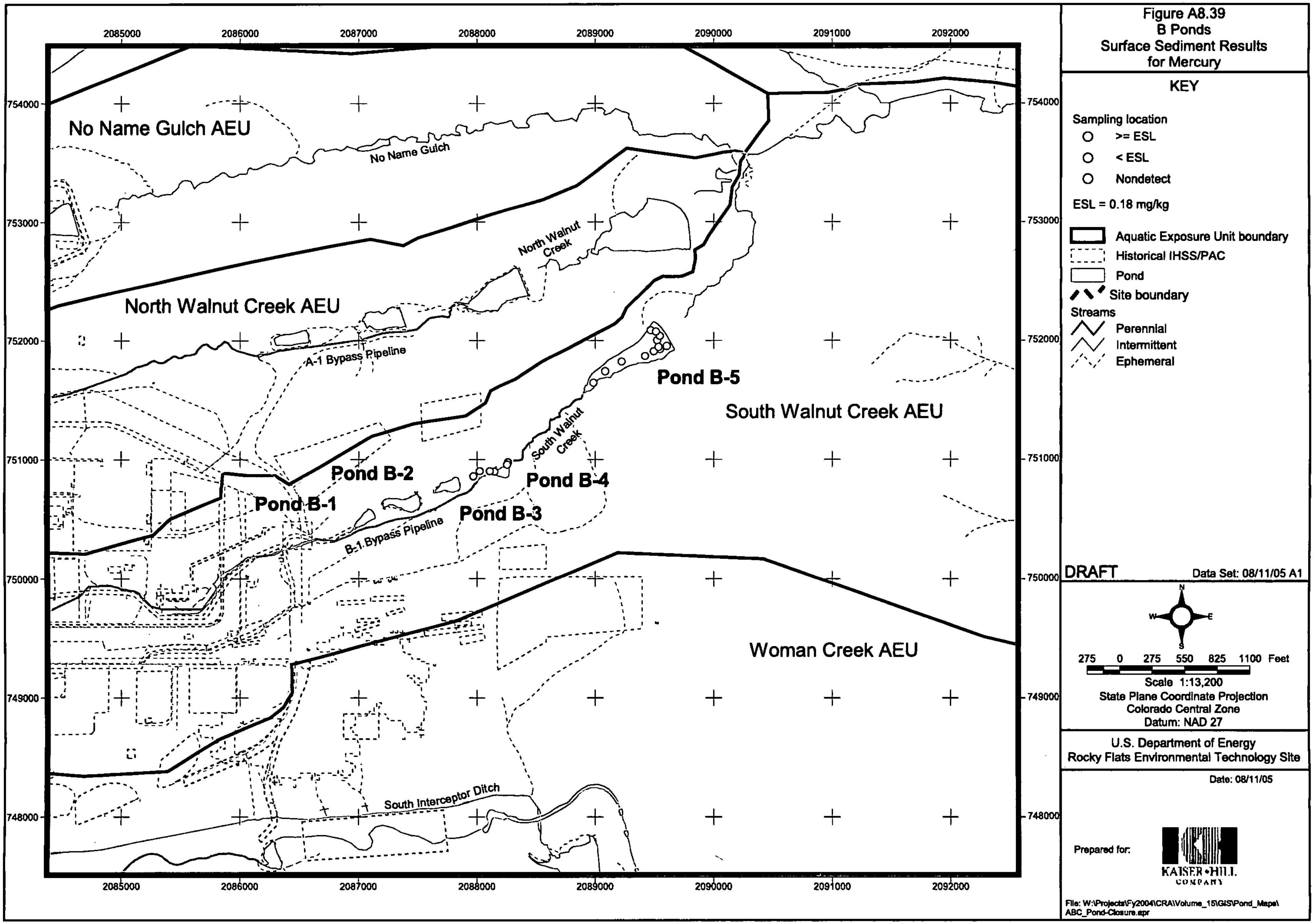

Figure A8.39
B Ponds
Surface Sediment Results
for Mercury
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 0.18 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
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275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
No Name Gulch AEU
No Name Gulch
North Walnut Creek
North Walnut Creek AEU
A-1 Bypass Pipeline
Pond B-5
South Walnut Creek AEU
South Walnut Creek
Pond B-2
Pond B-4
Pond B-1
Pond B-3
B-1 Bypass Pipeline
Woman Creek AEU
South Interceptor Ditch
2085000
2086000
2087000
2088000
2089000
2090000
2091000
2092000
754000
753000
752000
751000
750000
749000
748000

953

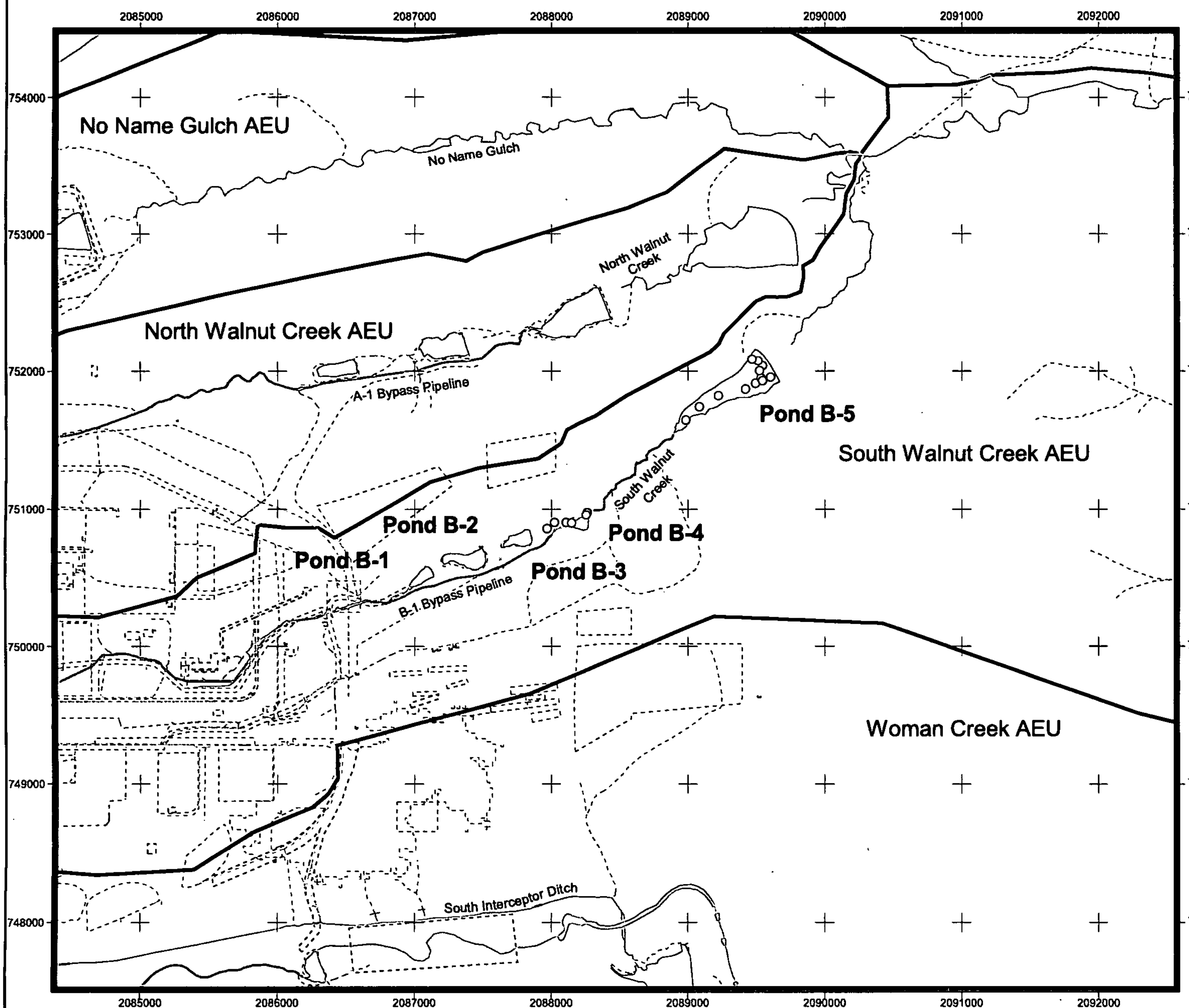

Figure A8.40
B Ponds
Surface Sediment Results
for Nickel

KEY

Sampling location
O >= ESL
O < ESL
O Nondetect

ESL = 22.7 mg/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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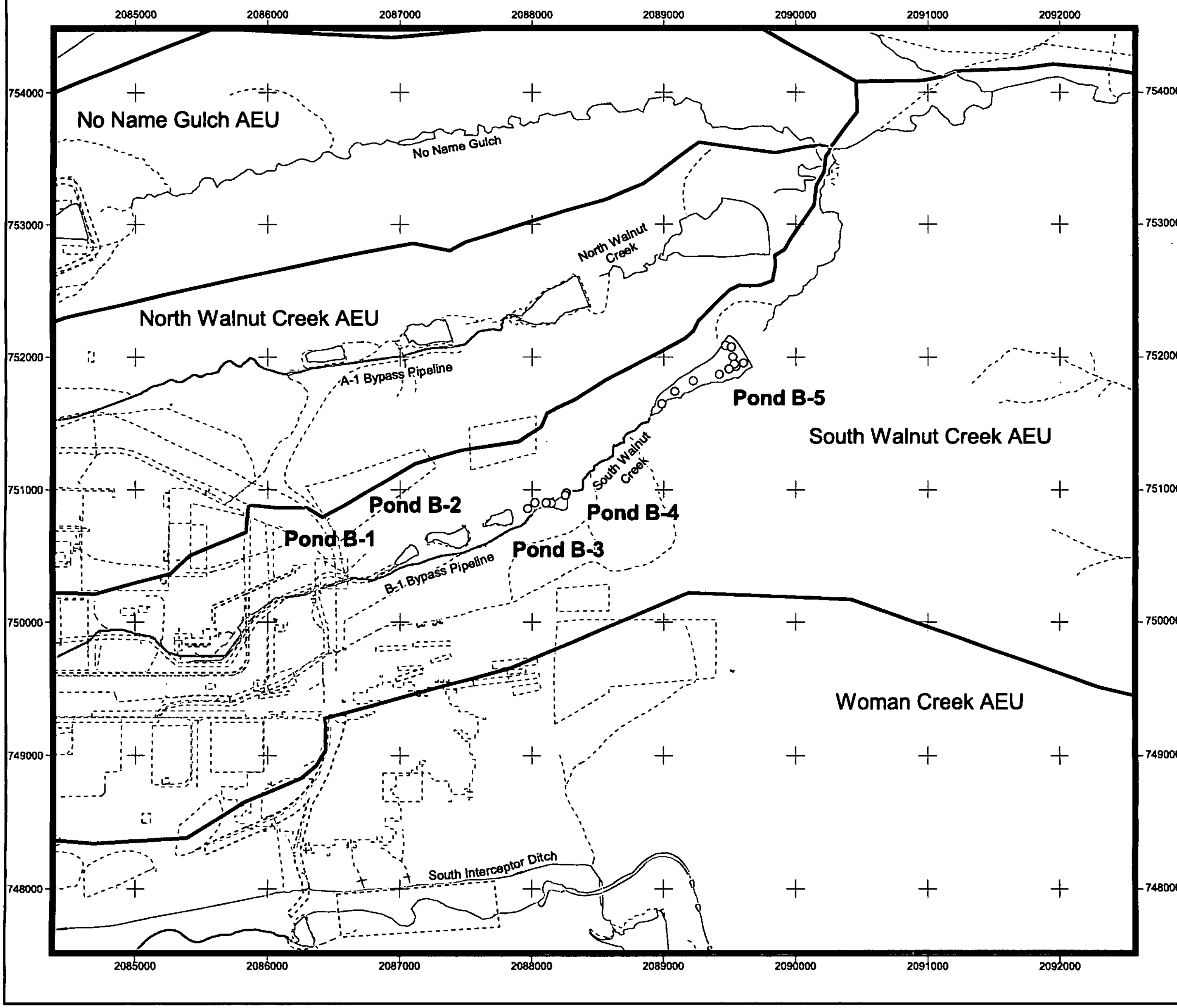
954

Figure A8.41
B Ponds
Surface Sediment Results for Selenium



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 0.95 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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955

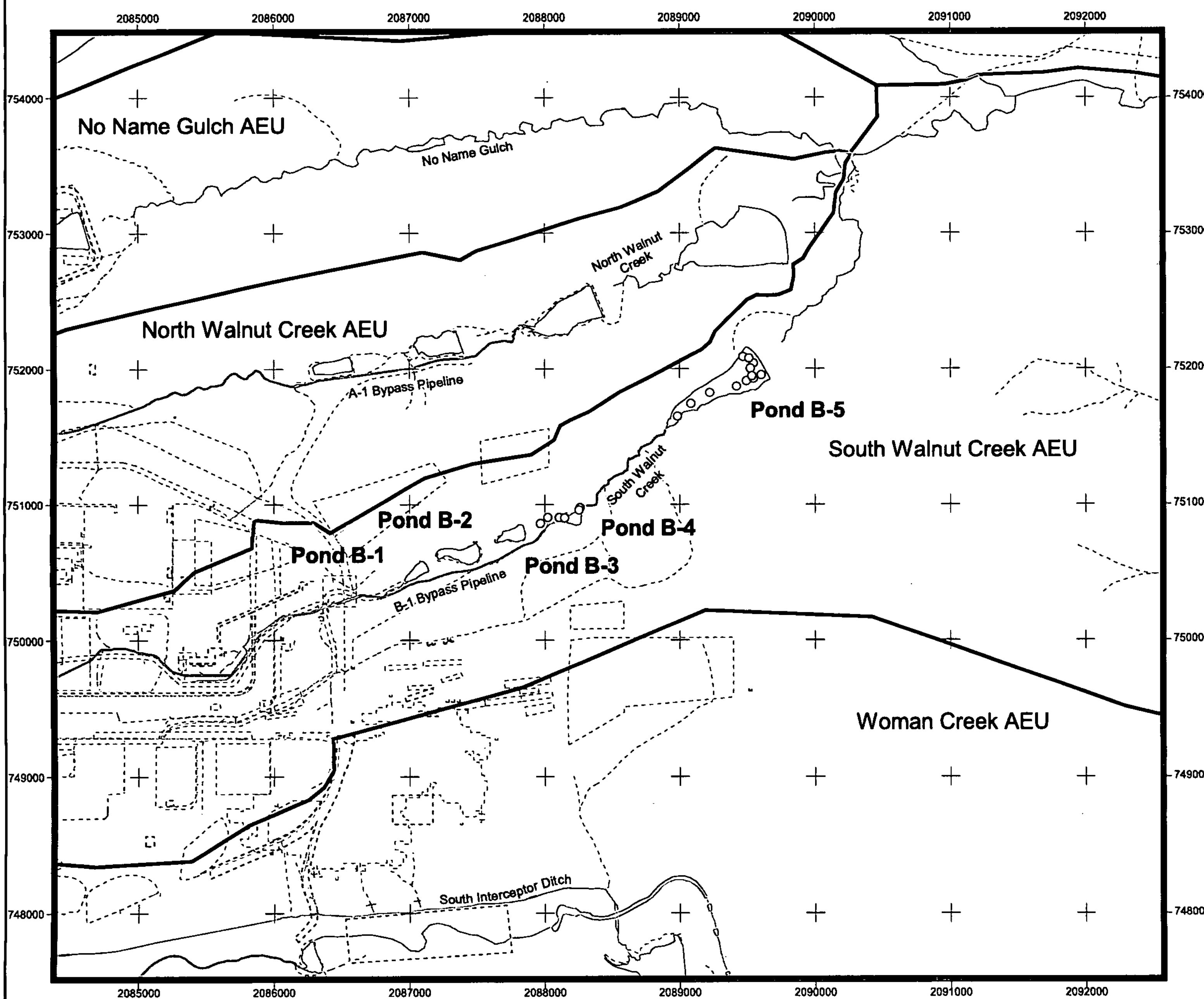

Figure A8.42
B Ponds
Surface Sediment Results
for Silver

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 1 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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954

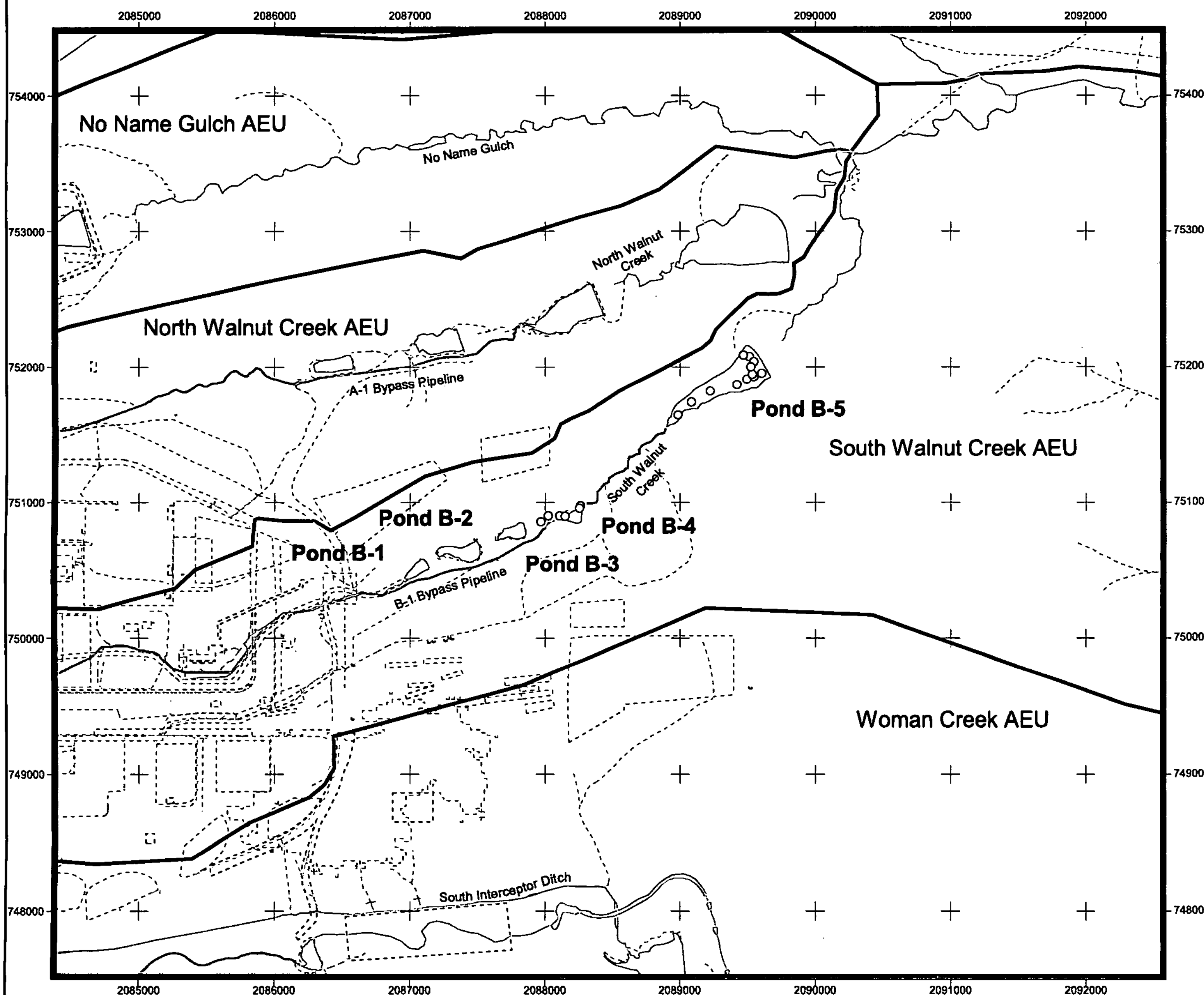

Figure A8.43
B Ponds
Surface Sediment Results
for Zinc

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 121 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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957

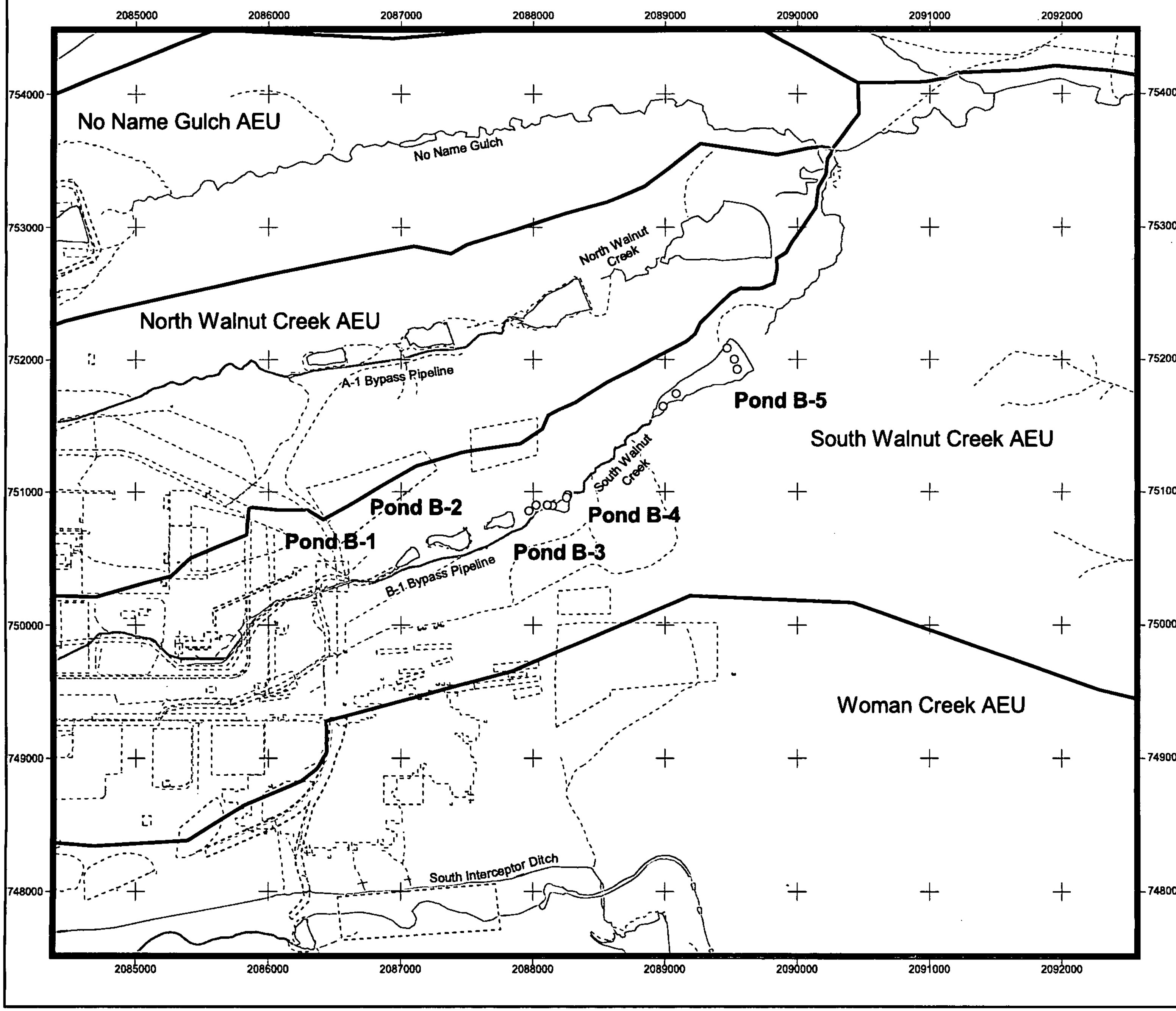

Figure A8.44
B Ponds
Surface Sediment Results
for Anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 57.2 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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958

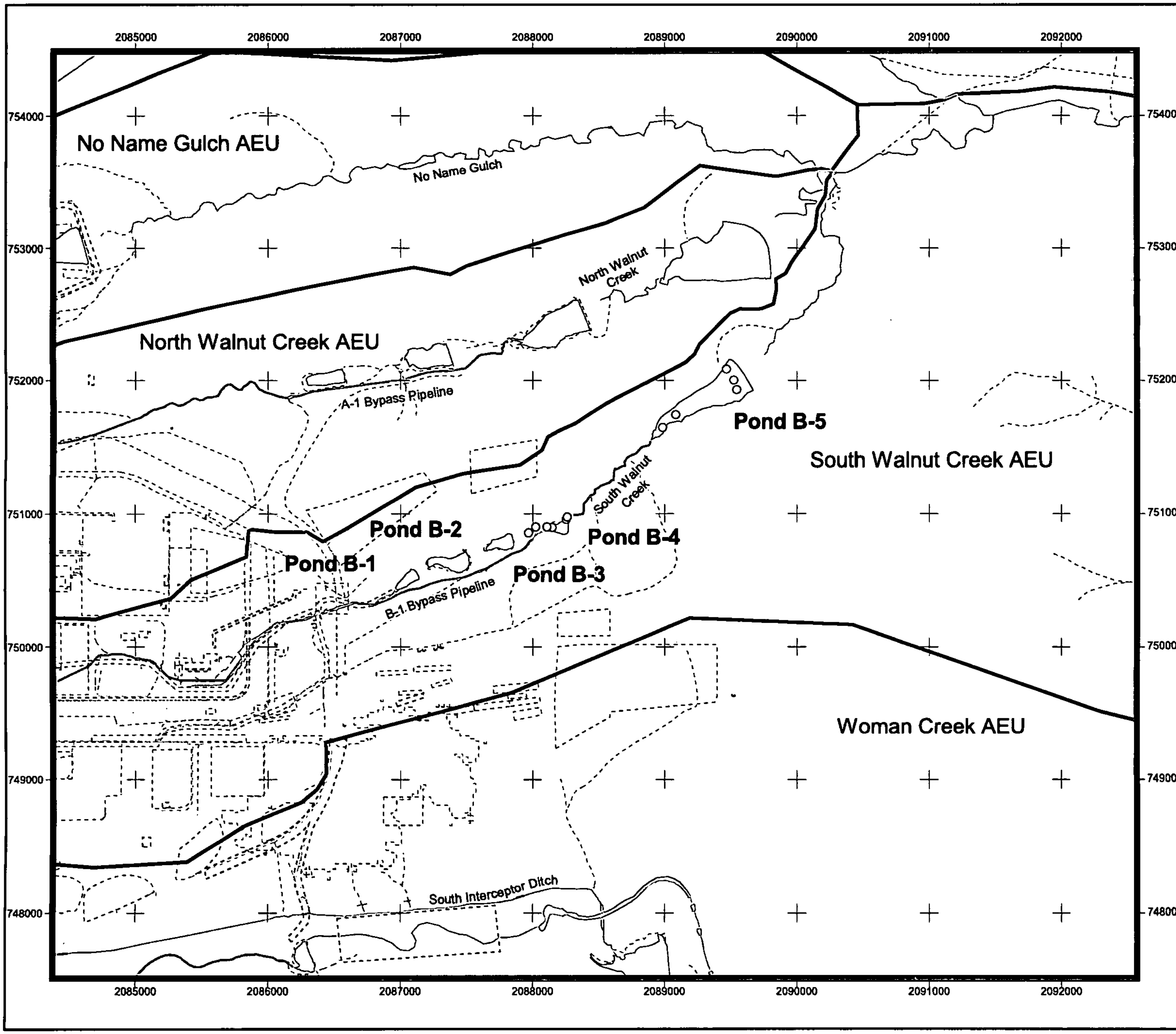

Figure A8.45
B Ponds
Surface Sediment Results
for Benzo(a)anthracene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 108 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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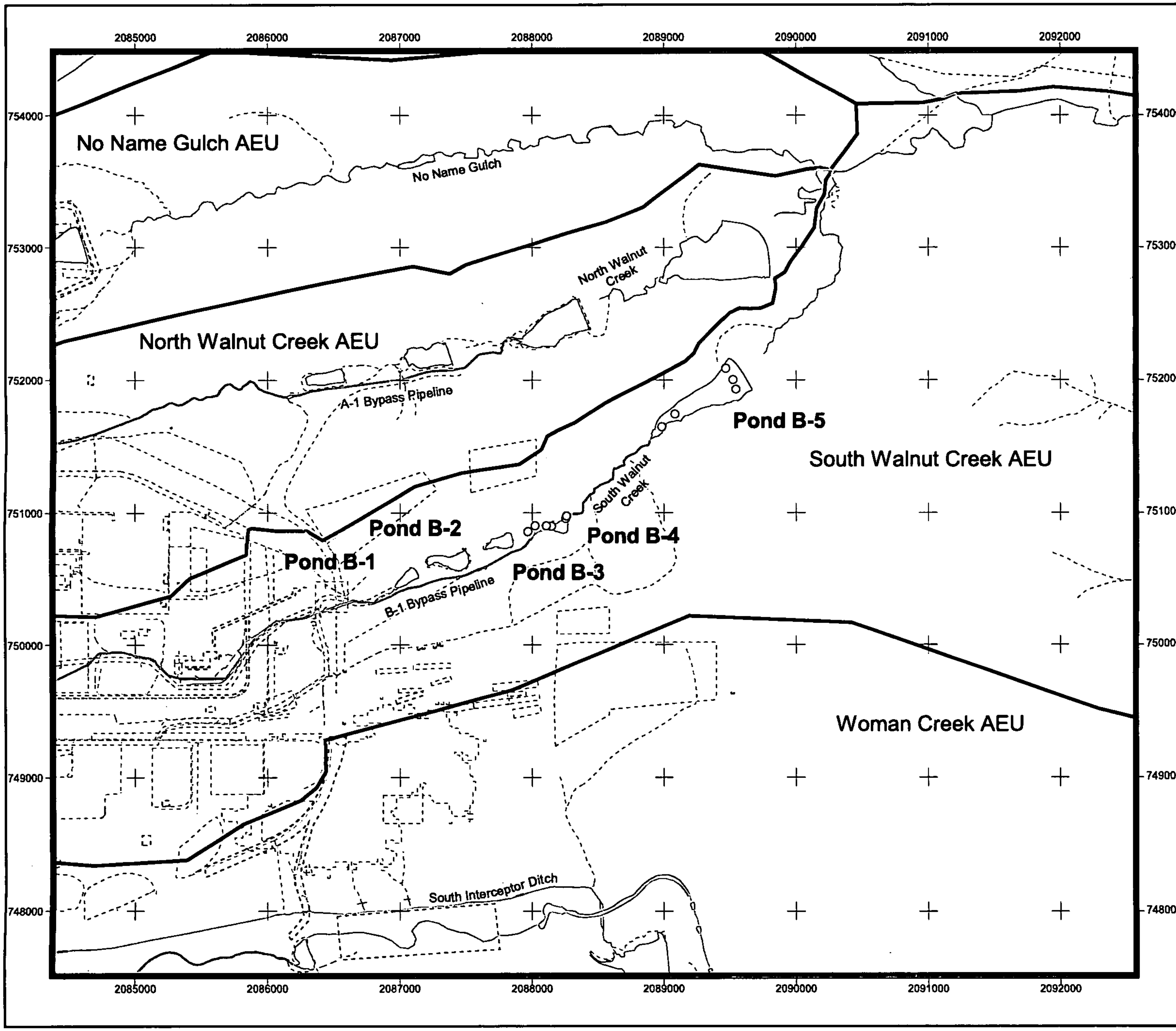

Figure A8.46
B Ponds
Surface Sediment Results
for Benzo(a)pyrene

KEY

Sampling location
O >= ESL
O < ESL
O Nondetect

ESL = 150 ug/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary

Streams
Perennial
Intermittent
Ephemeral

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Data Set: 08/11/05 A1

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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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960

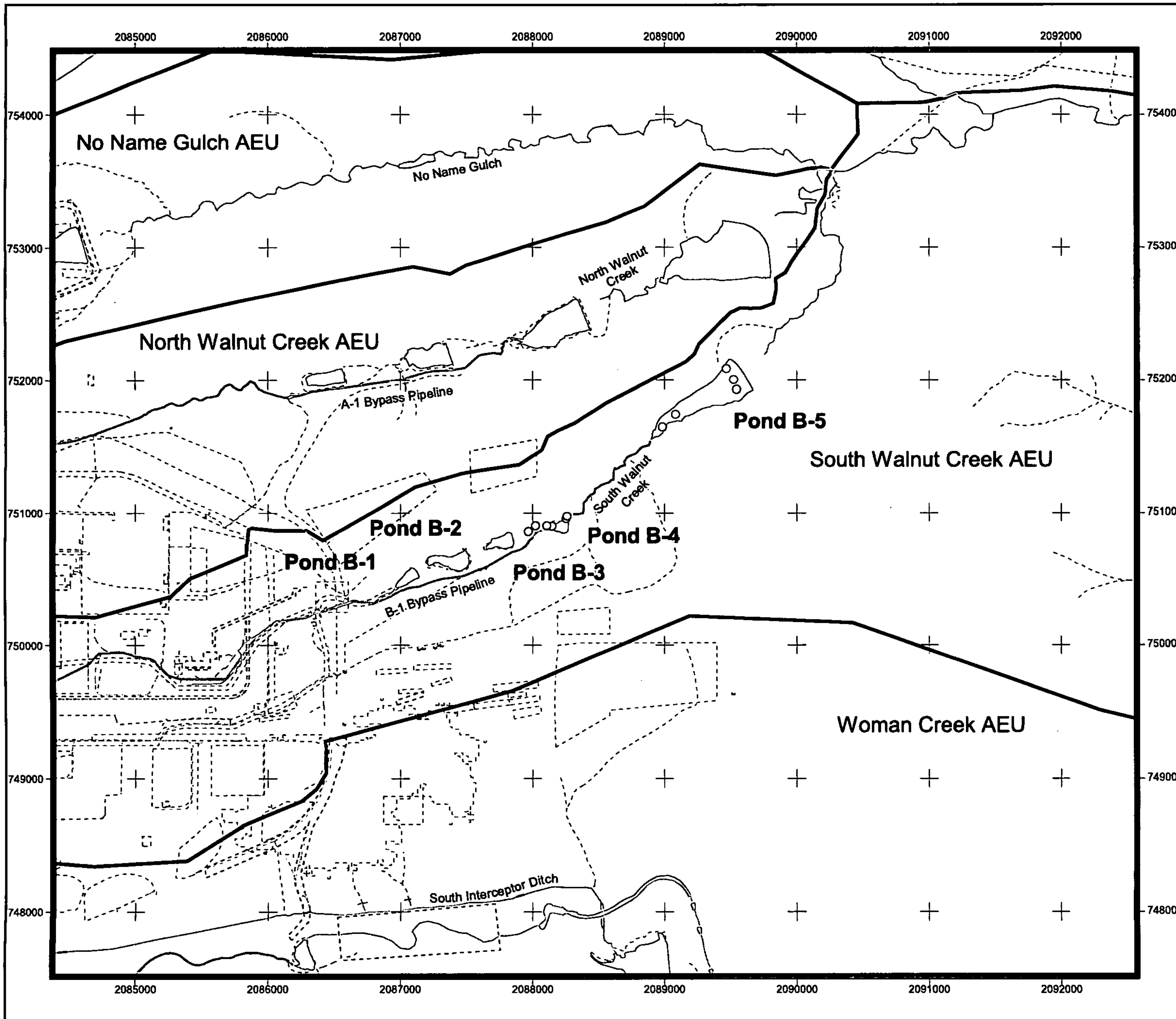

Figure A8.47
B Ponds
Surface Sediment Results
for Benzo(g,h,i)perylene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 13 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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919

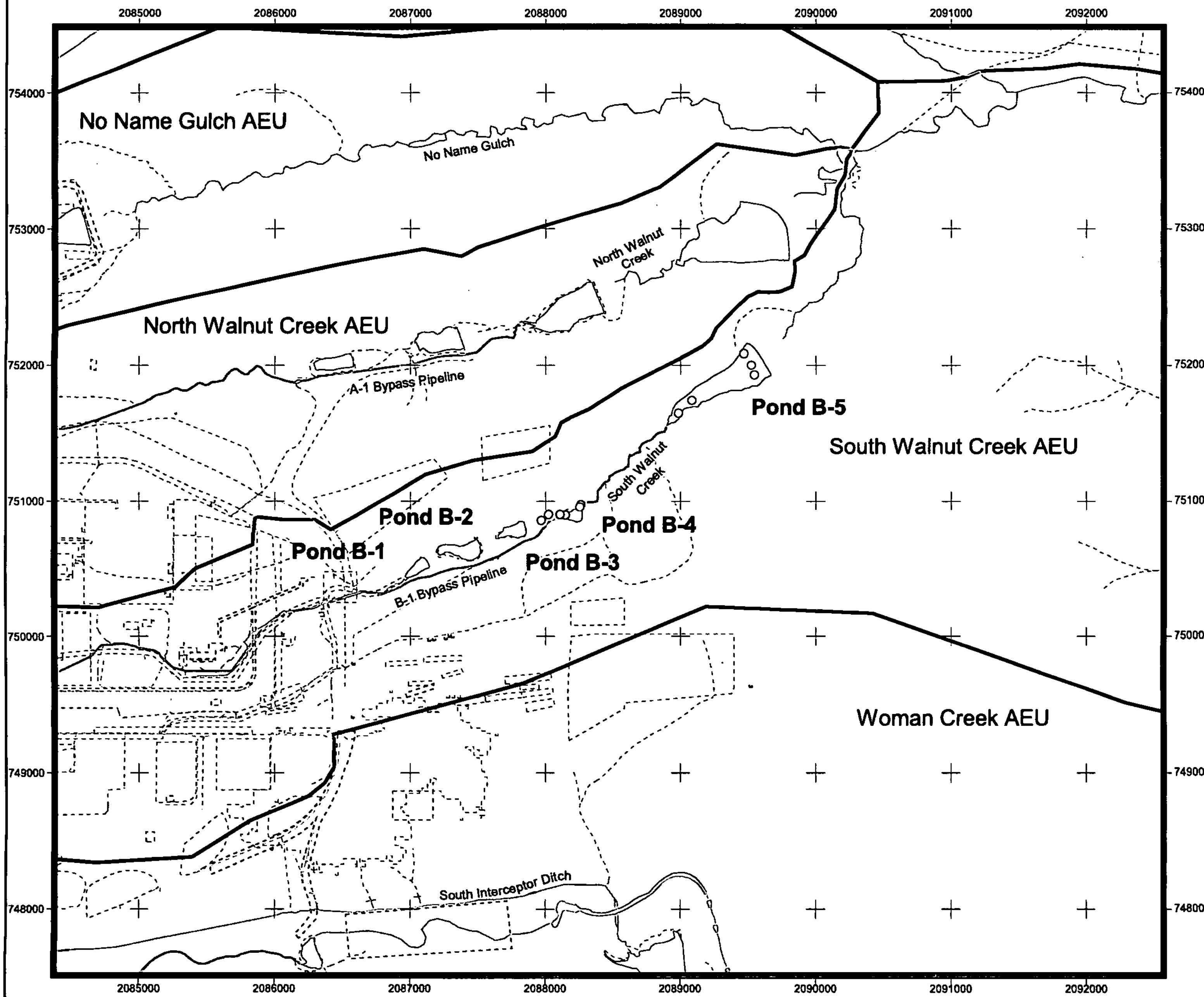

Figure A8.48
B Ponds
Surface Sediment Results
for Benzo(k)fluoranthene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 240 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
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Datum: NAD 27

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962

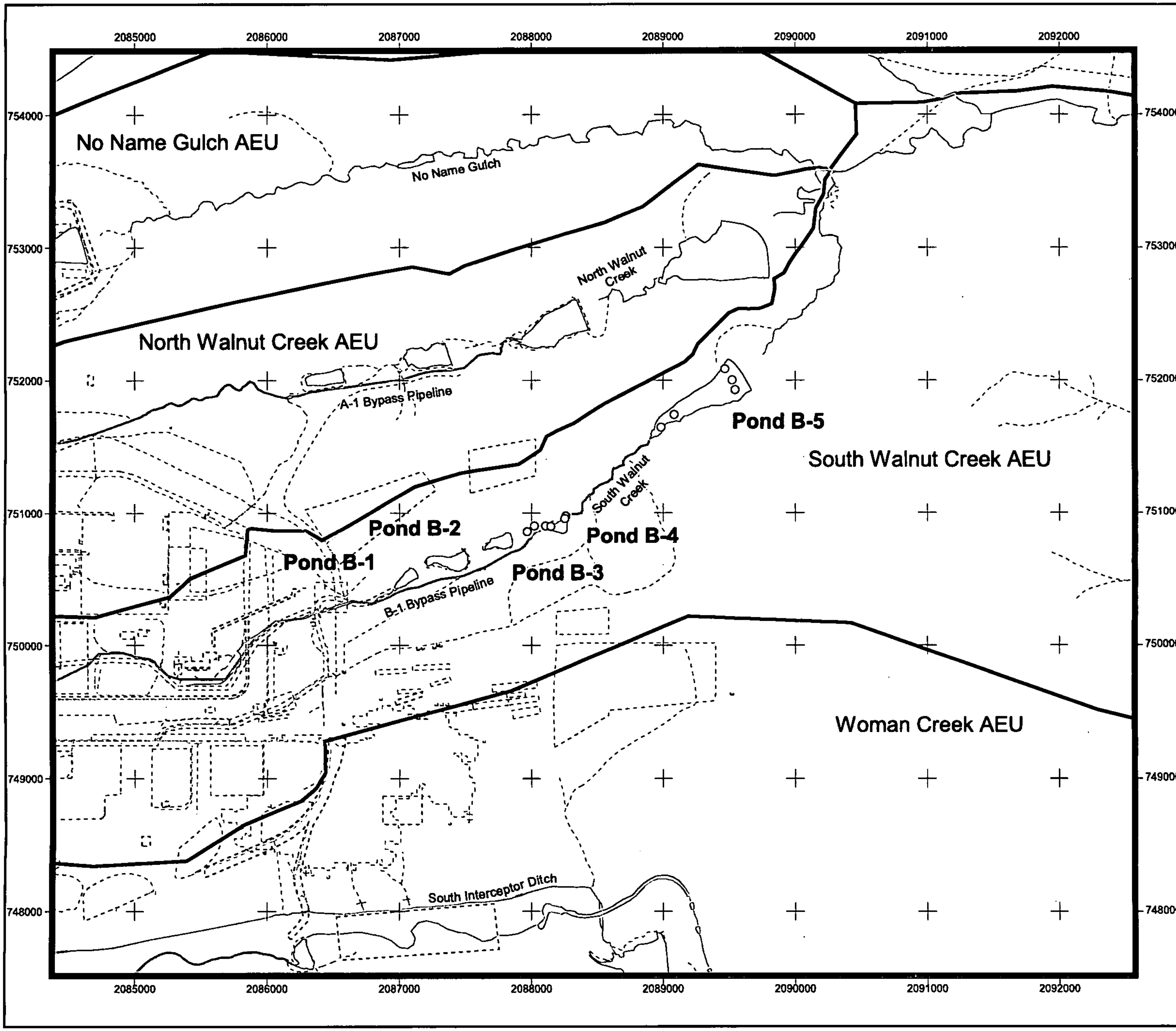

Figure A8.49
B Ponds
Surface Sediment Results
for bis(2-ethylhexyl)phthalate

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 24900 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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963

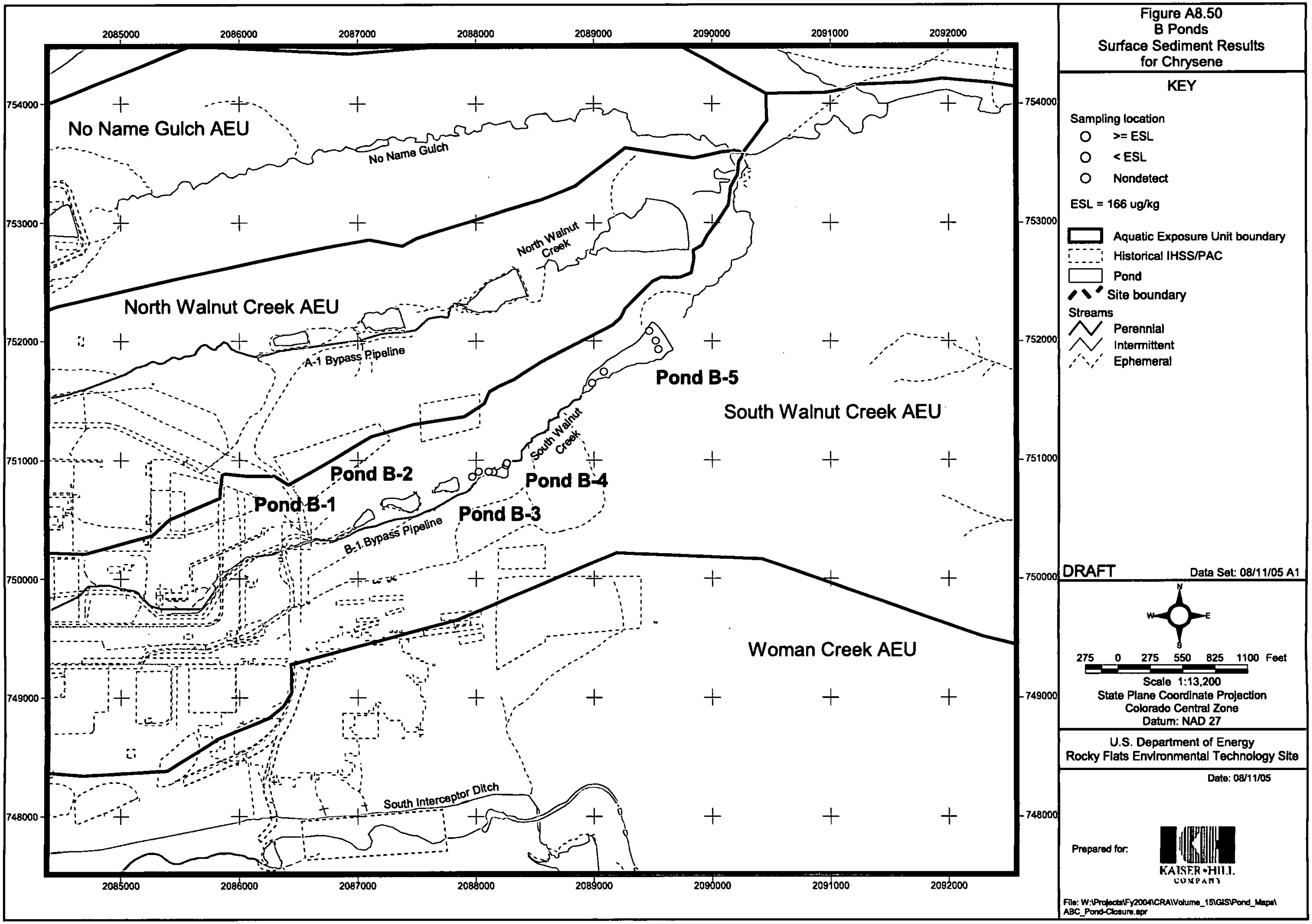
Figure A8.50
B Ponds
Surface Sediment Results
for Chrysene
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 166 ug/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
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275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
Rocky Flats Environmental Technology Site
Date: 08/11/05
Prepared for:
KAISER-HILL COMPANY
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
No Name Gulch AEU
No Name Gulch
North Walnut Creek
North Walnut Creek AEU
A-1 Bypass Pipeline
Pond B-5
South Walnut Creek AEU
South Walnut Creek
Pond B-2
Pond B-4
Pond B-1
Pond B-3
B-1 Bypass Pipeline
Woman Creek AEU
South Interceptor Ditch
2085000
2086000
2087000
2088000
2089000
2090000
2091000
2092000
754000
753000
752000
751000
750000
749000
748000

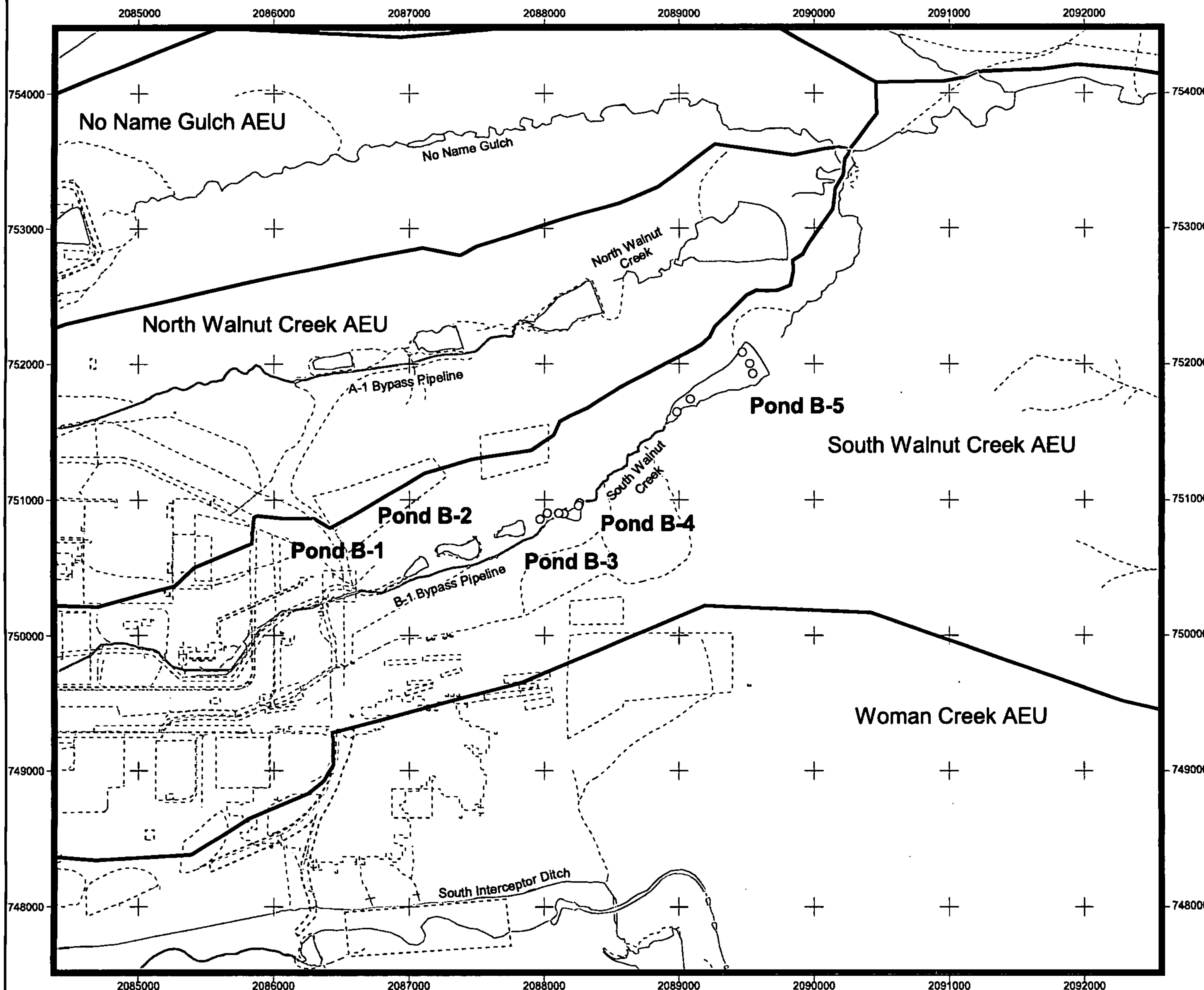

Figure A8.51
B Ponds
Surface Sediment Results
for Dibenz(a,h)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 33 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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965

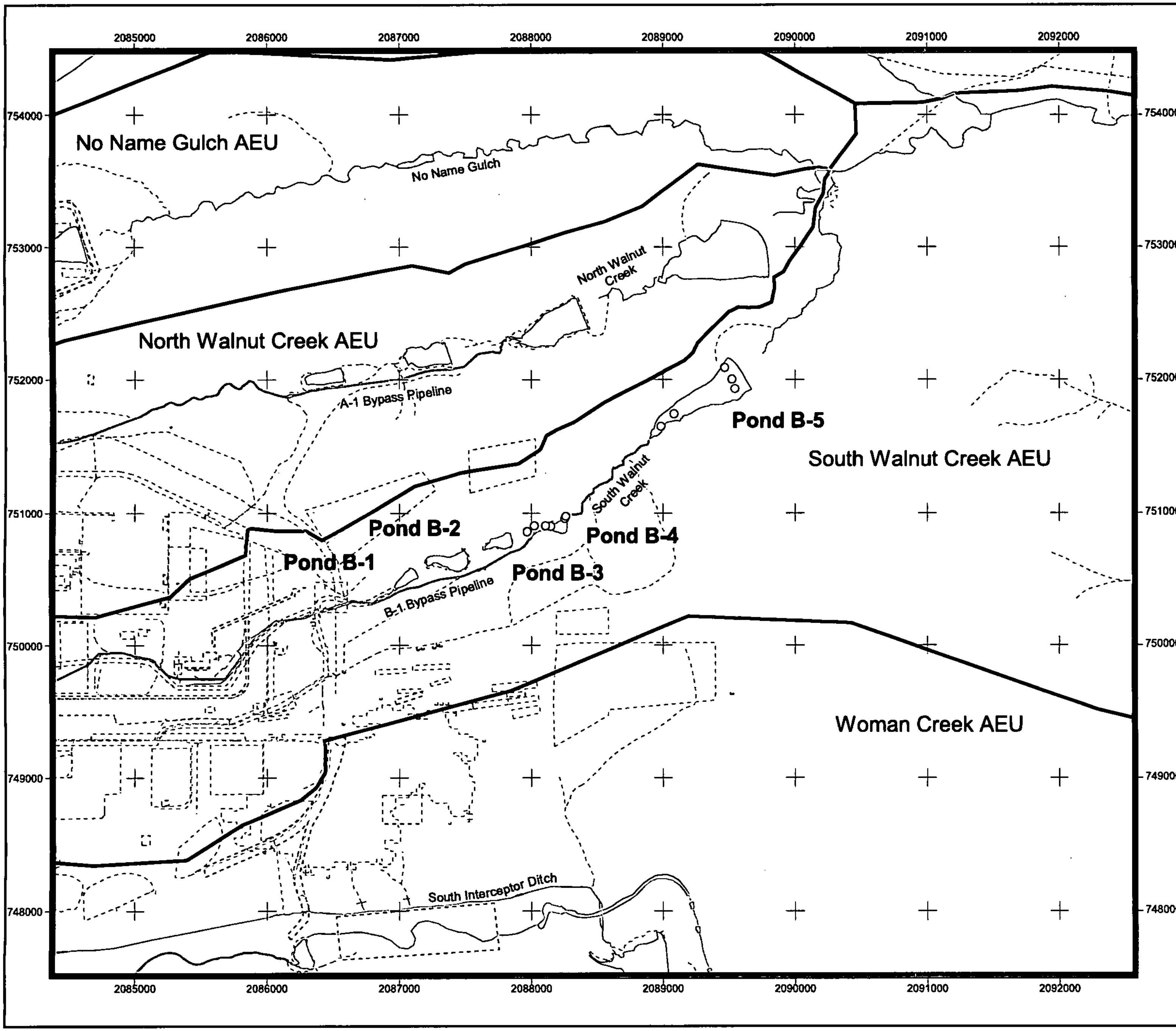

Figure A8.52
B Ponds
Surface Sediment Results
for Fluoranthene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 423 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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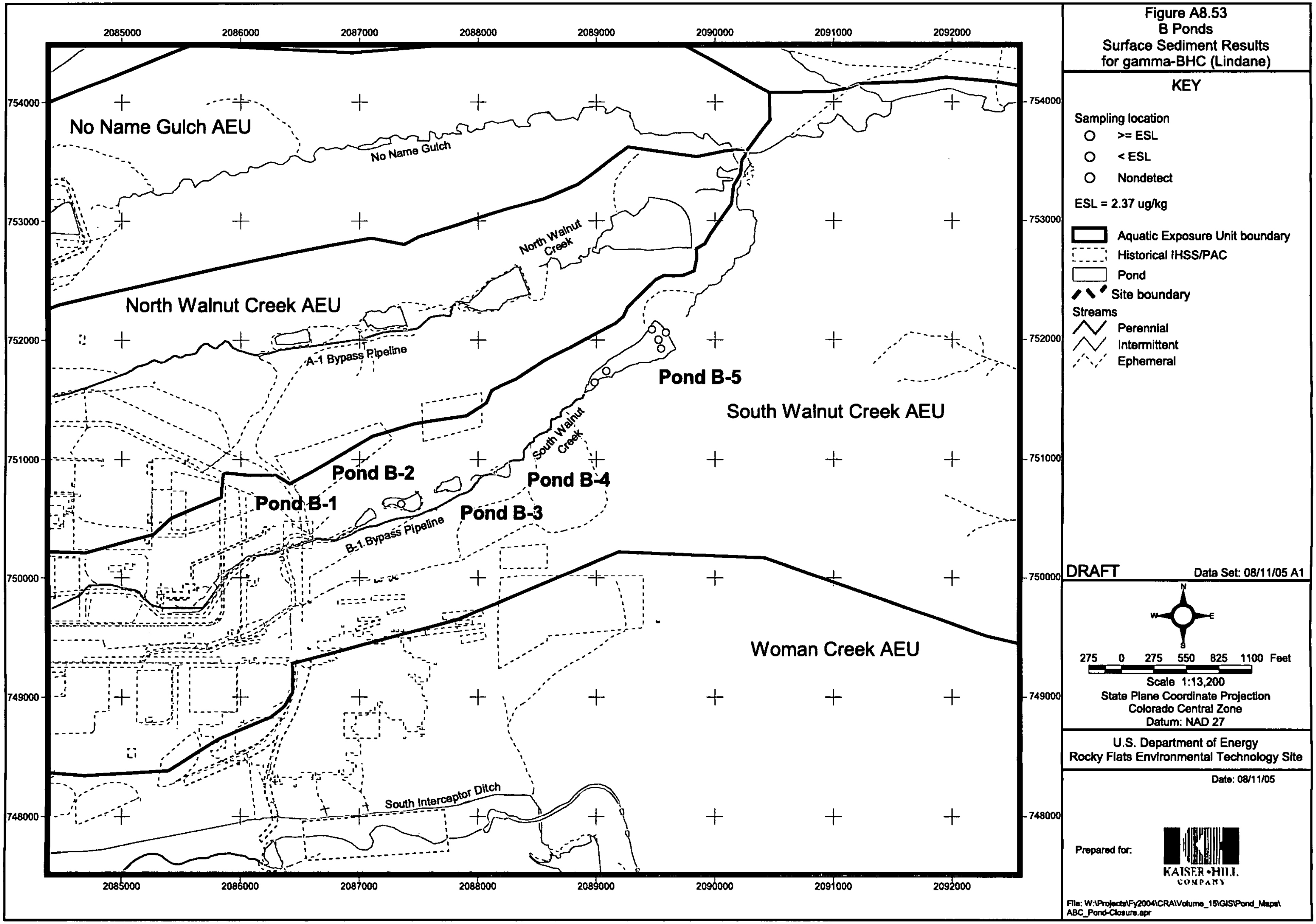

Figure A8.53
B Ponds
Surface Sediment Results
for gamma-BHC (Lindane)

967

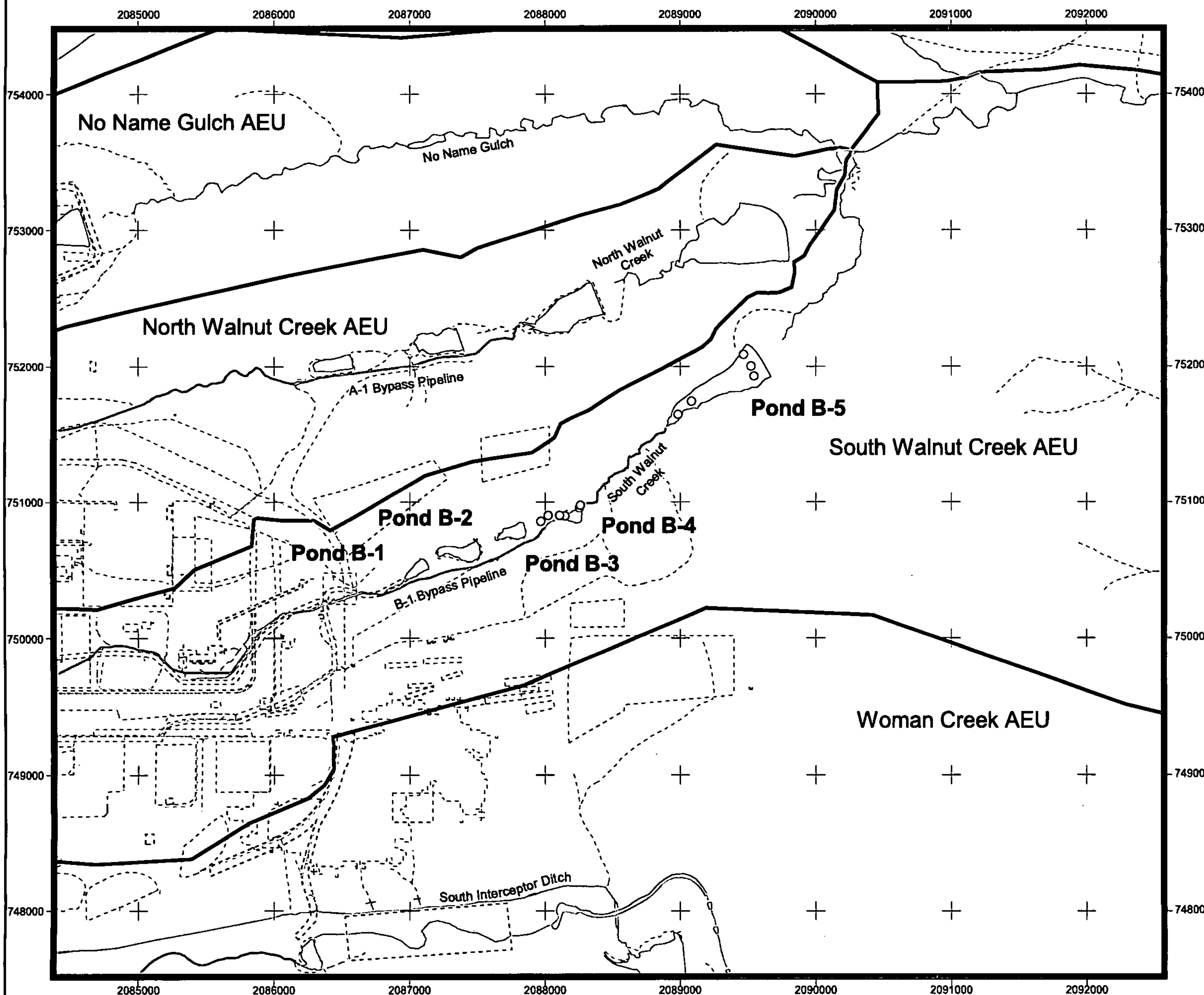

Figure A8.54
B Ponds
Surface Sediment Results
for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 17 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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968

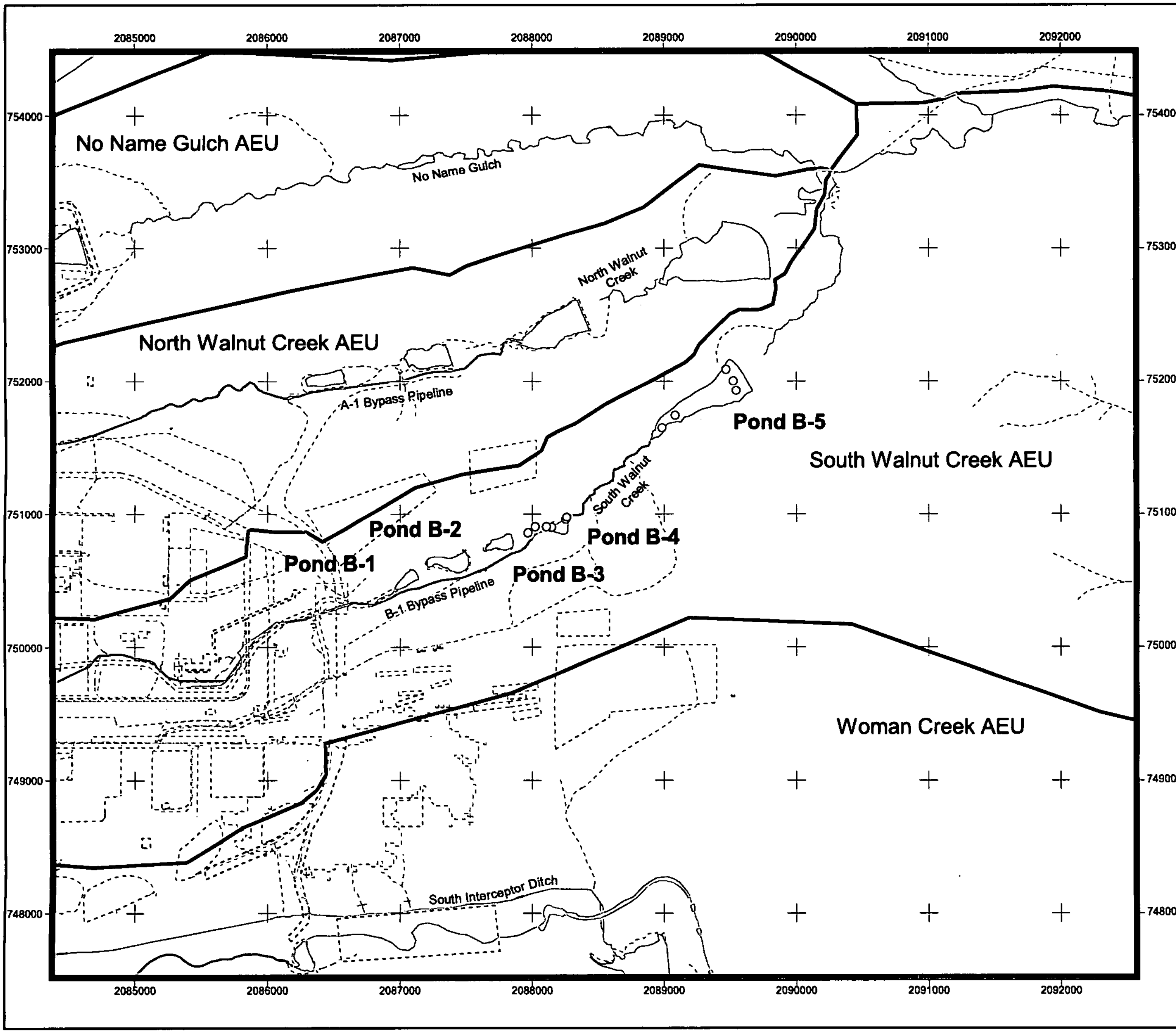

Figure A8.55
B Ponds
Surface Sediment Results
for Phenanthrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 204 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

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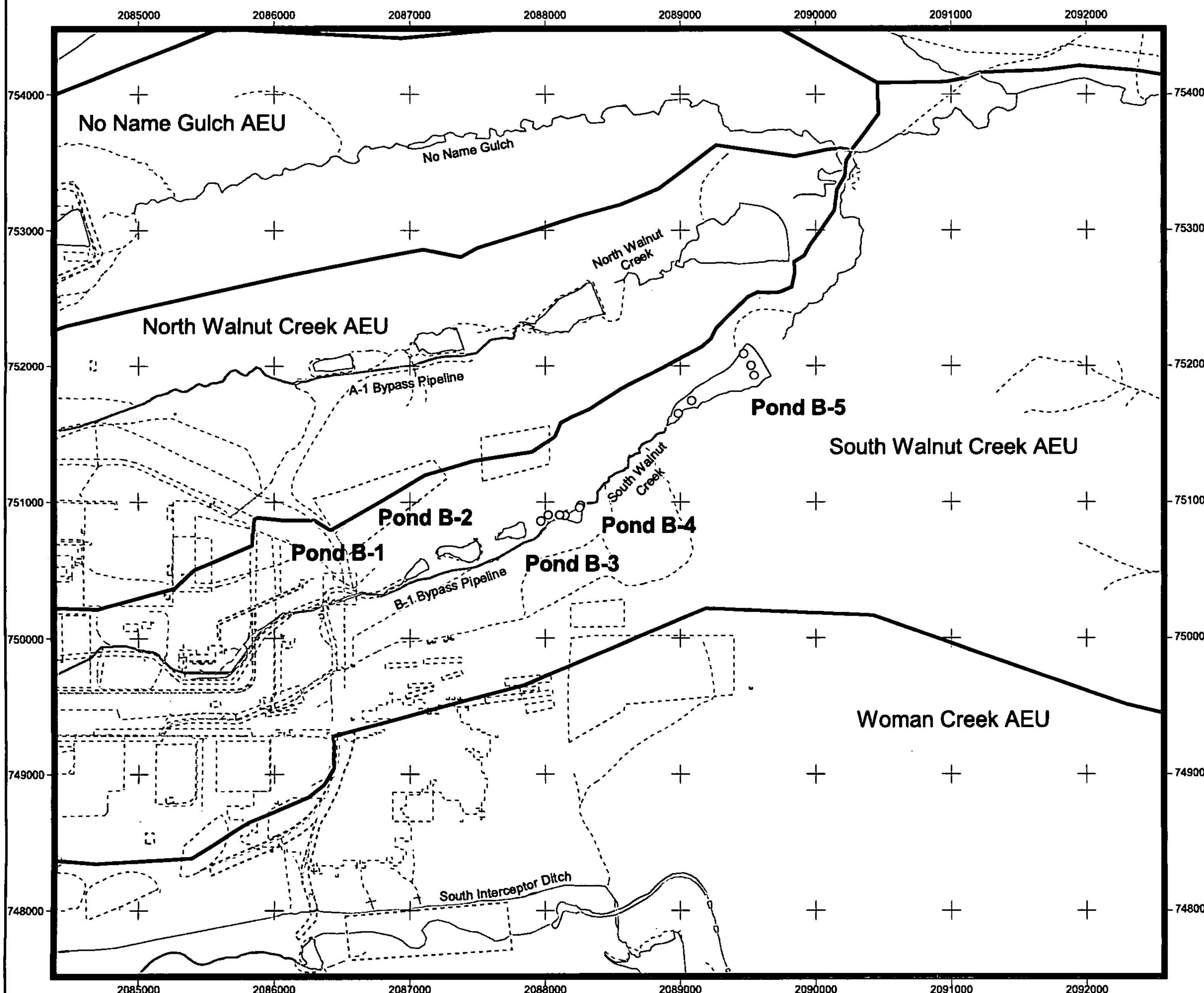
Figure A8.56
B Ponds
Surface Sediment Results for Pyrene



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 195 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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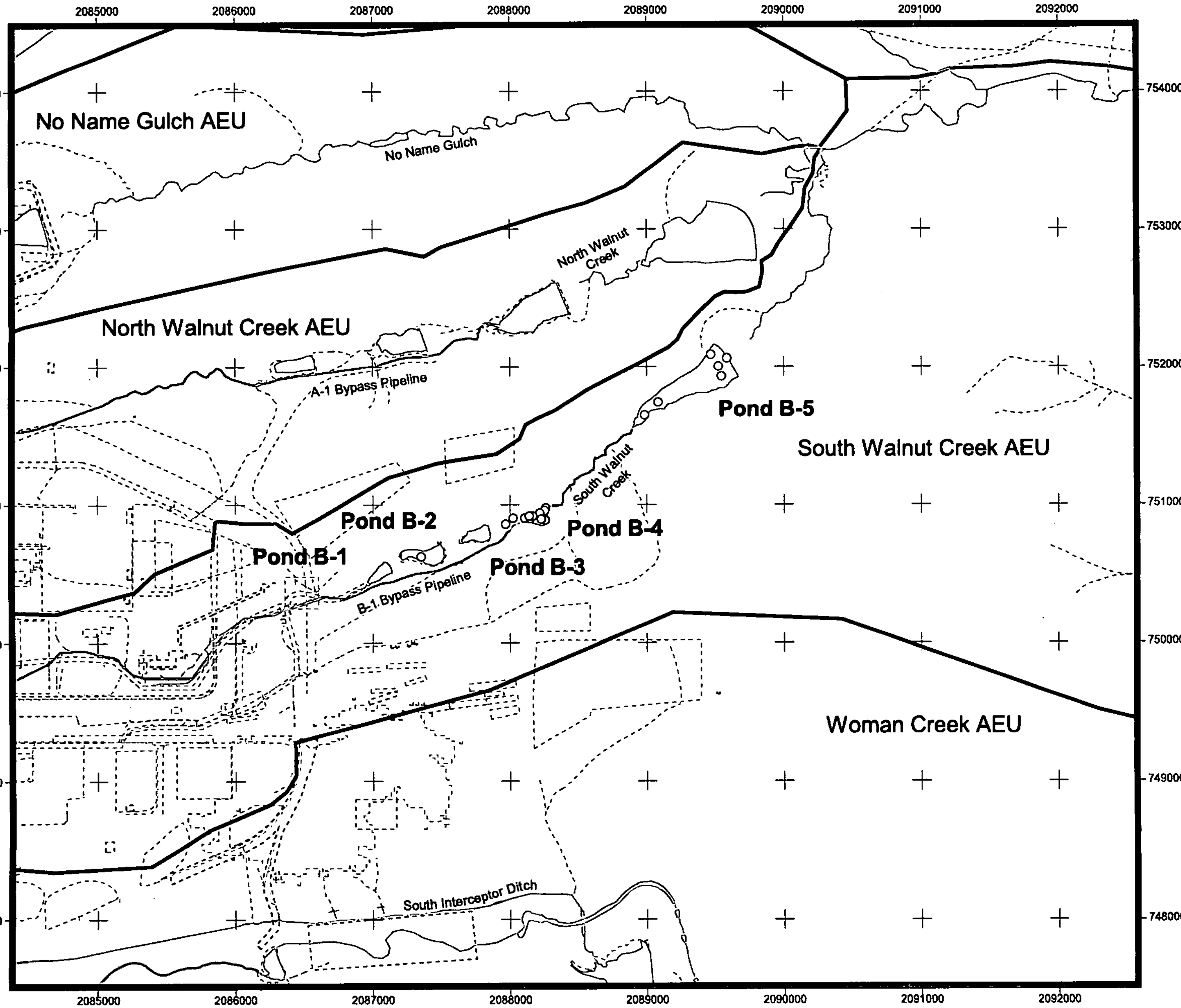

Figure A8.57
B Ponds
Surface Sediment Results
for Aroclor-1254

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 40 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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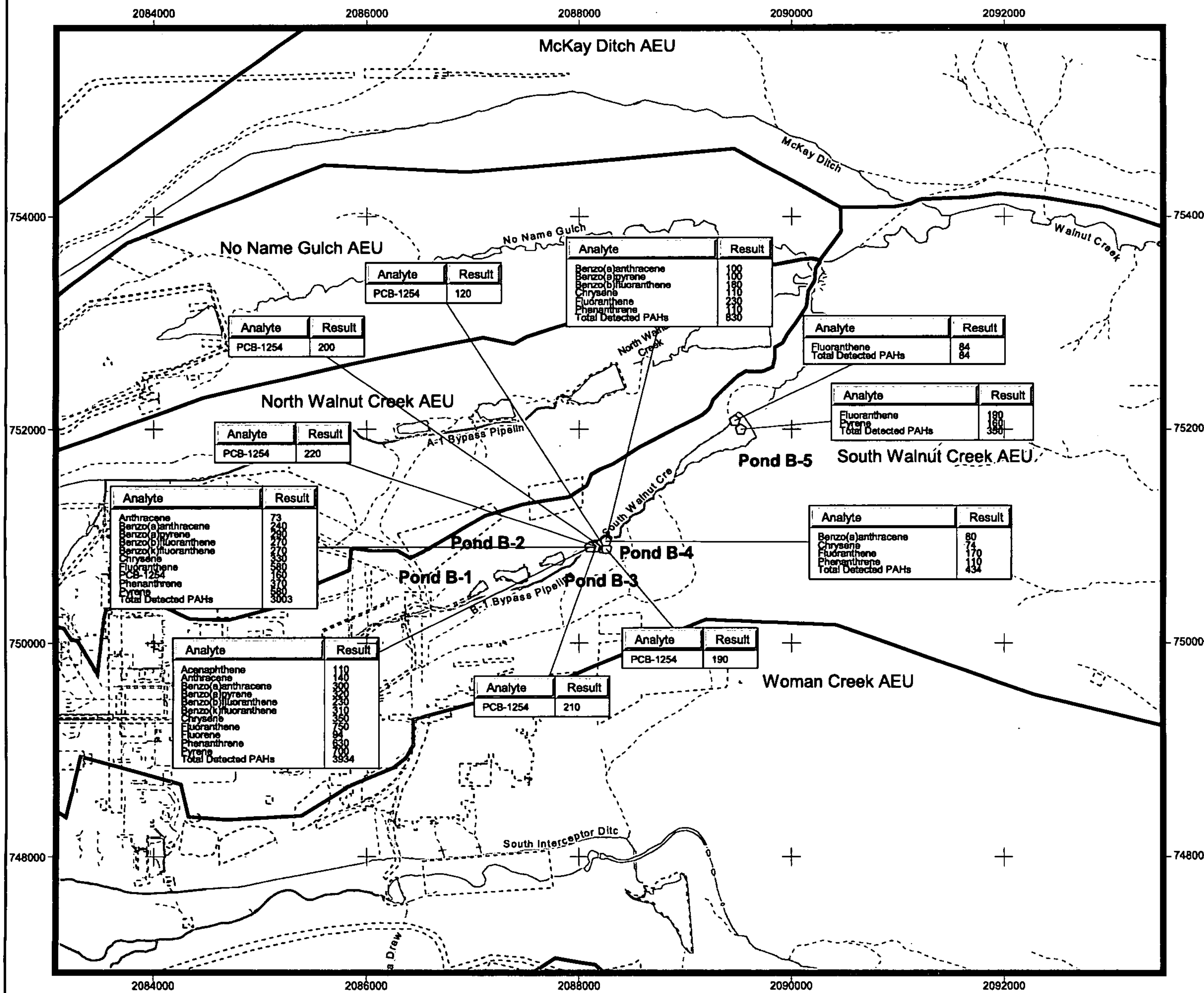

Figure A8.58
PAH and PCB Constituent Results Within the B-Series Surface Sediment

KEY

- Surface sediment sampling location
- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

Units = ug/kg

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Data Set: 08/10/05 A1

N E S W

350 0 350 700 1050 1400 Feet

Scale 1: 16,800

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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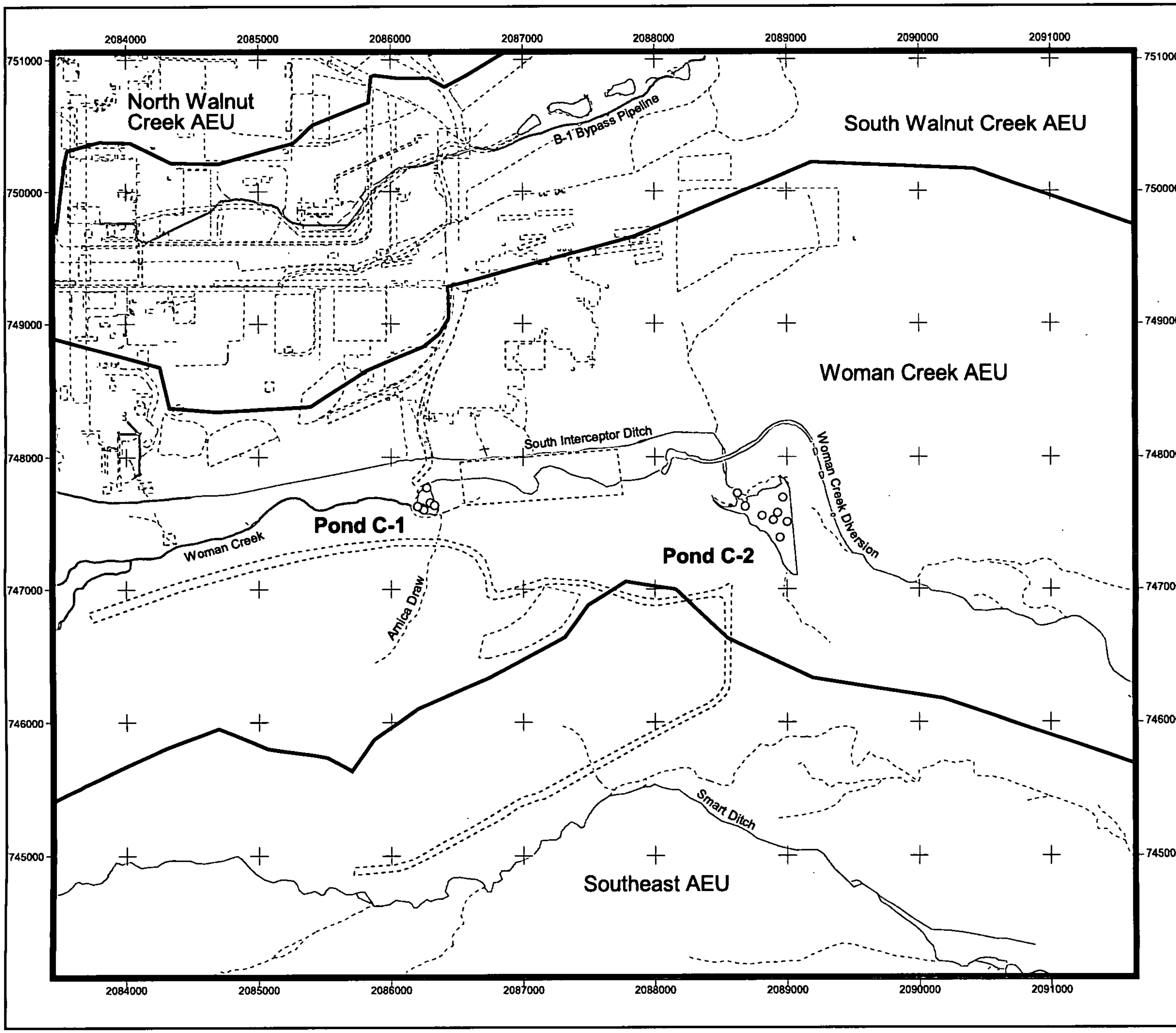
Figure A8.59
C Ponds
Surface Sediment Results for Aluminum



KEY

Sampling location

- >= ESL
- < ESL
- Nondetect

ESL = 15900 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams

- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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973

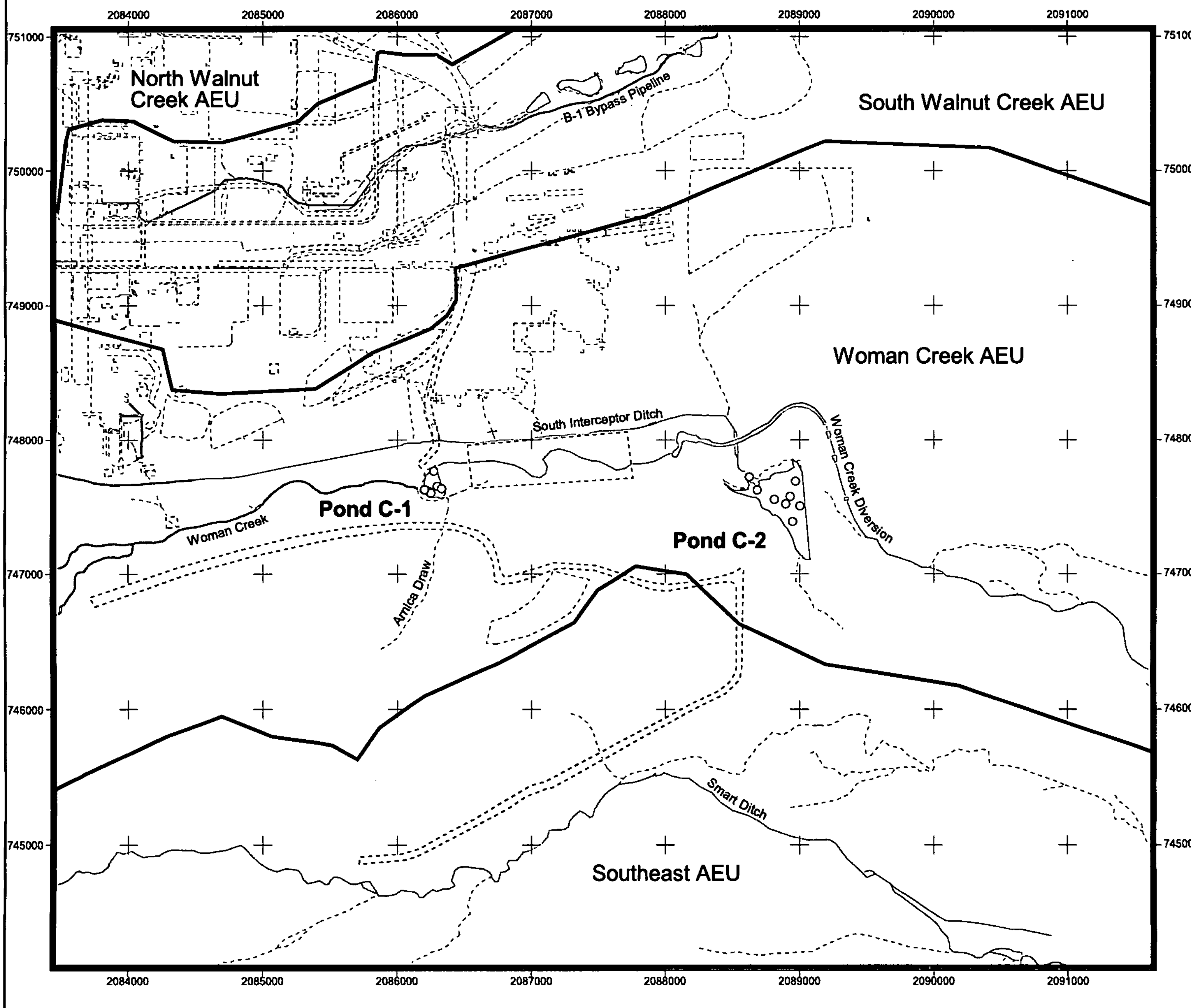

Figure A8.60
C Ponds
Surface Sediment Results
for Arsenic

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 9.79 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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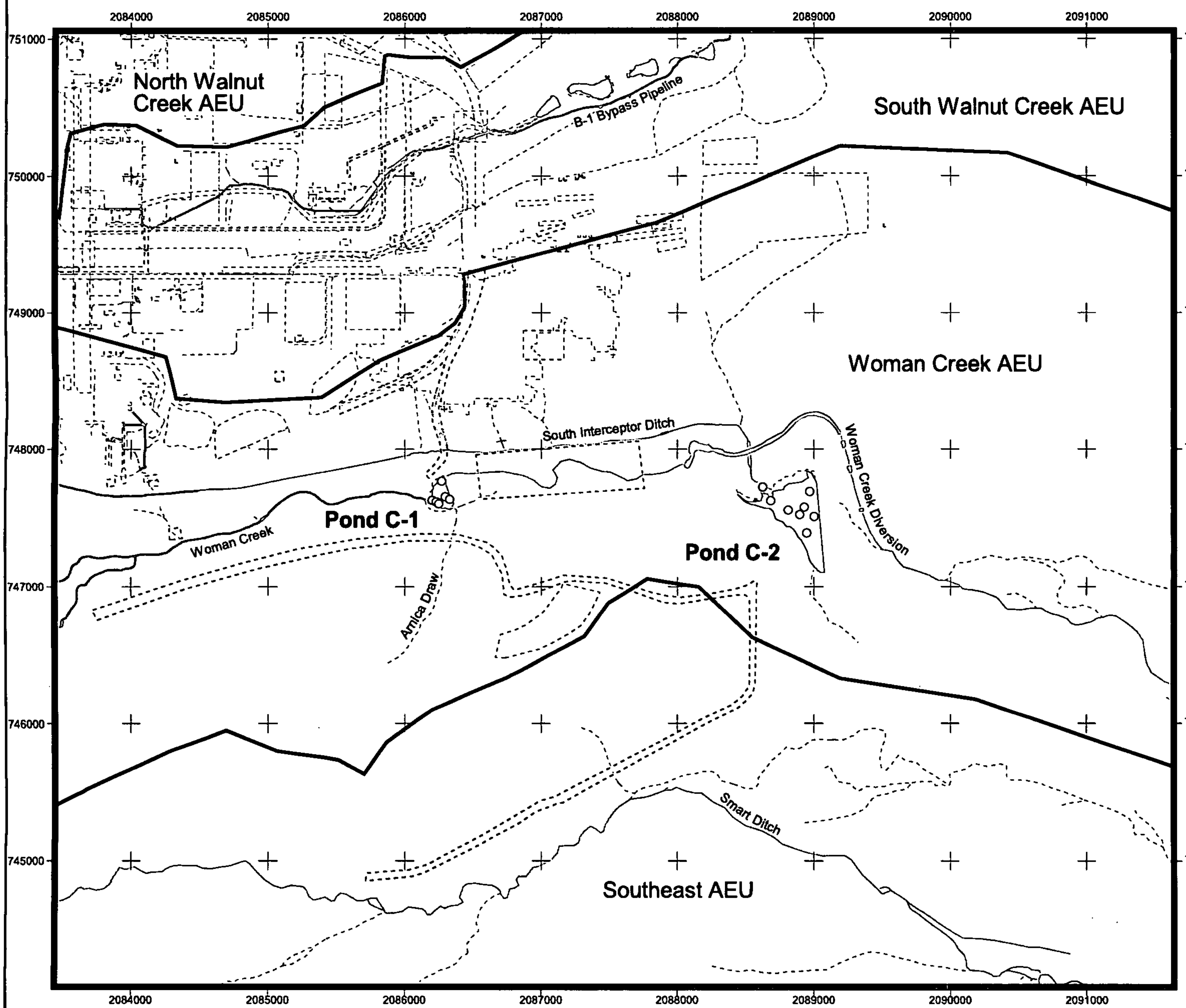
974

Figure A8.61
C Ponds
Surface Sediment Results
for Barium



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 189 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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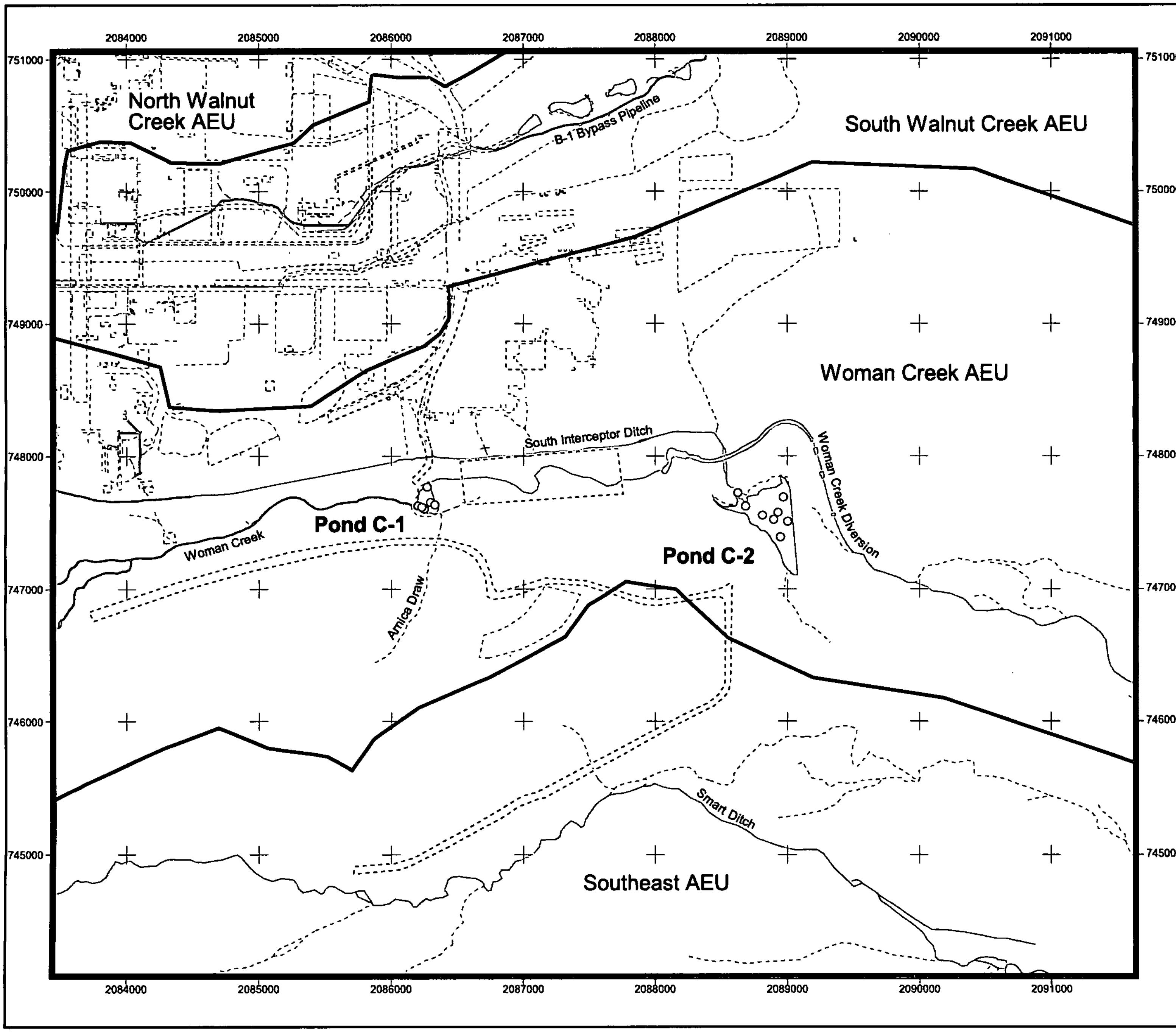
Figure A8.62
C Ponds
Surface Sediment Results for Copper



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 31.6 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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926

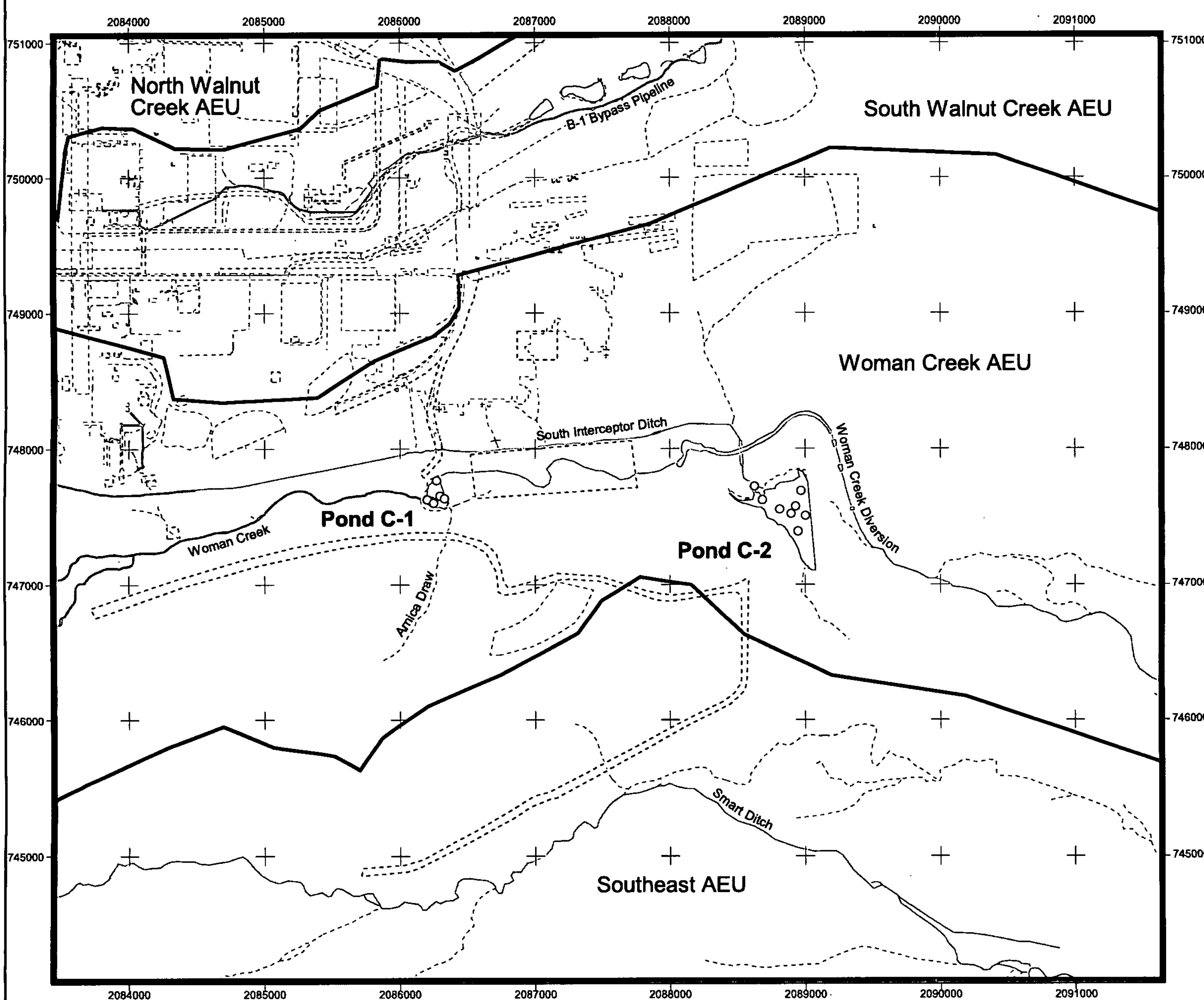

Figure A8.63
C Ponds
Surface Sediment Results for Iron

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 20000 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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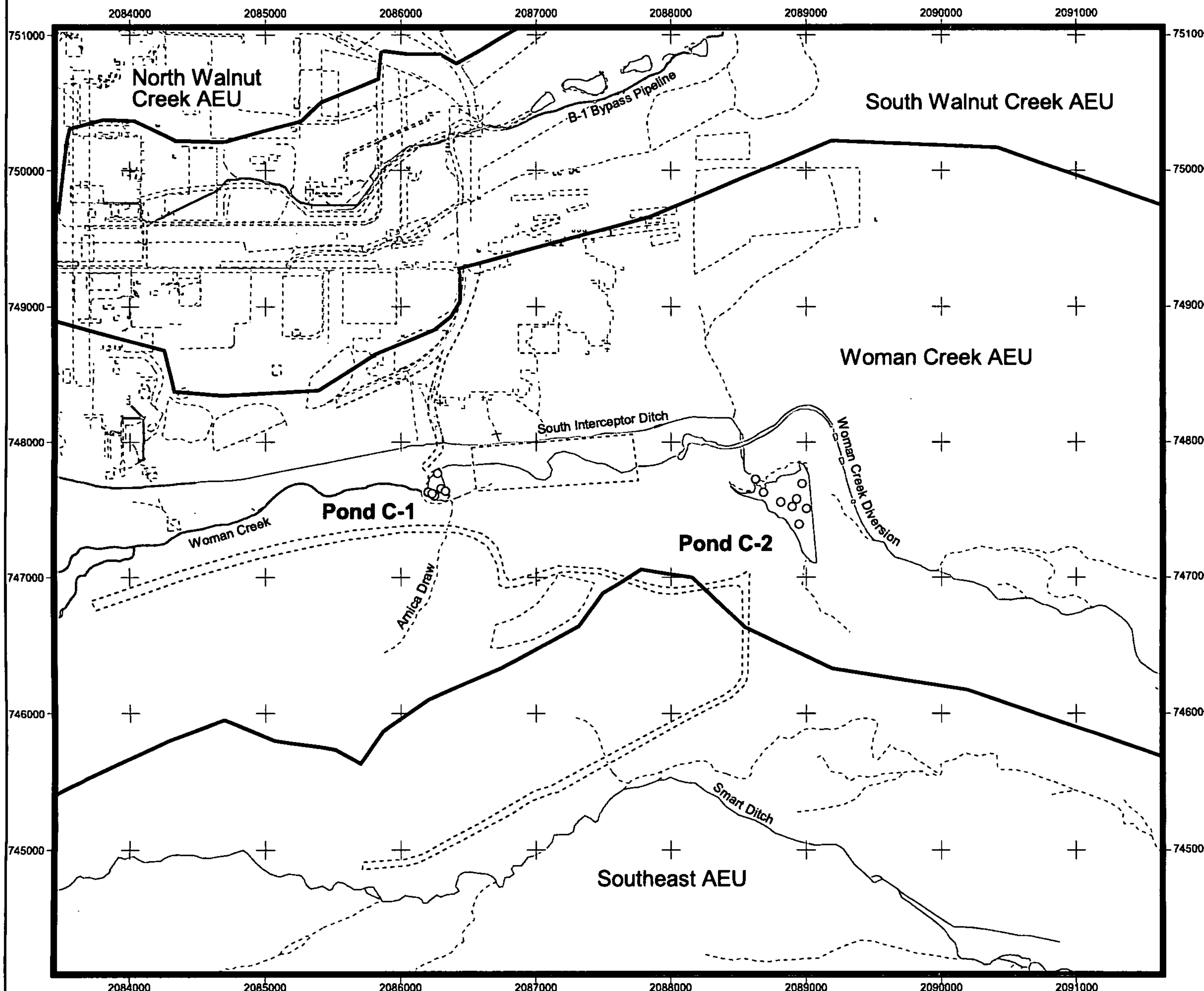

Figure A8.64
C Ponds
Surface Sediment Results
for Lead

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 35.8 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N E S W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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908

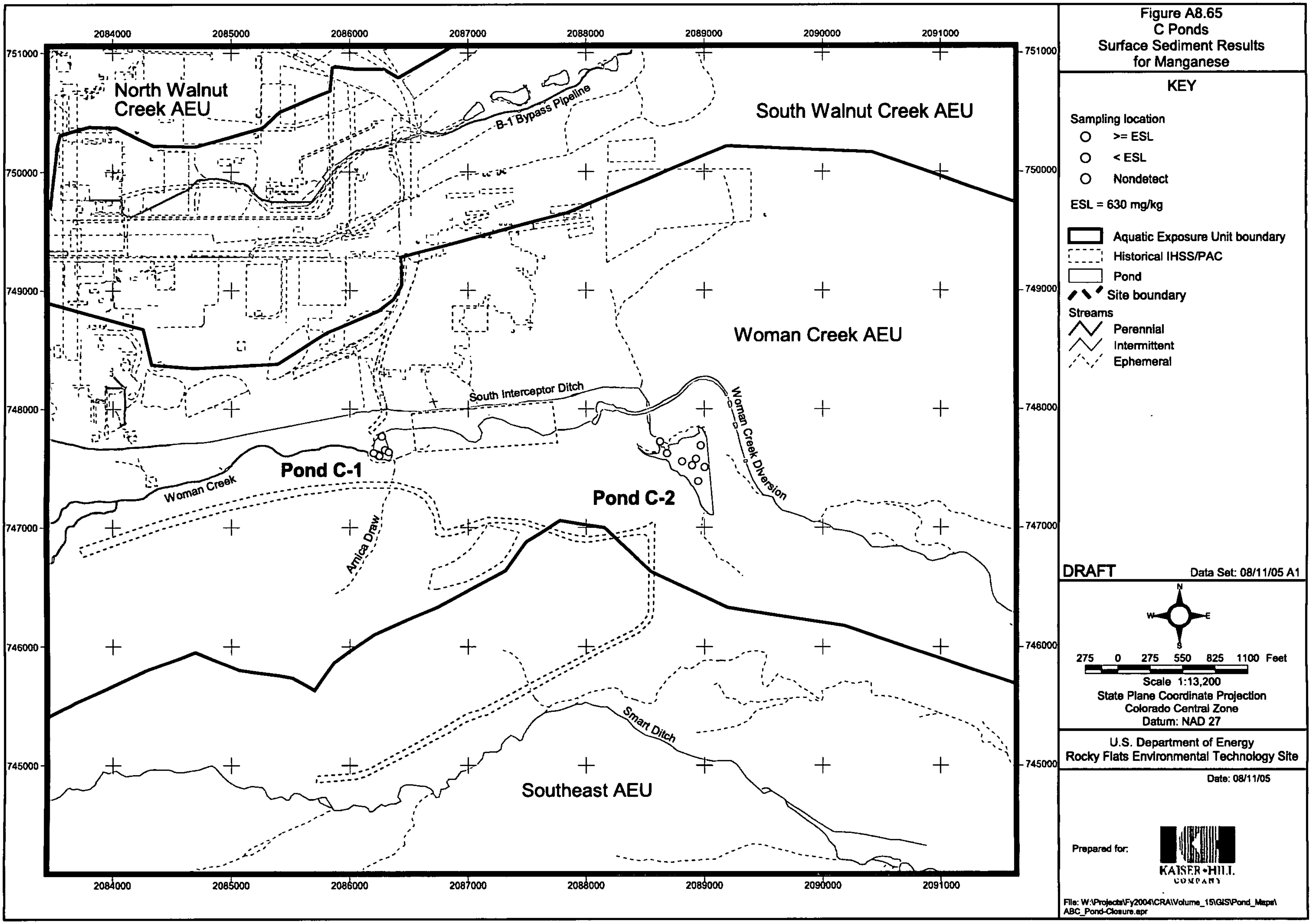

Figure A8.65
C Ponds
Surface Sediment Results
for Manganese
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 630 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
DRAFT
Data Set: 08/11/05 A1
275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
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Date: 08/11/05
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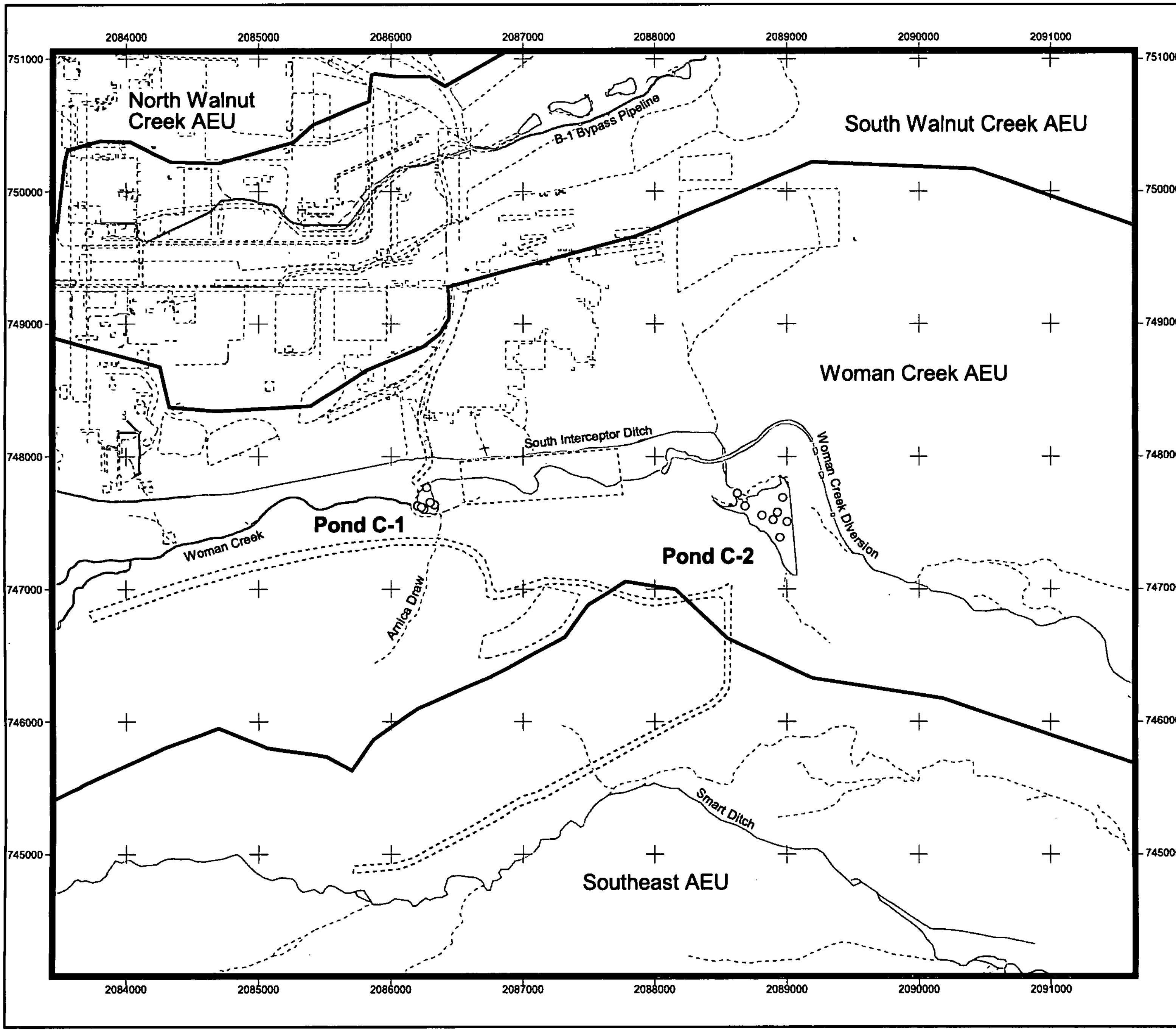
File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr
North Walnut Creek AEU
South Walnut Creek AEU
Woman Creek AEU
Southeast AEU
Pond C-1
Pond C-2
B-1 Bypass Pipeline
South Interceptor Ditch
Woman Creek
Woman Creek Diversion
Arnica Draw
Smart Ditch
2084000
2085000
2086000
2087000
2088000
2089000
2090000
2091000
751000
750000
749000
748000
747000
746000
745000

Figure A8.66
C Ponds
Surface Sediment Results
for Mercury



KEY

Sampling location
>= ESL
< ESL
Nondetect

ESL = 0.18 mg/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

DRAFT

Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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980

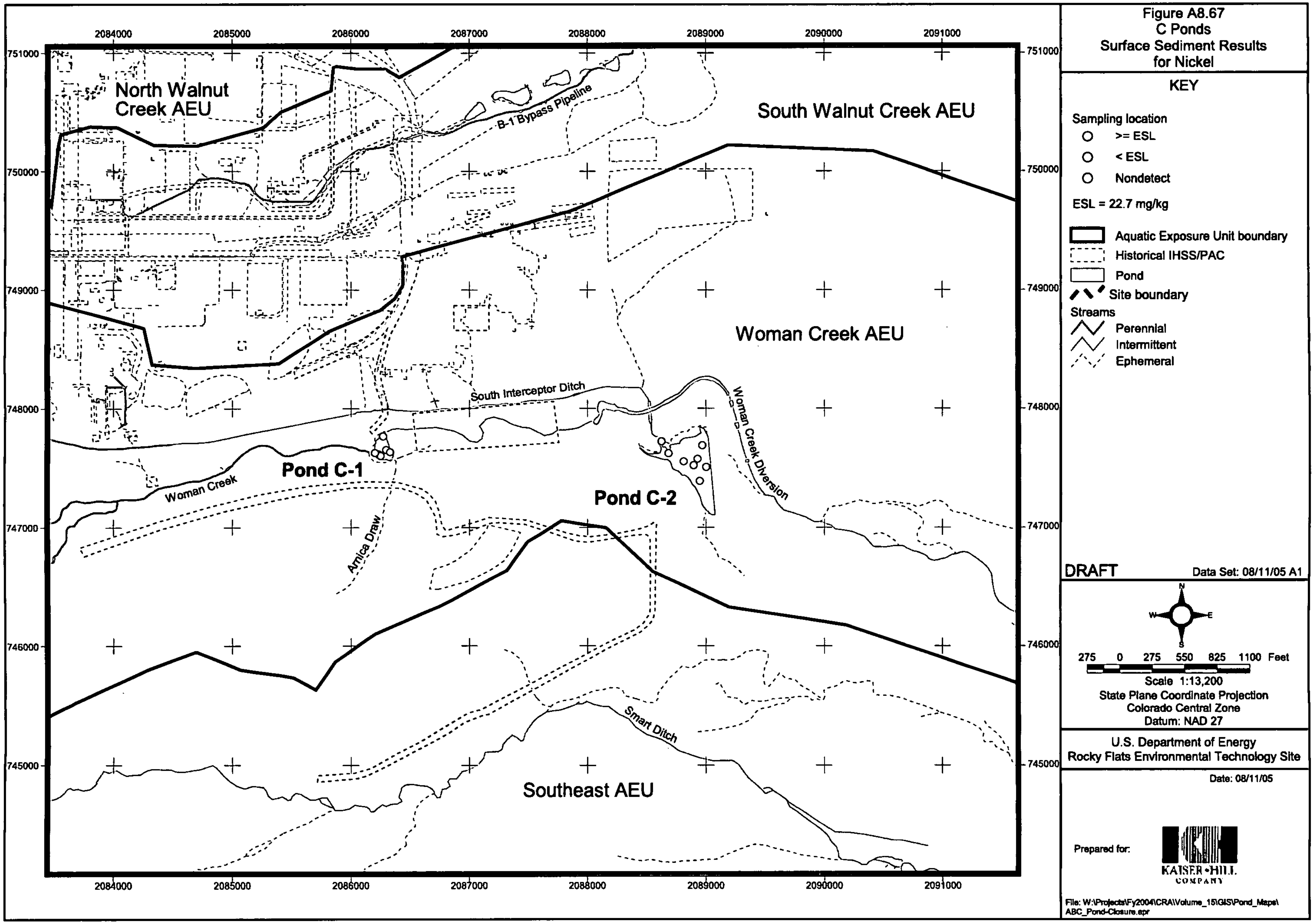
Figure A8.67
C Ponds
Surface Sediment Results
for Nickel
KEY
Sampling location
>= ESL
< ESL
Nondetect
ESL = 22.7 mg/kg
Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral
North Walnut Creek AEU
South Walnut Creek AEU
Woman Creek AEU
Southeast AEU
B-1 Bypass Pipeline
South Interceptor Ditch
Woman Creek Diversion
Woman Creek
Pond C-1
Pond C-2
Arnica Draw
Smart Ditch
2084000
2085000
2086000
2087000
2088000
2089000
2090000
2091000
751000
750000
749000
748000
747000
746000
745000
DRAFT
Data Set: 08/11/05 A1
N
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275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27
U.S. Department of Energy
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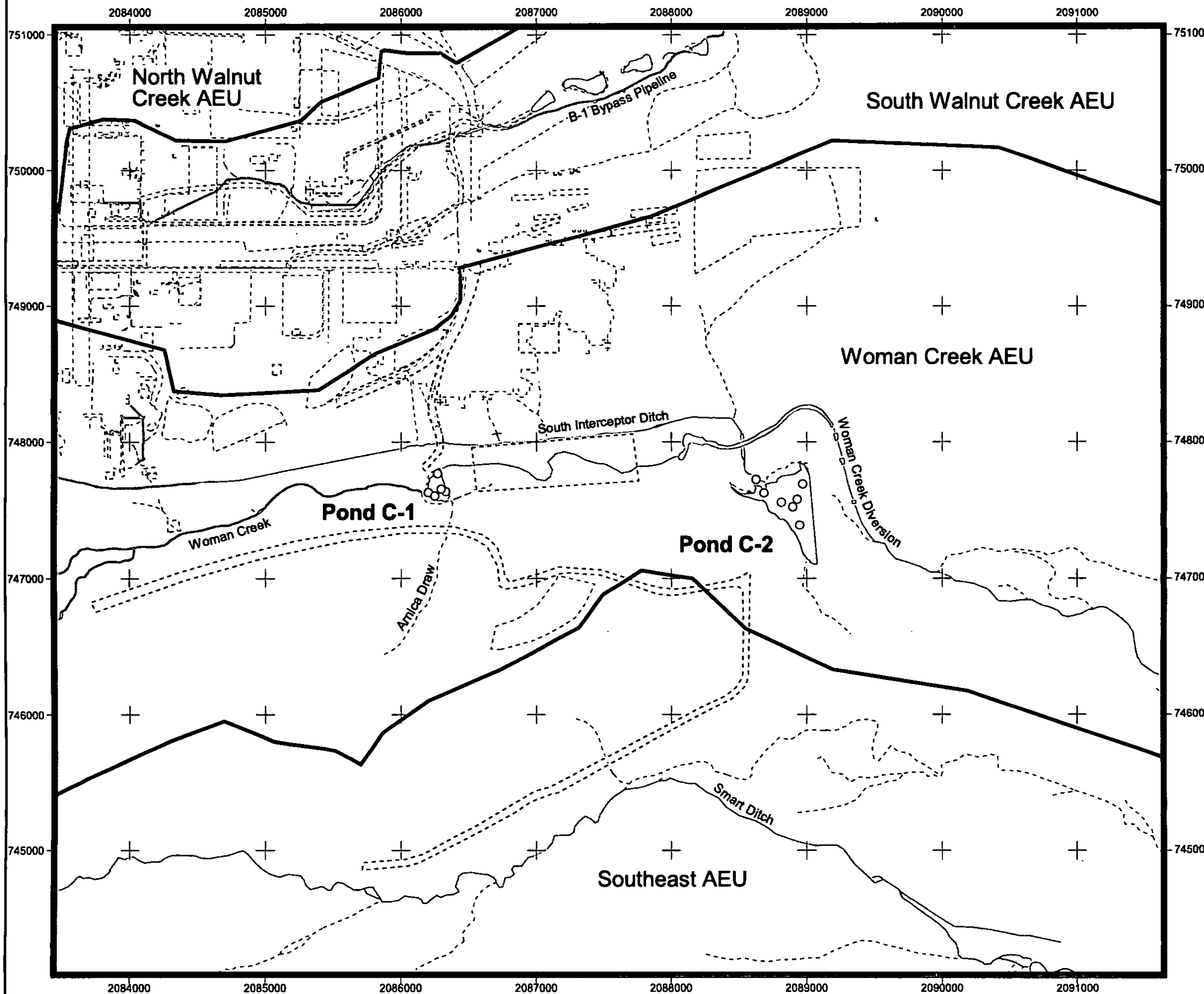
Figure A8.68
C Ponds
Surface Sediment Results
for Selenium



KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 0.95 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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982

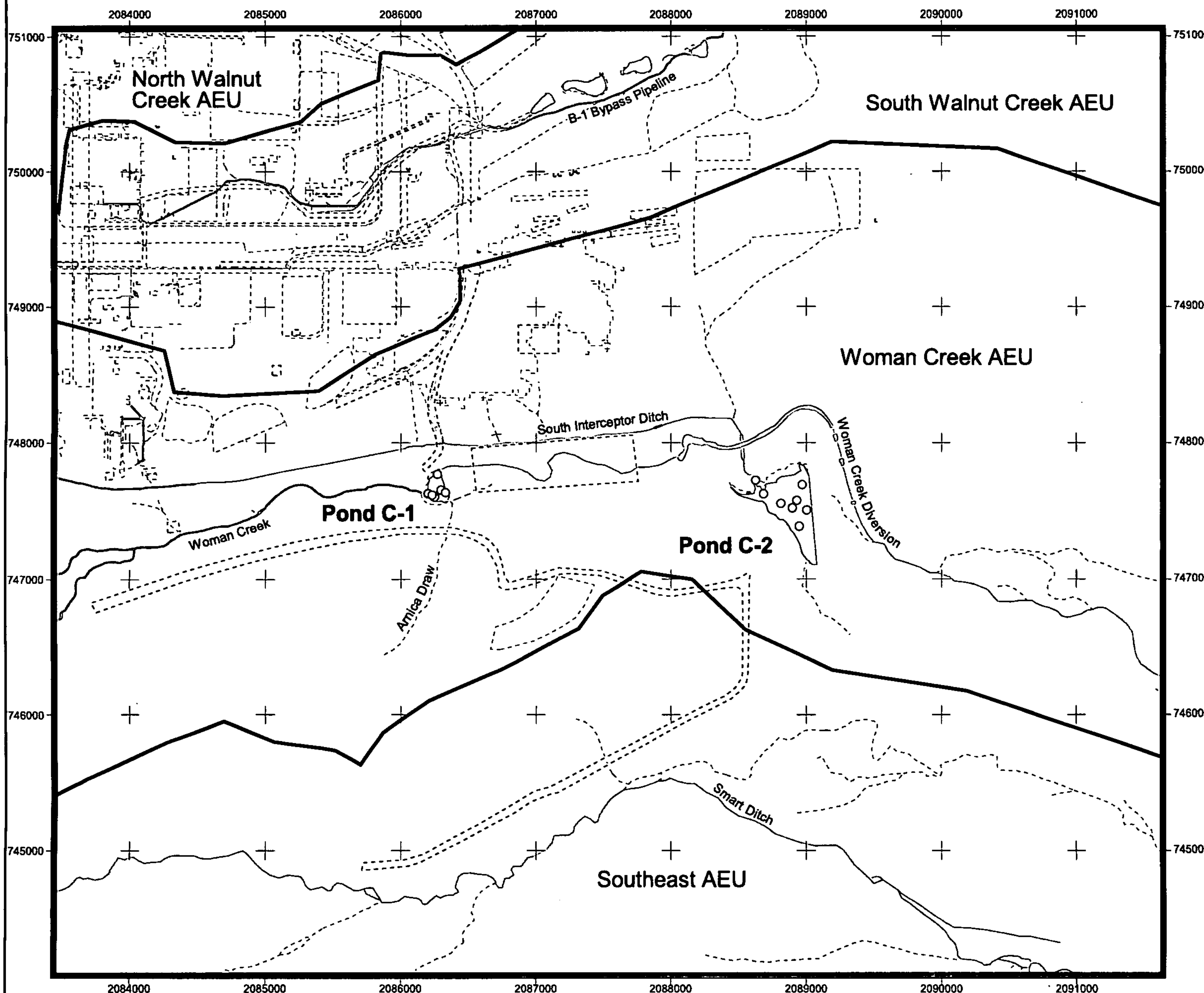

Figure A8.69
C Ponds
Surface Sediment Results
for Zinc

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 121 mg/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
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983

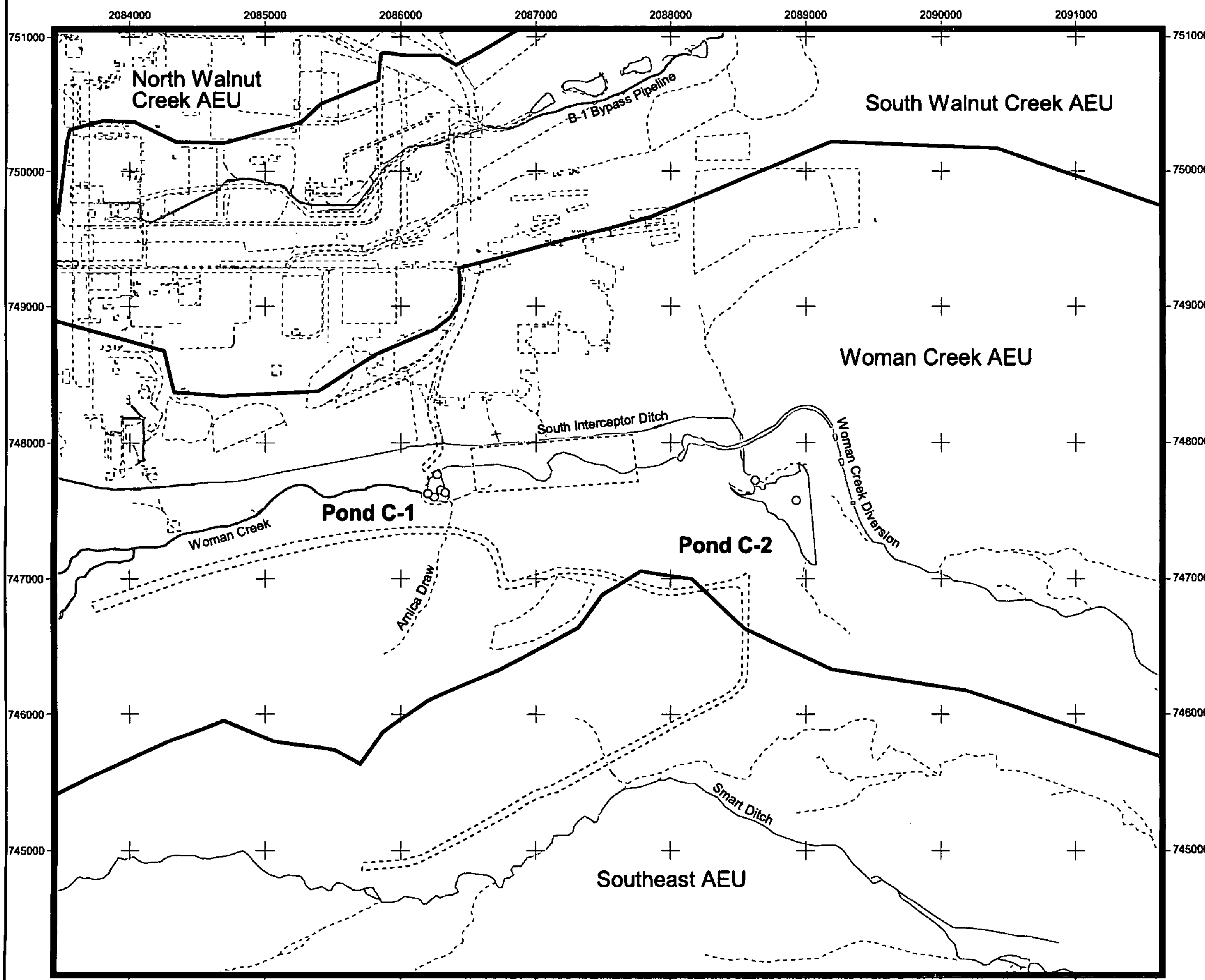

Figure A8.70
C Ponds
Surface Sediment Results
for Acenaphthene

KEY

Sampling location
>= ESL
< ESL
Nondetect

ESL = 6.71 ug/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

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Data Set: 08/11/05 A1

275 0 275 550 825 1100 Feet
Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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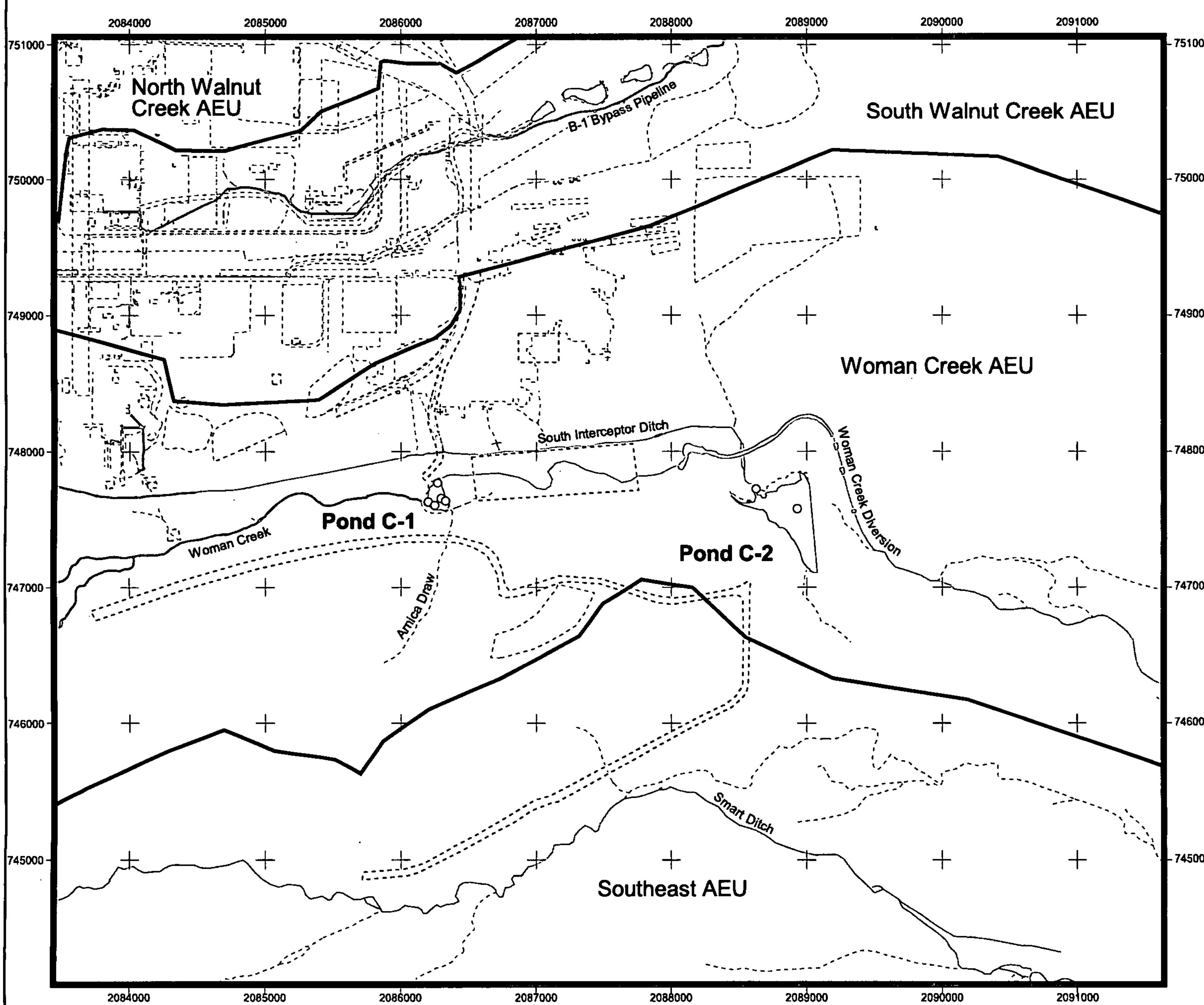

Figure A8.71
C Ponds
Surface Sediment Results
for Anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 57.2 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
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Datum: NAD 27

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985

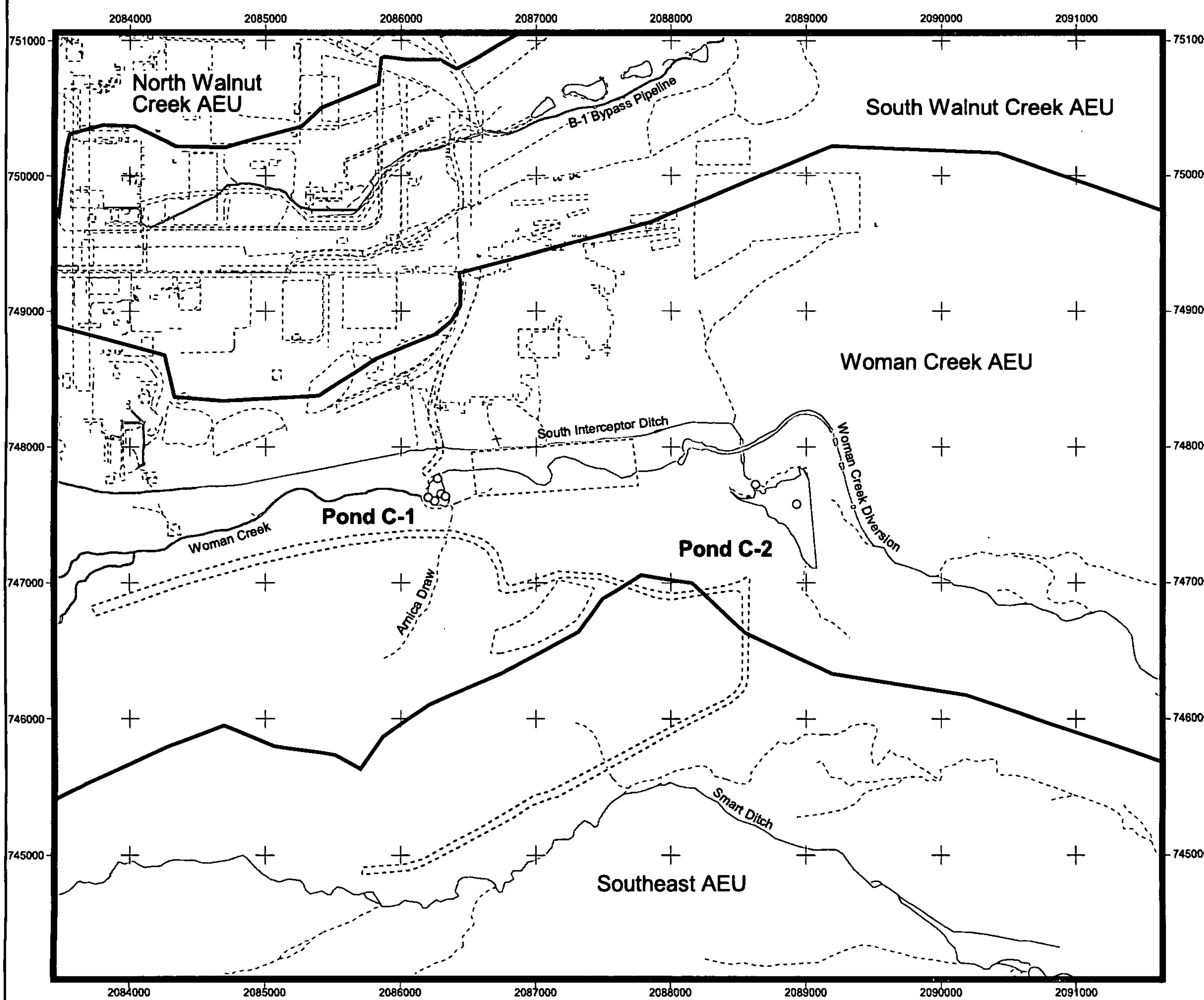

Figure A8.72
C Ponds
Surface Sediment Results
for Benzo(a)anthracene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 108 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
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Datum: NAD 27

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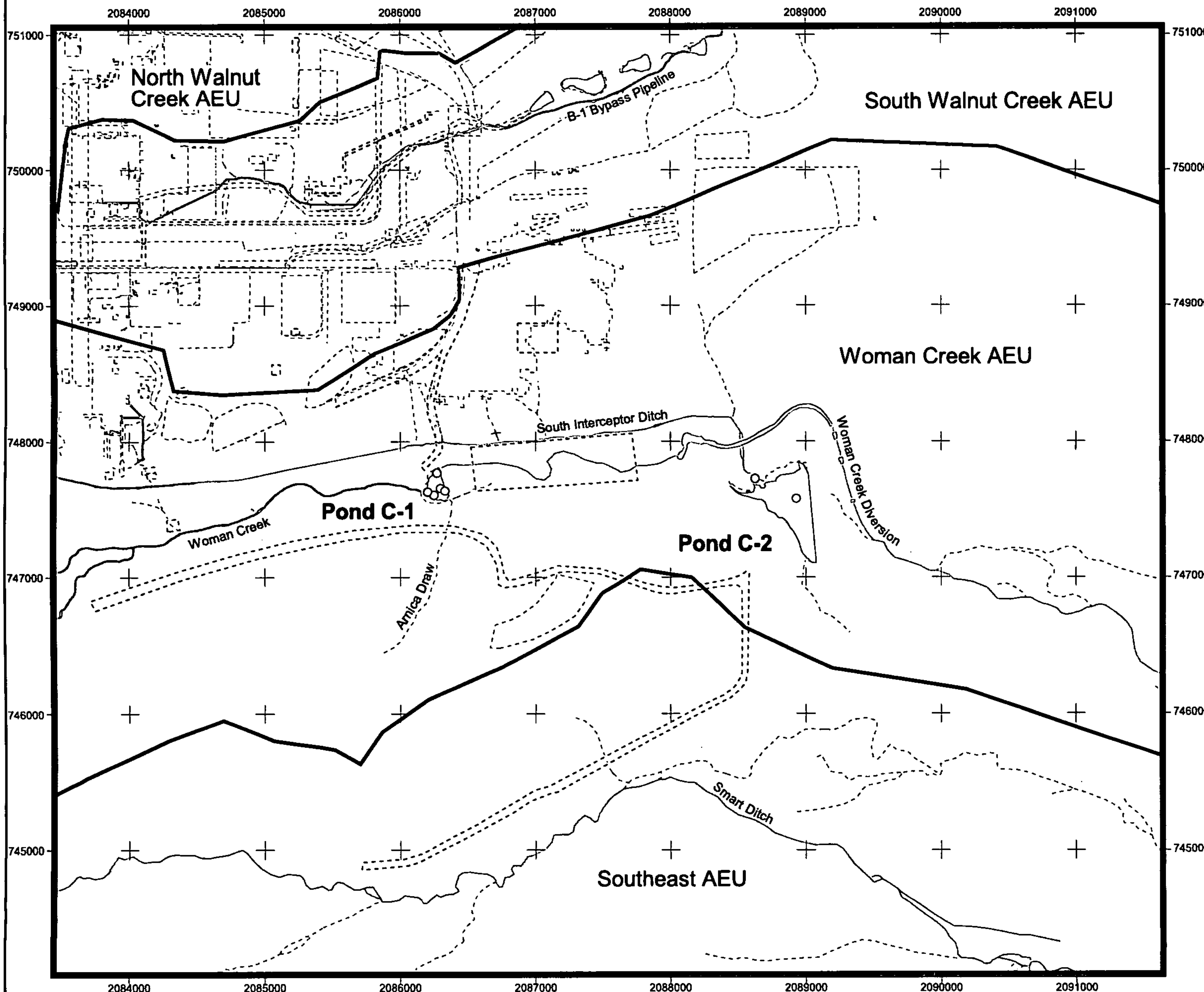
986

Figure A8.73
C Ponds
Surface Sediment Results for Benzo(a)pyrene



KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 150 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

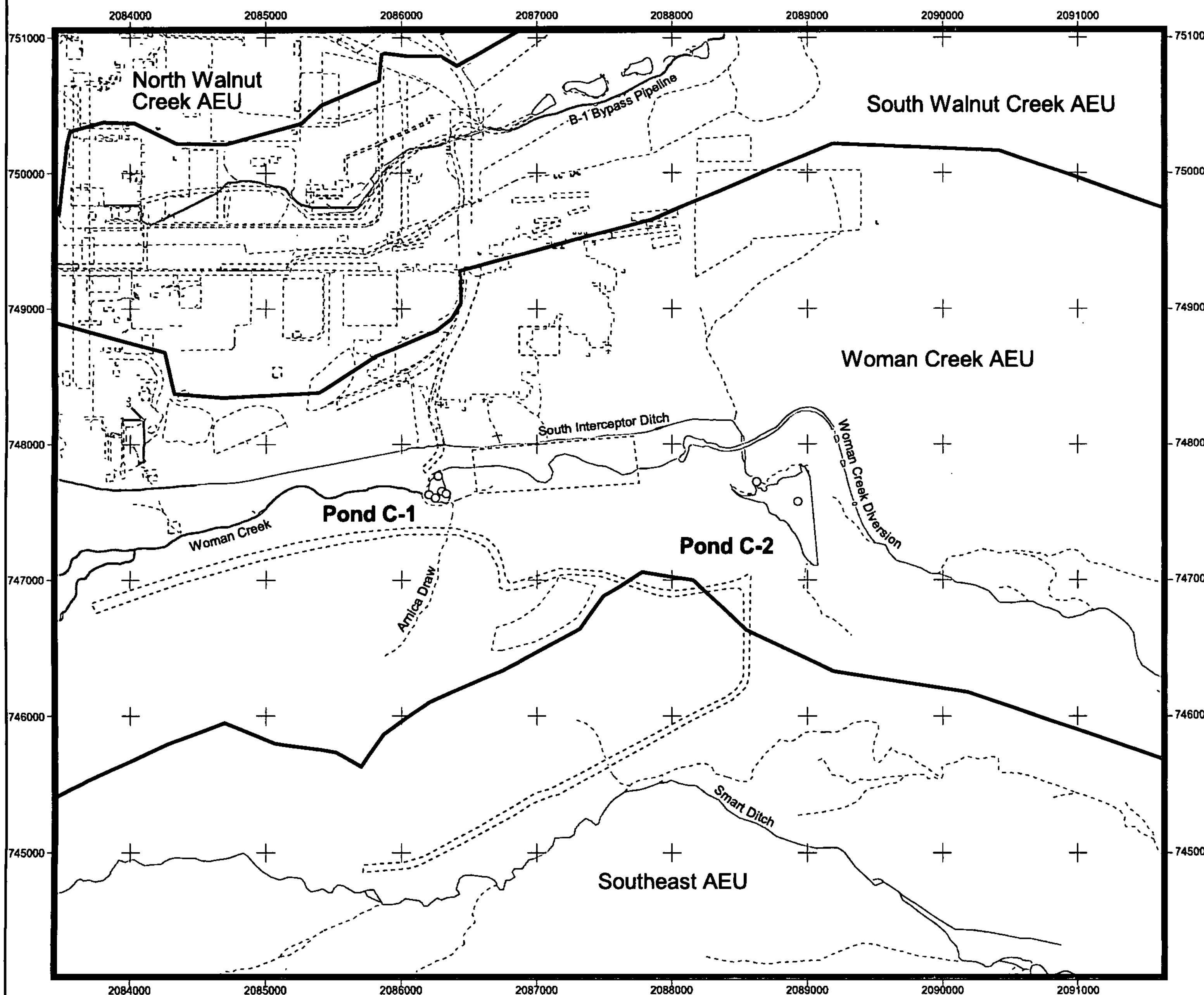

Figure A8.74
C Ponds
Surface Sediment Results for Benzo(g,h,i)perylene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 13 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N S E W

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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988

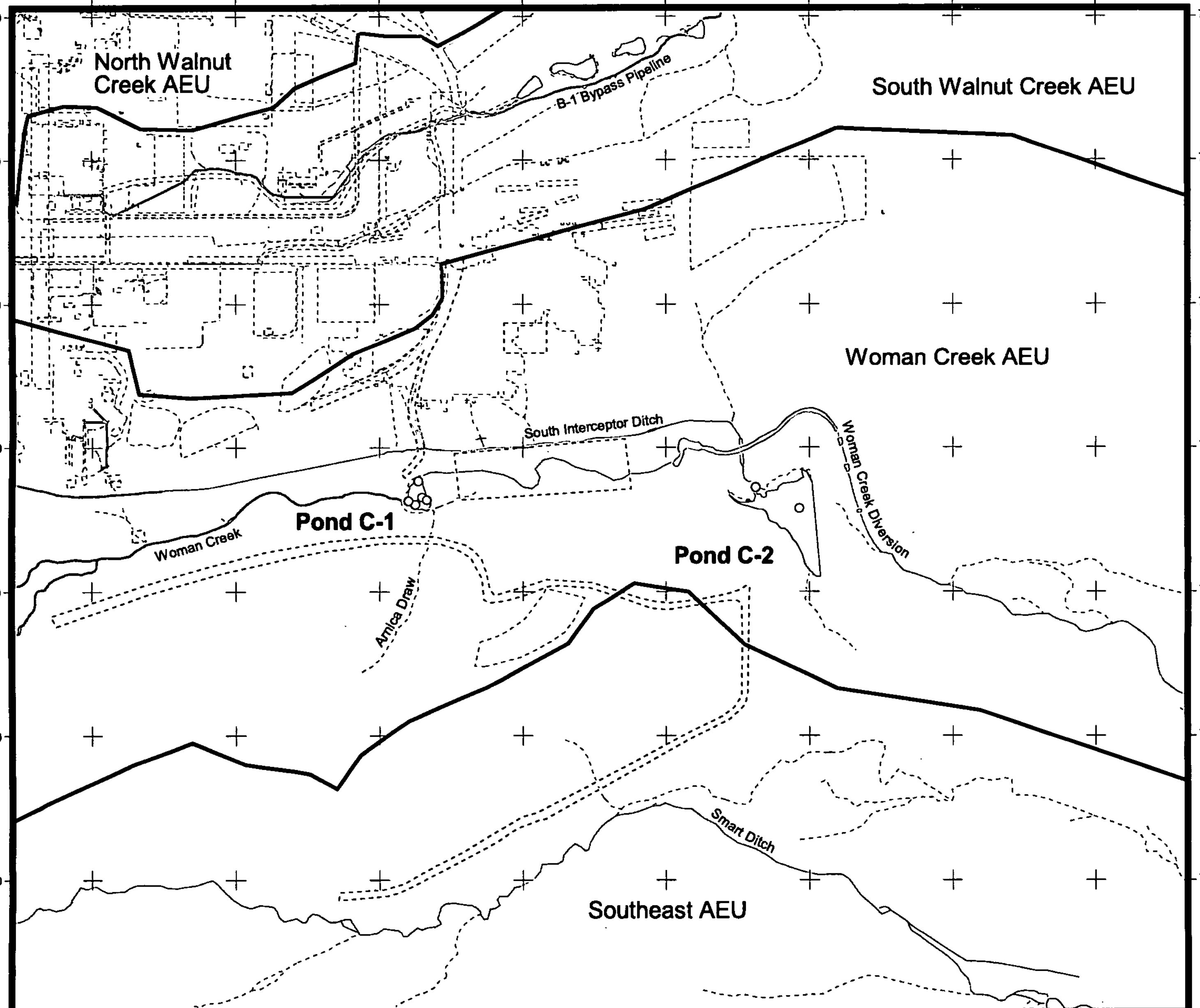

Figure A8.75
C Ponds
Surface Sediment Results
for Chrysene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 166 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

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Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

989

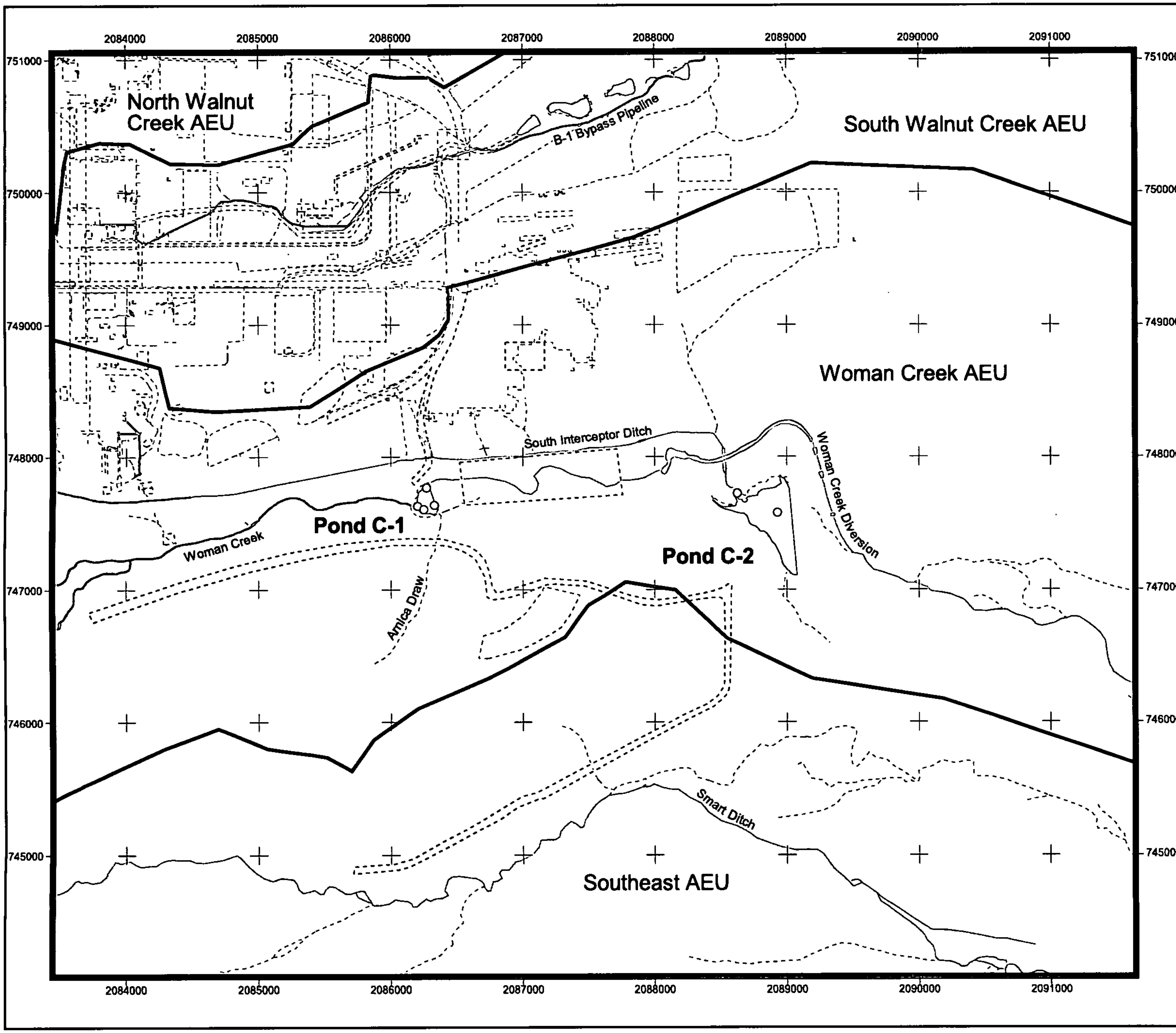

Figure A8.76
C Ponds
Surface Sediment Results
for Dibenz(a,h)anthracene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 33 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 08/11/05

Prepared for:

KAISER-HILL COMPANY

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

990

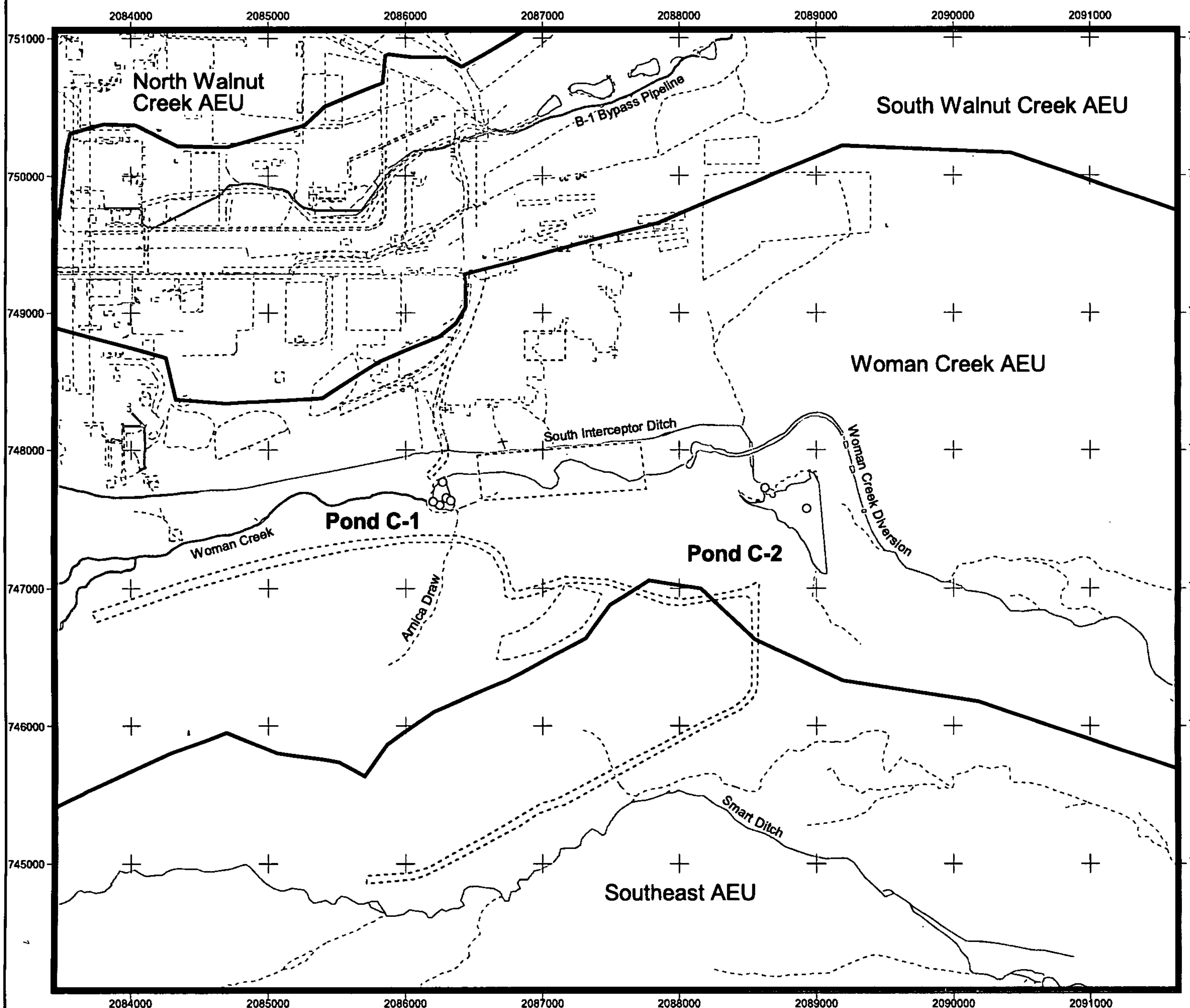

Figure A8.77
C Ponds
Surface Sediment Results
for Indeno(1,2,3-cd)pyrene

KEY

Sampling location
- O >= ESL
- O < ESL
- O Nondetect

ESL = 17 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N S W E

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

Prepared for:

KAISER+HILL COMPANY

File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

991

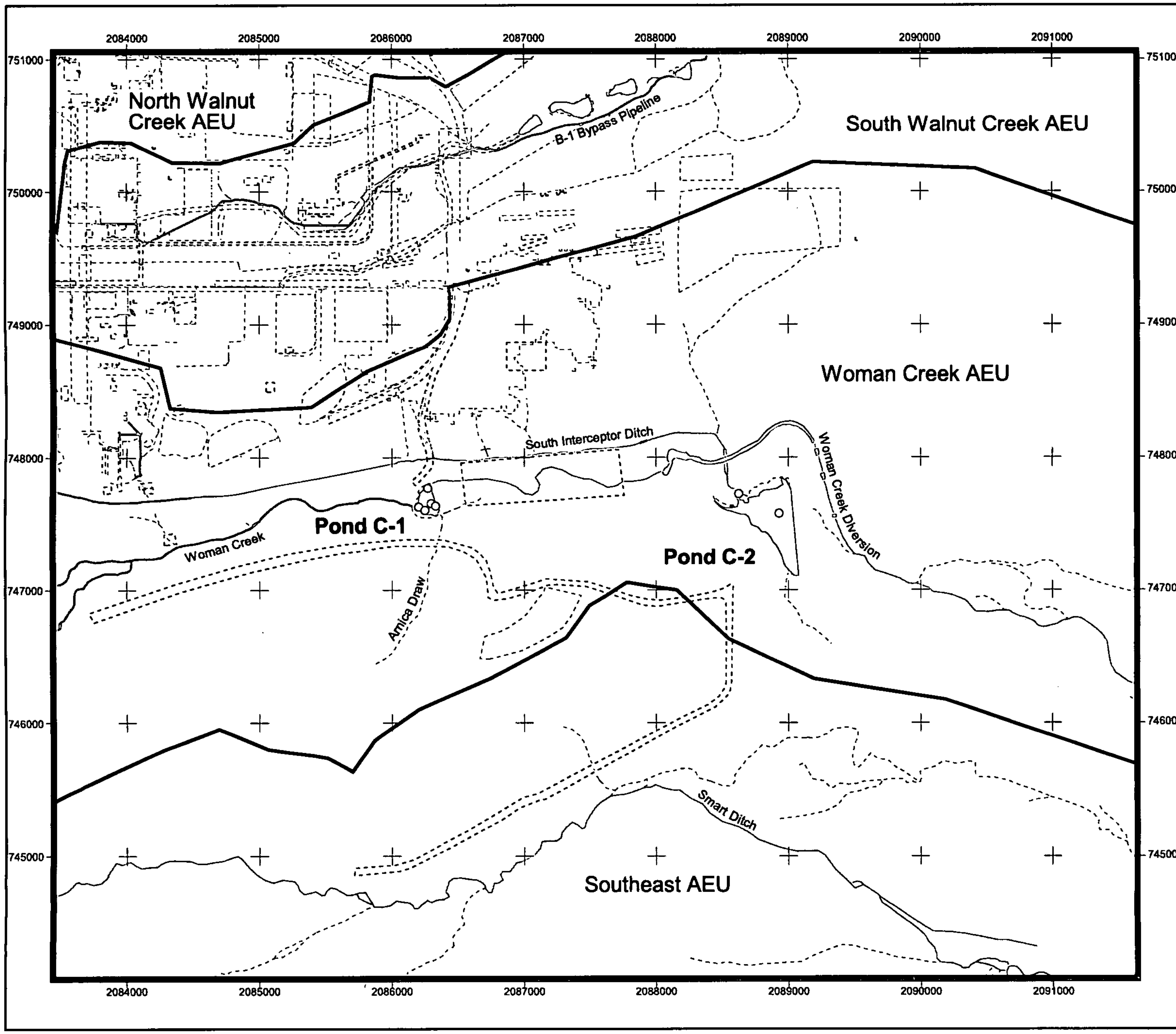

Figure A8.78
C Ponds
Surface Sediment Results
for Pentachlorophenol

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 255 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT Data Set: 08/11/05 A1

N
W E
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275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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992

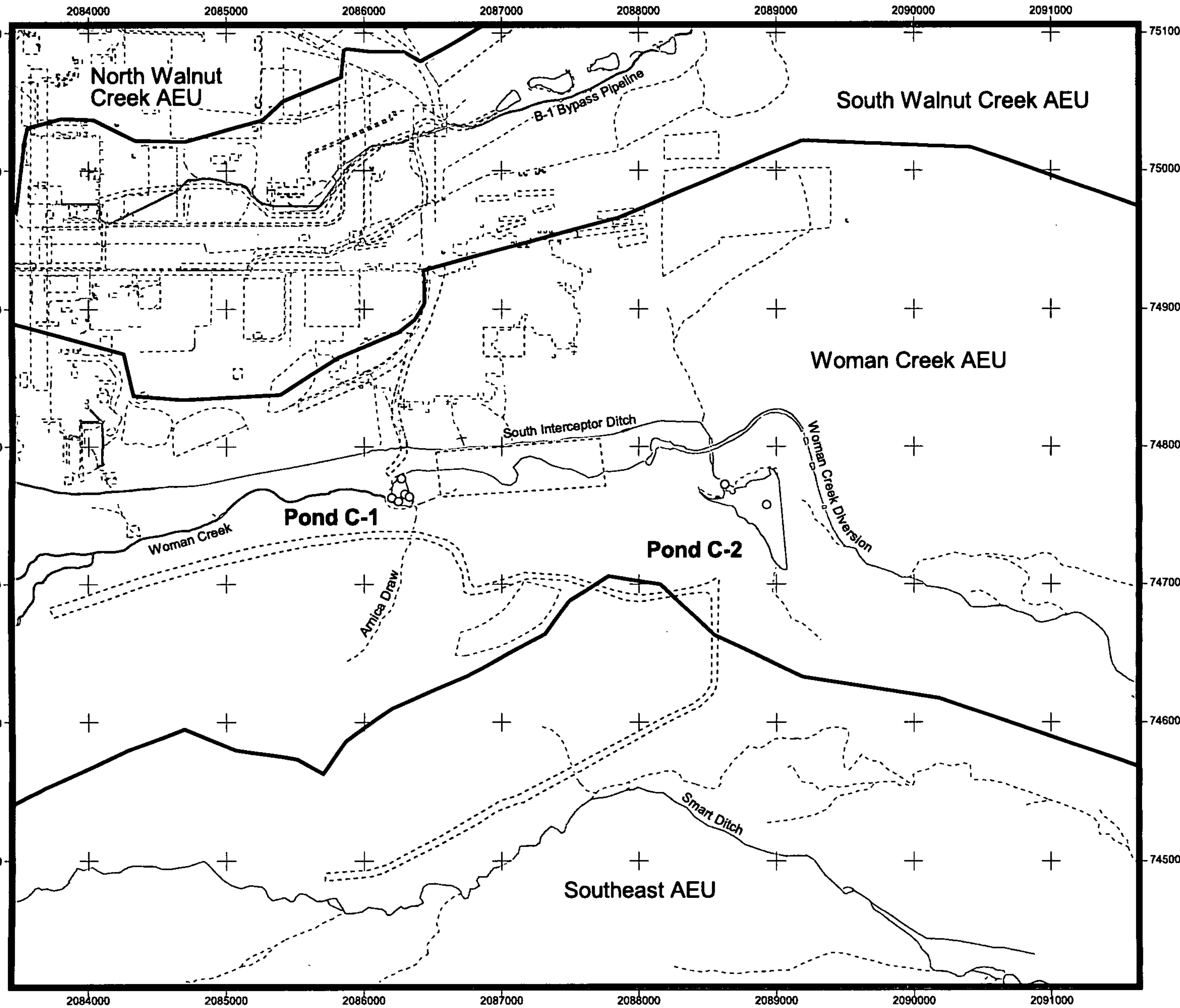

Figure A8.79
C Ponds
Surface Sediment Results
for Phenanthrene

KEY

Sampling location
○ >= ESL
○ < ESL
○ Nondetect

ESL = 204 ug/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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993

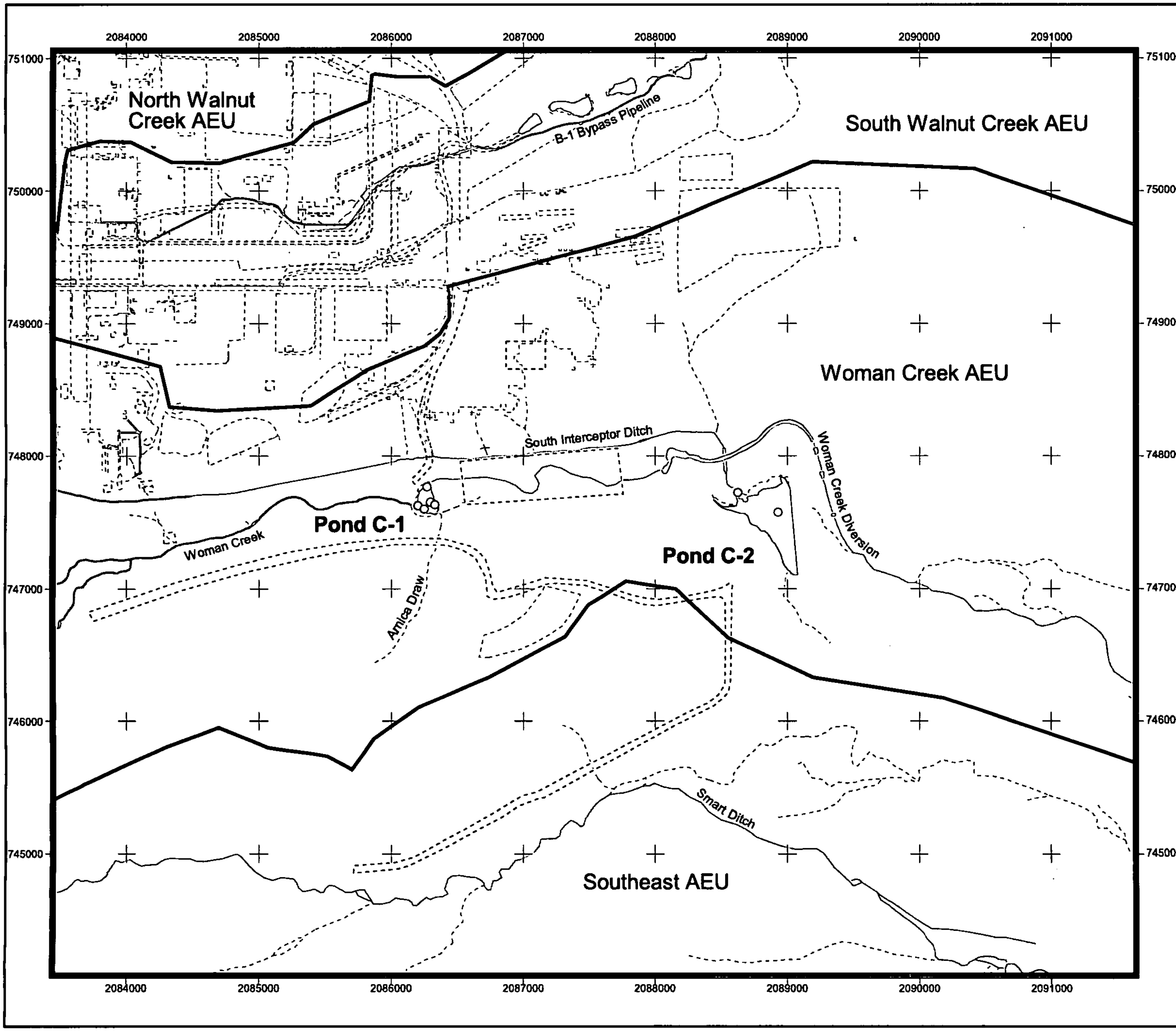

Figure A8.80
C Ponds
Surface Sediment Results for Pyrene

KEY

Sampling location
- >= ESL
- < ESL
- Nondetect

ESL = 195 ug/kg

- Aquatic Exposure Unit boundary
- Historical IHSS/PAC
- Pond
- Site boundary

Streams
- Perennial
- Intermittent
- Ephemeral

DRAFT

Data Set: 08/11/05 A1

N W E S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
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Date: 08/11/05

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File: W:\Projects\Fy2004\CRA\Volume_15\GIS\Pond_Maps\ABC_Pond-Closure.apr

994

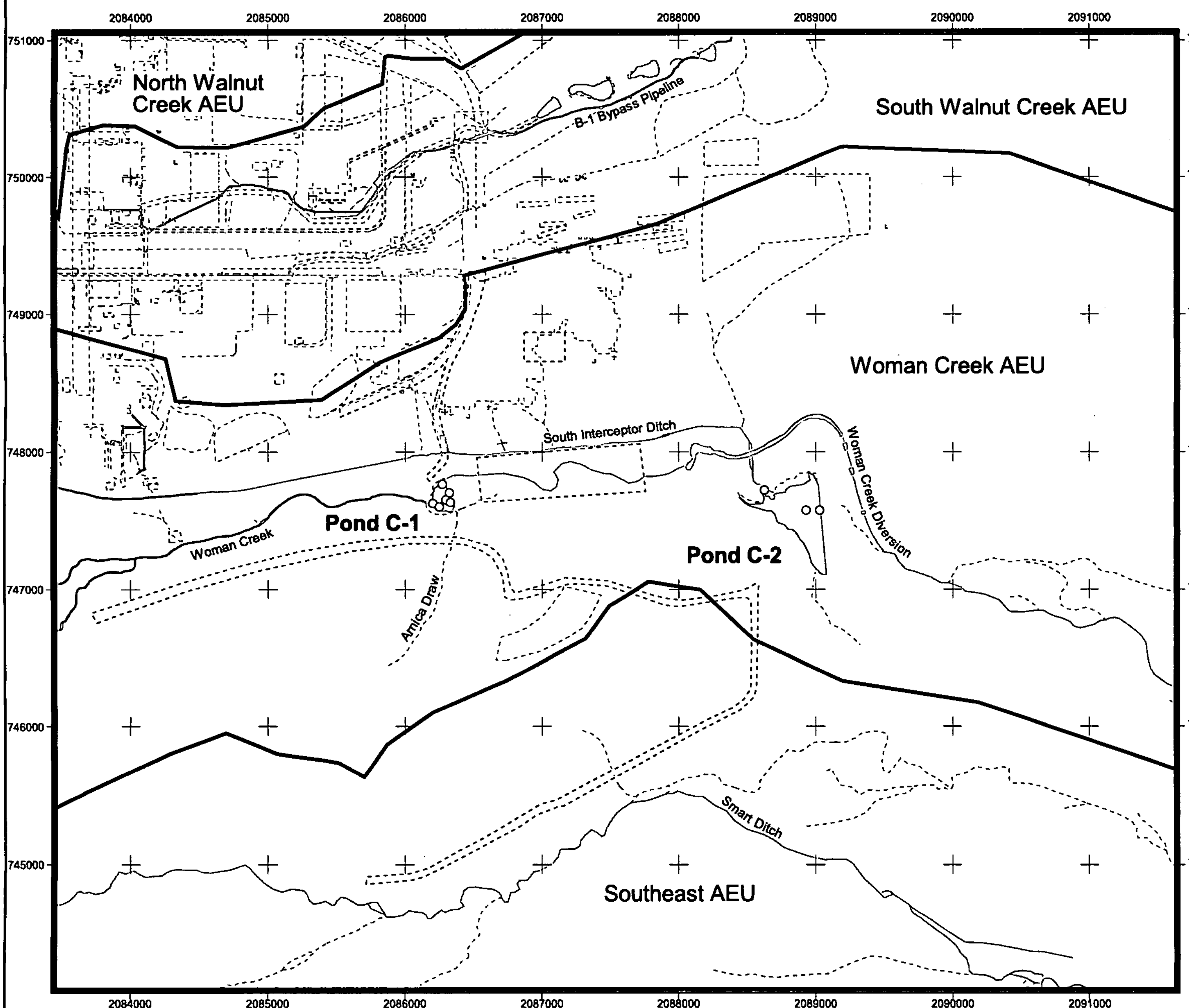

Figure A8.81
C Ponds
Surface Sediment Results
for Aroclor-1254

KEY

Sampling location
O >= ESL
O < ESL
O Nondetect

ESL = 40 ug/kg

Aquatic Exposure Unit boundary
Historical IHSS/PAC
Pond
Site boundary
Streams
Perennial
Intermittent
Ephemeral

DRAFT

Data Set: 08/11/05 A1

N
W E
S

275 0 275 550 825 1100 Feet

Scale 1:13,200
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

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Date: 08/11/05

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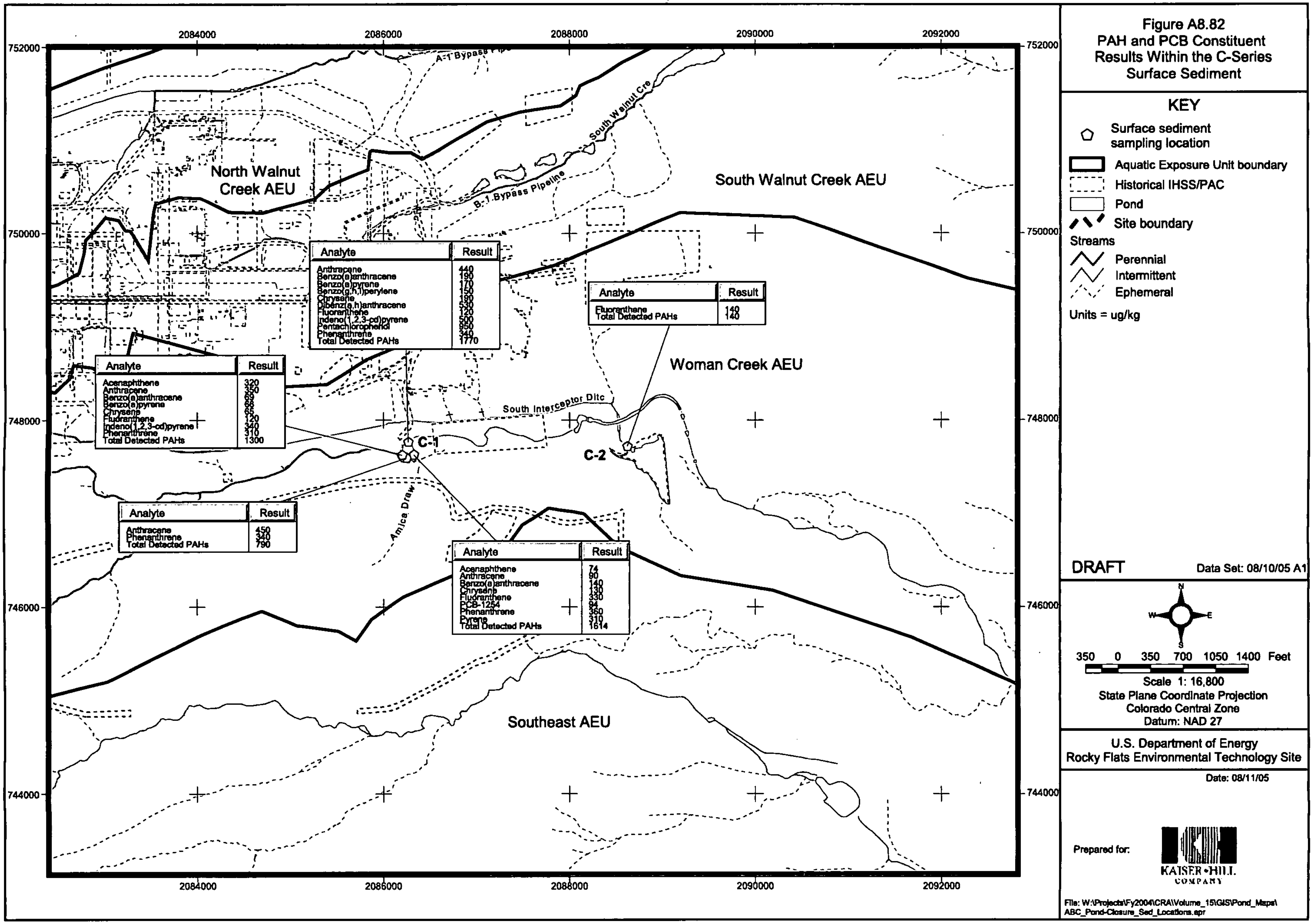
Figure A8.82
PAH and PCB Constituent Results Within the C-Series Surface Sediment



Analyte	Result
Anthracene	440
Benzo(a)anthracene	190
Benzo(a)pyrene	170
Benzo(g,h,i)perylene	150
Chrysene	190
Dibenz(a,h)anthracene	530
Fluoranthene	120
Indeno(1,2,3-cd)pyrene	500
Pentachlorophenol	950
Phenanthrene	340
Total Detected PAHs	1770

Analyte	Result
Fluoranthene	140
Total Detected PAHs	140

Analyte	Result
Acenaphthene	320
Anthracene	350
Benzo(a)anthracene	69
Benzo(a)pyrene	66
Chrysene	65
Fluoranthene	120
Indeno(1,2,3-cd)pyrene	340
Phenanthrene	310
Total Detected PAHs	1300

Analyte	Result
Anthracene	450
Phenanthrene	340
Total Detected PAHs	790

Analyte	Result
Acenaphthene	74
Anthracene	90
Benzo(a)anthracene	140
Chrysene	130
Fluoranthene	330
PCB-1254	94
Phenanthrene	360
Pyrene	310
Total Detected PAHs	1614

Scale 1: 16,800
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD 27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Date: 08/11/05

Prepared for: KAISER-HILL COMPANY

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