

**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
µg/L	micrograms per liter
AEU	Aquatic Exposure Unit
CD	compact disc
CDH	Colorado Department of Health
CLP	Contract Laboratory Program
CRA	Comprehensive Risk Assessment
CRQL	Contract Required Quantitation Limit
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DOE	Department of Energy
ECOI	Ecological Contaminant of Interest
EPA	Environmental Protection Agency
ESL	ecological screening level
EU	Exposure Unit
IAEU	Industrial Area Exposure Unit
IDL	instrument detection limit
IHSS	Individual Hazardous Substance Site
LOAEL	Lowest Observed Adverse Effect Level
MDL	method detection limit
NOAEL	no observed adverse effect level
NW AEU	North Walnut Creek Aquatic Exposure Unit
PAC	Potential Area of Concern

PCOC	Potential Contaminant of Concern
PRG	preliminary remediation goal
RL	reporting limit
SQL	sample quantitation limit
SVOC	Semi-volatile organic compound
SW AEU	South Walnut Creek Aquatic Exposure Unit
SWD	soil water database
TCDD	2,3,7,8-tetrachlorodibenzo- <i>p</i> -dioxin
WC AEU	Woman Creek Aquatic Exposure Unit
WRW	wildlife refuge worker

## **1.0 EVALUATION OF ANALYTE DETECTION LIMITS FOR THE AQUATIC EXPOSURE UNITS**

For the North Walnut Creek Aquatic Exposure Unit (AEU), South Walnut Creek AEU, and Woman Creek AEU, the detection limits for non-detected analytes as well as analytes detected in less than 5 percent of the surface water and sediment samples are compared to the ecological screening levels (ESLs). The comparisons are presented in the tables to this attachment for ecological contaminants of interest (ECOIs) in surface water and sediment. The percent of the samples with detection limits that exceed the ESLs are listed in these tables. When these detection limits exceed the respective ESLs with high frequency and magnitude, this is a source of uncertainty in the overall risk estimates, i.e., risks may be underestimated because the analytes may have been included as Ecological Contaminants of Potential Concern (ECOPCs) had the analytes been detected using lower detection limits. This condition requires further analysis using professional judgment and ecological risk potential to determine the extent of this uncertainty.

For surface water, professional judgment indicates whether the analytes have potential to be ECOPCs in the AEU based on 1) a listing of the analytes (or classes of analytes) as constituents in wastes potentially released at historical Individual Hazardous Substance Sites (IHSSs) in the AEU (DOE 2005a), 2) the historical inventory for the analyte at RFETS (CDH 1991), 3) the maximum detected concentration and detection frequency of the analyte in AEU and sitewide surface water, and 4) the maximum detected concentration and detection frequency in AEU surface soil and sediment. The comparison of the AEU and sitewide maximum detected concentrations and detection frequencies (criterion 3) is performed to assess if the AEU observations are much higher, which may indicate a potential historical source for the analyte within the AEU. With regard to criterion 4, a high maximum concentration and/or high frequency of detection in the AEU surface soil or sediment may also indicate a potential source for the analyte in surface water within the AEU.

For sediment, professional judgment indicates whether the analytes are likely to be ECOPCs in the AEU based on 1) a listing of the analytes (or classes of analytes) as constituents in wastes potentially released at historical IHSSs in the AEU (DOE 2005a), 2) the historical inventory for the analyte at RFETS (CDH 1991), 3) the maximum detected concentration and detection frequency of the analyte in AEU and sitewide sediment, and 4) the maximum detected concentration and detection frequency in AEU surface soil. The comparison of the AEU and sitewide maximum detected concentrations and detection frequencies (criterion 3) is performed to assess if the AEU observations are much higher, which may indicate a potential historical source for the analyte within the AEU. With regard to criterion 4, a high maximum concentration and/or high frequency of detection in the AEU surface soil may also indicate a potential historical source for the analyte in within the AEU.

The professional judgment analysis results in categorizing the analytes into groups (categories) with an ascending order of potential to be ECOPCs, and accordingly,

contributing greater uncertainty in the risk estimates. For surface water, the criteria for each category are as follows:

*Category 1*

- low historical inventory at RFETS (< 1 kg);
- are not listed as waste constituents for the AEU historical IHSSs;
- are not detected in the AEU surface soil or sediment; and
- are not detected in the AEU or sitewide surface water.

*Category 2*

- low historical inventory at RFETS (< 1 kg);
- are not detected in the AEU surface soil or sediment; and
- are not detected in the AEU surface water but are detected in sitewide surface water.

*Category 3*

- low historical inventory at RFETS (< 1 kg); and
- are detected in sitewide surface water, and are detected in either the AEU surface soil/sediment or the AEU surface water but the maximum detected concentration in the AEU surface water is no greater than 10 times the chronic ESL.

*Category 4*

- are detected in the AEU surface soil/sediment; and
- are detected in the AEU surface water and sitewide surface water, and the maximum detected concentration in the AEU surface water is greater than 10 times the chronic ESL.

For sediment, the criteria for each category are as follows:

*Category 1*

- low historical inventory at RFETS (< 1 kg);
- are not listed as waste constituents for the AEU historical IHSSs;
- are not detected in the AEU surface soil; and

- are not detected in the AEU or sitewide sediment.

*Category 2*

- low historical inventory at RFETS (< 1 kg);
- are not detected in the AEU surface soil; and
- are not detected in the AEU sediment but are detected in sitewide sediment.

*Category 3*

- low historical inventory at RFETS (< 1 kg); and
- are detected in sitewide sediment, and are detected in either the AEU surface soil or the AEU sediment but the maximum detected concentration in the AEU sediment is no greater than 10 times the ESL.

*Category 4*

- are detected in the AEU surface soil; and
- are detected in the AEU sediment and sitewide sediment, and the maximum detected concentration in the AEU sediment is greater than 10 times the ESL.

Based on professional judgment, the uncertainty in the risk estimates is considered low for categories 1 and 2, moderate to high for category 3, and high for category 4. Accordingly, analytes in categories 3 and 4 are considered to have potential to be ECOPCs had the analytes been detected using lower detection limits.

The assessment of the ecological risk potential compares the maximum detection limit of the analyte to the chronic ESL and to the acute effect level in surface water, and to a Lowest Observed Effect Concentration (LOEC) in sediment. For surface water, a maximum detection limit/chronic ESL ratio greater than one indicates a potential for chronic effects if the analyte was actually present at the highest detection limit. A maximum detection limit/acute effect level ratio greater than one indicates a potential for an acute ecological effect if the analyte was actually present at the highest detection limit. For sediment, a maximum detection limit/LOEC ratio greater than one for sediment indicates a potential for an adverse ecological effect if the analyte was actually present at the highest detection limit.

Laboratory reported results for “U” qualified data (nondetects) are used to perform the detection limit screen rather than the detection limit identified in the detection limit field within the Soil Water Database (SWD). The basis for the detection limit is not always provided in SWD, e.g., Instrument Detection Limit (IDL), Method Detection Limit (MDL), Reporting Limit (RL), and Sample Quantitation Limit (SQL). Therefore, to be consistent in reporting, the “reported results” are presented in the tables to this

attachment. Also, for statistical computations and risk estimations presented in the main text and tables to this volume, one-half the reported results are used as proxy values for nondetected data.

The term analyte as used in the following sections refers to analytes that are non-detected or detected in less than 5 percent of the samples. ESLs do not exist for some of these analytes, which is also a source of uncertainty for the risk assessment. This uncertainty is discussed in Section 6.4 of the main text of this volume.

## **1.1 Comparison of Reported Results to Ecological Screening Levels**

### **1.1.1 North Walnut Creek Aquatic Exposure Unit (NW AEU)**

#### ***Surface Water***

As shown in Table A1.2NWAEU.1, there are 43 analytes in surface water where some percent of the reported results exceed the chronic effects ESL. For 14 of these analytes, more than 70% (and often more than 95%) of the reported results are less than the chronic effects ESL. Consequently, for these analytes, there is minimal uncertainty in the overall risk estimates because of these higher reported results. Of the remaining 29, greater than 50% (and often 100%) of the reported results exceed the chronic effects ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the chronic effects ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for these remaining 29 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the minimum reported results (see Table A1.2NWAEU.1) are similar in magnitude, if not substantially lower, than the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (5-20 ug/L for semi-volatile organic compounds (SVOCs), 0.01-0.1 ug/L for pesticides, and 0.2-0.4 ug/L for polychlorinated biphenyls (PCBs) depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment and ecological risk potential.

As shown in Table A1.2NWAEU.2, most of the 29 analytes are in categories 3 and 4, and thus have potential to be ECOPCs in NW AEU surface water had the analytes been detected more frequently using lower detection limits. The category 4 analytes, i.e., those that have the greatest potential to be ECOPCs in NW AEU surface water based on professional judgment, include 4,4'-DDT, benzo(a)anthracene, and benzo(a)pyrene. Also,

they are listed waste constituents for NW AEU historical IHSSs. Furthermore, all of these analytes are also ECOPCs for sediment in the NW AEU.

As shown in Table A1.2NWAEU.2, comparing the maximum reported results to the chronic ESLs and acute effects values (where available), indicates all the listed analytes would present a potential for chronic ecological effects, and more than half of the analytes would present a potential for acute ecological effects if they were detected at the maximum reported results. The category 3 and 4 analytes with potential for acute effects include 4,4' DDT, benzo(a)anthracene, benzo(a)pyrene, benzyl alcohol, endrin, PCB-1260, and pentachlorophenol.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 and 4 analytes, i.e., overall risks to the NW AEU aquatic populations may be underestimated because these category 3 and 4 analytes may have been included as ECOPCs for surface water had the analytes been detected at higher frequencies using lower detection limits (lower reported results). The uncertainty is somewhat greater for 4,4' DDT, benzo(a)anthracene, benzo(a)pyrene, benzyl alcohol, endrin, PCB-1260, and pentachlorophenol because they also present a potential for acute ecological effects if they were detected at the maximum reported results.

### ***Sediment***

As shown in Table A1.2NWAEU.3, there are 37 analytes in sediment where some percent of the reported results exceed the lowest ESL. For five of these analytes, more than 75% (and often more than 95%) of the reported results are less than the lowest ESL. Consequently, for these analytes, there is minimal uncertainty in the overall risk estimates because of these higher reported results. Of the remaining 32, greater than 65% (and often 100%) of the reported results exceed the lowest ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the lowest ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for the remaining 32 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the minimum reported results (see Table A1.2NWAEU.3) are similar in magnitude to the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (330-830 ug/kg for semi-volatile organic compounds (SVOCs); 1.7-3.3 ug/kg for pesticides; and 33-67 ug/kg for PCBs depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment, and ecological risk potential.

As shown in Table A1.2NWAEU.4, most of the 32 analytes are in categories 1 and 2, and thus are not likely to be ECOPCs in the NW AEU sediment based on professional judgment. Category 3 analytes include 4-methylphenol, acenaphthene, aldrin, benzyl alcohol, beta-chordane, delta-BHC, diethylphthalate, gamma-BHC, heptachlor, heptachlor epoxide, and endosulfan I. In accordance with the criteria for classifying these analytes, gamma-BHC, heptachlor, heptachlor epoxide are technically category 2. However, because they are listed waste constituents for NW AEU IHSSs, and the sitewide maximum detected concentrations in sediment are greater than 10 times the ESLs, they have been classified as category 3 to be conservative. There are no category 4 analytes. The category 3 analytes have potential to be ECOPCs in NW AEU sediment had the analytes been detected more frequently using lower detection limits.

As shown in Table A1.2NWAEU.4, comparing the maximum reported results to the LOEC, where available, indicates that most of the analytes would present a potential for adverse ecological effects if they were detected at the maximum reported results, including the category 3 analytes 4-methylphenol, acenaphthene, heptachlor, heptachlor epoxide, PCB-1260, and pentachlorophenol.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 analytes, i.e., overall risks to the NW AEU aquatic populations may be underestimated because the category 3 analytes may have been included as ECOPCs for sediment had they been detected more frequently using lower detection limits (lower reported results). 4-methylphenol, acenaphthene, heptachlor, heptachlor epoxide, PCB-1260, and pentachlorophenol would also present a potential for adverse ecological effects if they were detected at the maximum reported results.

### **1.1.2 South Walnut Creek Aquatic Exposure Unit (SW AEU)**

#### ***Surface Water***

As shown in Table A1.2SWAEU.1, there are 40 analytes in surface water where some percent of the reported results exceed the chronic effects ESL. For 12 of these analytes, more than 50% (and often more than 95%) of the reported results are less than the chronic effects ESL. Consequently, for these analytes, there is minimal uncertainty in the overall risk estimates because of these higher reported results. Of the remaining 28, greater than 75% (and often 100%) of the reported results exceed the chronic effects ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the chronic effects ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for these remaining 28 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the minimum reported results (see Table A1.2NWAEU.1) are similar in magnitude to the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (5-20 ug/L for semi-volatile organic compounds (SVOCs), 0.01-0.1 ug/L for pesticides, and 0.2-0.4 ug/L for

polychlorinated biphenyls (PCBs) depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment and ecological risk potential.

As shown in Table A1.2SWAEU.2, most of the 28 analytes are in categories 3 and 4, and thus have potential to be ECOPCs in SW AEU surface water had the analytes been detected more frequently using lower detection limits. PCB-1254 is the only category 4 analyte, i.e., it has the greatest potential to be an ECOPC in SW AEU surface water based on professional judgment. Also, it is a listed waste constituent for SW AEU historical IHSSs. Furthermore, it is an ECOPC for sediment in the SW AEU.

As shown in Table A1.2SWAEU.2, comparing the maximum reported results to the chronic ESLs and acute effects values (where available), indicates all the listed analytes would present a potential for chronic ecological effects, and more than half of the analytes would present a potential for acute ecological effects if they were detected at the maximum reported results. The category 3 and 4 analytes with potential for acute effects include anthracene, benzo(a)anthracene, benzo(a)pyrene, dieldrin, endosulfan II, endosulfan sulfate, endrin, PCB-1254, PCB-1260, and pentachlorophenol.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 and 4 analytes, i.e., overall risks to the SW AEU aquatic populations may be underestimated because these category 3 and 4 analytes may have been included as ECOPCs for surface water had the analytes been detected at higher frequencies using lower detection limits (lower reported results). The uncertainty is somewhat greater for anthracene, benzo(a)anthracene, benzo(a)pyrene, dieldrin, endosulfan II, endosulfan sulfate, endrin, PCB-1254, PCB-1260, and pentachlorophenol because they also present a potential for acute ecological effects if they were detected at the maximum reported results.

### ***Sediment***

As shown in Table A1.2SWAEU.3, there are 40 analytes in sediment where some percent of the reported results exceed the lowest ESL. For three of these analytes, more than 95% of the reported results are less than the lowest ESL. Consequently, for these analytes, there is minimal uncertainty in the overall risk estimates because of these higher reported results. Of the remaining 37, greater than 50% (and often 100%) of the reported results exceed the lowest ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the lowest ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for the remaining 37 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the

minimum reported results (see Table A1.2SWAEU.3) are similar in magnitude to the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (330-830 ug/kg for semi-volatile organic compounds (SVOCs); 1.7-3.3 ug/kg for pesticides; and 33-67 ug/kg for PCBs depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment, and ecological risk potential.

As shown in Table A1.2SWAEU.4, most of the 37 analytes are in categories 3 and 4, and thus have potential to be ECOPCs in SW AEU sediment had the analytes been detected more frequently using lower detection limits. In accordance with the criteria for classifying these analytes, heptachlor is technically category 2. However, because it is a listed waste constituents for SW AEU IHSSs, and the sitewide maximum detected concentration in sediment is greater than 10 times the ESL, it has been classified as category 3 to be conservative. Category 4 analytes include benzyl alcohol and heptachlor epoxide, i.e., they have the greatest potential to be ECOPCs in SW AEU sediment based on professional judgment.

As shown in Table A1.2SWAEU.4, comparing the maximum reported results to the LOEC, where available, indicates that most of the analytes would not present a potential for adverse ecological effects if they were detected at the maximum reported results; however, the category 3 and 4 analytes, 2-methylnaphthalene, 4-methylphenol, heptachlor epoxide, naphthalene, and pentachlorophenol would present a potential for adverse ecological effects if they were detected at the maximum reported results.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 and 4 analytes, i.e., overall risks to the SW AEU aquatic populations may be underestimated because the category 3 and 4 analytes may have been included as ECOPCs for sediment had they been detected more frequently using lower detection limits (lower reported results). 2-methylnaphthalene, 4-methylphenol, heptachlor epoxide, naphthalene, and pentachlorophenol would also present a potential for adverse ecological effects if they were detected at the maximum reported results.

### **1.1.3 Woman Creek Aquatic Exposure Unit (WC AEU)**

#### ***Surface Water***

As shown in Table A1.2WCAEU.1, there are 41 analytes in surface water where some percent of the reported results exceed the chronic effects ESL. For 9 of these analytes, more than 50% (and often more than 95%) of the reported results are less than the chronic effects ESL. Consequently, for these analytes, there is minimal uncertainty in the

overall risk estimates because of these higher reported results. Of the remaining 32, greater than 50% (and often 100%) of the reported results exceed the chronic effects ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the chronic effects ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for these remaining 32 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the minimum reported results (see Table A1.2WCAEU.1) are similar in magnitude to the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (5-20 ug/L for semi-volatile organic compounds (SVOCs), 0.01-0.1 ug/L for pesticides, and 0.2-0.4 ug/L for polychlorinated biphenyls (PCBs) depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment and ecological risk potential.

As shown in Table A1.2WCAEU.2, most of the 32 analytes are in categories 3 and 4, and thus have potential to be ECOPCs in WC AEU surface water had the analytes been detected more frequently using lower detection limits. Cyanide, 4,4'-DDT, and pyrene are the only category 4 analytes, i.e., they have the greatest potential to be ECOPCs in WC AEU surface water based on professional judgment. Also, 4,4'-DDT, and pyrene are listed waste constituent for WC AEU historical IHSSs. Furthermore, pyrene is an ECOPC for sediment in the WC AEU.

As shown in Table A1.2WCAEU.2, comparing the maximum reported results to the chronic ESLs and acute effects values (where available), indicates all the listed analytes would present a potential for chronic ecological effects, and more than half of the analytes would present a potential for acute ecological effects if they were detected at the maximum reported results. The category 3 and 4 analytes with potential for acute effects include benzo(a)anthracene, benzo(a)pyrene, dieldrin, endosulfan sulfate, endrin ketone, PCB-1254, PCB-1260, and pentachlorophenol.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 and 4 analytes, i.e., overall risks to the WC AEU aquatic populations may be underestimated because these category 3 and 4 analytes may have been included as ECOPCs for surface water had the analytes been detected at higher frequencies using lower detection limits (lower reported results). The uncertainty is somewhat greater for benzo(a)anthracene, benzo(a)pyrene, dieldrin, endosulfan sulfate, endrin ketone, PCB-1254, PCB-1260, and pentachlorophenol because they also present a potential for acute ecological effects if they were detected at the maximum reported results.

## ***Sediment***

As shown in Table A1.2WCAEU.3, there are 40 analytes in sediment where some percent of the reported results exceed the lowest ESL. For three of these analytes, more than 75% of the reported results are less than the lowest ESL. Consequently, for these analytes, there is minimal uncertainty in the overall risk estimates because of these higher reported results. Of the remaining 37, greater than 75% (and often 100%) of the reported results exceed the lowest ESL, and in some cases, the maximum reported results are 1 to 3 orders of magnitude higher than the lowest ESL. This condition requires further analysis to determine the extent of uncertainty in the overall risk estimates.

First, for the remaining 37 analytes, it is noted that the reported results are generally consistent with industry standards for laboratory detection limits. In all cases, the minimum reported results (see Table A1.2NWAEU.3) are similar in magnitude to the Contract Required Quantitation Limits (CRQLs) for the Environmental Protection Agency's (EPA) Contract Laboratory Program (CLP) (330-830 ug/kg for semi-volatile organic compounds (SVOCs); 1.7-3.3 ug/kg for pesticides; and 33-67 ug/kg for PCBs depending on the compound). The CRQLs are minimum limits established by the CLP for identifying contaminants at Superfund sites.

Even though the lower limit of the range of reported results are generally consistent with industry standards for laboratory detection limits, the extent of uncertainty in the overall risk estimates was further assessed based on professional judgment, and ecological risk potential.

As shown in Table A1.2WCAEU.4, most of the 37 analytes are in categories 3 and 4, and thus have potential to be ECOPCs in WC AEU sediment had the analytes been detected more frequently using lower detection limits. In accordance with the criteria for classifying these analytes, atrazine and endosulfan I are technically category 2. However, because they are listed waste constituents for WC AEU IHSSs, and the sitewide maximum detected concentrations in sediment are greater than 10 times the ESLs, they have been classified as category 3 to be conservative. Category 4 analytes include carbazole, dibenz(a,h)anthracene, dibenzofuran, fluorine, and naphthalene, i.e., they have the greatest potential to be ECOPCs in WC AEU sediment based on professional judgment.

As shown in Table A1.2WCAEU.4, comparing the maximum reported results to the LOEC, where available, indicates that most of the analytes would present a potential for adverse ecological effects if they were detected at the maximum reported results, including the category 3 and 4 analytes, 2-methylnaphthalene, 4,4'-DDT, acenaphthene, atrazine, carbazole, fluorene, heptachlor epoxide, naphthalene, and pentachlorophenol would present a potential for adverse ecological effects if they were detected at the maximum reported results.

Therefore, there is some uncertainty in the overall risk estimates because of the higher reported results for the category 3 and 4 analytes, i.e., overall risks to the WC AEU

aquatic populations may be underestimated because the category 3 and 4 analytes may have been included as ECOPCs for sediment had they been detected more frequently using lower detection limits (lower reported results). 2-methylnaphthalene, 4,4'-DDT, acenaphthene, atrazine, carbazole, fluorene, heptachlor epoxide, naphthalene, and pentachlorophenol would also present a potential for adverse ecological effects if they were detected at the maximum reported results.

## **2.0 REFERENCES**

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## **TABLES**

Table A1.2.NWAEU.1

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

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Inorganic (Dissolved) (mg/L)</b>						
Beryllium	1.50E-05 - 0.0100	227	0.00240	2	0.881	Yes
Hydrogen Sulfide	-	0		0	0	No
Thallium	5.00E-06 - 0.191	224	0.0150	6	2.68	Yes
Tin	9.80E-05 - 0.206	181	0.0730	7	3.87	Yes
Total Petroleum Hydrocarbons	-	0		0	0	No
<b>Inorganic (Total) (mg/L)</b>						
Beryllium	1.00E-05 - 0.0270	915	0.00240	41	4.48	Yes
Hydrogen Sulfide	1 - 1	1		0	0	No
Thallium	2.40E-05 - 0.294	632	0.0150	11	1.74	Yes
Tin	4.80E-04 - 0.315	543	0.0730	5	0.921	Yes
Total Petroleum Hydrocarbons	1 - 1	2		0	0	No
<b>Organics (Total) (ug/L)</b>						
1,1,1,2-Tetrachloroethane	0.100 - 5	144		0	0	No
1,1,1-Trichloroethane	0.100 - 10	306	89	0	0	Yes
1,1,2,2-Tetrachloroethane	0.100 - 10	305	2,400	0	0	Yes
1,1,2-Trichlorobenzene	1 - 1	1		0	0	No
1,1,2-Trichloroethane	0.100 - 10	306	940	0	0	No
1,1-Dichloroethane	0.100 - 10	306	740	0	0	Yes
1,1-Dichloroethene	0.200 - 10	306	65	0	0	Yes
1,1-Dichloropropene	0.100 - 5	148		0	0	No
1,2,3-Trichlorobenzene	0.100 - 5	148	8	0	0	Yes
1,2,3-Trichloropropane	0.100 - 5	148		0	0	No
1,2,4,5-Tetrachlorobenzene	10 - 10	1		0	0	No
1,2,4-Trichlorobenzene	0.100 - 18	236	50	0	0	No
1,2,4-Trimethylbenzene	0.100 - 5	148	17	0	0	Yes
1,2-Dibromo-3-chloropropane	0.160 - 5	140		0	0	No
1,2-Dibromoethane	0.200 - 5	148		0	0	No
1,2-Dichlorobenzene	0.100 - 18	256	13	1	0.391	No
1,2-Dichloroethane	0.100 - 10	298	20,000	0	0	No
1,2-Dichloroethene	5 - 10	164	1,100	0	0	Yes
1,2-Dichloropropane	0.100 - 10	306	5,700	0	0	No
1,3,5-Trimethylbenzene	0.100 - 5	148	45	0	0	No
1,3,5-Trinitrobenzene	10 - 10	1		0	0	No
1,3-Dichlorobenzene	0.100 - 18	256	28	0	0	Yes
1,3-Dichloropropane	0.100 - 5	148		0	0	No
1,3-Dinitrobenzene	10 - 10	1		0	0	No
1,4-Dichlorobenzene	0.100 - 18	256	16	1	0.391	Yes
1,4-Naphthoquinone	10 - 10	1		0	0	No
1,4-Phenylenediamine	10 - 10	1		0	0	No
1-Naphthylamine	10 - 10	1		0	0	No
2,2-Dichloropropane	0.100 - 5	146		0	0	No
2,3,4,6-Tetrachlorophenol	10 - 10	1		0	0	No
2,4,5-T	0.100 - 10	27		0	0	No
2,4,5-TP (Silvex)	0.100 - 10	59		0	0	No
2,4,5-Trichlorophenol	10 - 90	187		0	0	No
2,4,6-Trichlorophenol	1 - 18	187	5	126	67.4	No
2,4-D	0.450 - 13	59		0	0	No
2,4-DB	0.910 - 10	24		0	0	No
2,4-Dichlorophenol	5 - 18	187	365	0	0	No
2,4-Dimethylphenol	5 - 18	187	212	0	0	No
2,4-Dinitrophenol	23 - 90	181		0	0	No
2,4-Dinitrotoluene	5 - 18	189		0	0	No
2,6-Dichlorophenol	10 - 10	1		0	0	No
2,6-Dinitrotoluene	5 - 18	188		0	0	No
2378-TCDD	1.00E-04 - 0.00440	24		0	0	No
2-Acetylaminofluorene	10 - 10	1		0	0	No
2-Butanone	2 - 16	191	2,200	0	0	Yes

Table A1.2.NWAEU.1

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

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
2-Chloroethyl vinyl ether	0 - 10	30		0	0	No
2-Chloronaphthalene	5 - 18	189	630	0	0	No
2-Chlorophenol	5 - 18	187		0	0	No
2-Chlorotoluene	0.200 - 5	148		0	0	No
2-Hexanone	1 - 10	203	99	0	0	Yes
2-Methylnaphthalene	5 - 18	189		0	0	No
2-Methylphenol	5 - 18	186	82	0	0	No
2-Naphthylamine	10 - 10	1		0	0	No
2-Nitroaniline	23 - 90	189		0	0	No
2-Nitrophenol	5 - 18	187		0	0	No
2-Picoline	10 - 10	1		0	0	No
3 & 4-methyl phenol	10.4 - 11.2	4		0	0	No
3,3'-Dichlorobenzidine	9 - 36	187		0	0	No
3,3'-Dimethylbenzidine	10 - 10	1		0	0	No
3-Methylcholanthrene	10 - 10	1		0	0	No
3-Nitroaniline	23 - 90	186		0	0	No
4,4'-DDD	0.0200 - 1	116	0.0600	110	94.8	No
4,4'-DDE	0.0200 - 1	116	105	0	0	Yes
4,4'-DDT	0.0200 - 1	116	0.00100	116	100	Yes
4,6-Dinitro-2-methylphenol	23 - 90	186		0	0	No
4-Aminobiphenyl	10 - 10	1		0	0	No
4-Bromophenyl-phenylether	5 - 18	189		0	0	No
4-Chloro-3-methylphenol	5 - 22.5	187		0	0	No
4-Chloroaniline	5 - 22.5	187		0	0	No
4-Chlorophenyl-phenyl ether	5 - 18	189		0	0	No
4-Chlorotoluene	0.200 - 5	148		0	0	No
4-Isopropyltoluene	0.200 - 5	148		0	0	No
4-Methyl-2-pentanone	1 - 10	203	170	0	0	Yes
4-Methylphenol	5 - 18	182	25	0	0	No
4-Nitroaniline	1.10 - 59	186		0	0	Yes
4-Nitrophenol	23 - 90	187		0	0	No
5-Nitro-o-toluidine	10 - 10	1		0	0	No
7,12-Dimethylbenz(a)-anthracene	10 - 10	1		0	0	No
a,a-Dimethylphenethylamine	10 - 10	1		0	0	No
Acenaphthene	0.500 - 18	189	520	0	0	Yes
Acenaphthylene	1 - 18	189		0	0	No
Acetophenone	10 - 10	1		0	0	No
Acrylonitrile	10 - 10	16		0	0	No
Aldrin	0.0100 - 0.520	116	0.150	4	3.45	No
alpha-BHC	0.0100 - 0.520	116	2.20	0	0	Yes
alpha-Chlordane	0 - 5.20	111		0	0	Yes
Ametryne	0.180 - 0.760	76		0	0	No
Anthracene	0.0288 - 18	189	0.730	172	91.0	Yes
Aramite	21 - 21	1		0	0	No
Atraton	0.520 - 1	60		0	0	Yes
Azinphos-methyl	4 - 4	1		0	0	No
Benzene	0.100 - 10	306	530	0	0	Yes
Benzidine	10 - 10	6		0	0	No
Benzo(a)anthracene	0.130 - 18	189	0.0270	189	100	Yes
Benzo(a)pyrene	0.134 - 18	189	0.0140	189	100	Yes
Benzo(b)fluoranthene	0.144 - 18	189		0	0	Yes
Benzo(g,h,i)perylene	0.588 - 18	189		0	0	Yes
Benzo(k)fluoranthene	0.0768 - 18	189		0	0	Yes
Benzoic Acid	3 - 90	155	42	98	63.2	Yes
Benzyl Alcohol	5 - 860	164	8.60	113	68.9	Yes
beta-BHC	0.0100 - 0.520	116	2.20	0	0	Yes
beta-Chlordane	0.0490 - 5.20	62		0	0	No
bis(2-Chloroethoxy) methane	5 - 18	188		0	0	No

Table A1.2.NWAEU.1

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

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
bis(2-Chloroethyl) ether	5 - 18	188		0	0	No
bis(2-Chloroisopropyl) ether	5 - 18	184	29	0	0	No
Bladex	0.300 - 0.300	16		0	0	No
Bromobenzene	0.200 - 5	148		0	0	No
Bromochloromethane	0.200 - 5	144		0	0	Yes
Bromodichloromethane	0.200 - 10	294	1,100	0	0	Yes
Bromoform	0.200 - 10	306	320	0	0	No
Bromomethane	0.200 - 10	305	35	0	0	No
Carbazole	3 - 12	25	4	24	96	Yes
Carbon Disulfide	0.100 - 10	207	0.920	205	99.0	Yes
Chlordane (NOS)	0.500 - 0.500	5		0	0	No
Chlorobenzene	0.100 - 10	306	47	0	0	Yes
Chlorobenzilate	10 - 10	1		0	0	No
Chloroethane	0.200 - 10	306		0	0	No
Chloromethane	0.200 - 10	304		0	0	No
Chlorpyrifos	1 - 1	1		0	0	No
Chrysene	0.499 - 18	189		0	0	Yes
cis-1,3-Dichloropropene	0.100 - 10	304	244	0	0	No
Coumaphos	4 - 4	1		0	0	No
Dalapon	0.990 - 10.5	24		0	0	Yes
delta-BHC	0.0100 - 0.520	116	2.20	0	0	No
Demeton	2 - 2	1		0	0	No
Diallate (cis or trans)	10 - 10	1		0	0	No
Diazinon	1 - 1	1		0	0	No
Dibenz(a,h)anthracene	0.300 - 18	189		0	0	Yes
Dibenzofuran	5 - 18	189	4	189	100	No
Dibromochloromethane	0.200 - 10	306		0	0	Yes
Dibromomethane	0.200 - 5	148		0	0	No
Dichlorodifluoromethane	0.200 - 10	168		0	0	Yes
Dichlorovos	2 - 2	1		0	0	No
Dieldrin	0.0200 - 1	116	0.0560	110	94.8	No
Dimethylaminoazobenzene	10 - 10	1		0	0	No
Dimethylphthalate	0.790 - 18	189		0	0	Yes
Di-n-octylphthalate	5 - 18	189		0	0	Yes
Dinoseb	0.0700 - 10	24	0.480	14	58.3	Yes
Diphenylamine	10 - 11.2	7		0	0	No
Disulfoton	0.520 - 1	2		0	0	No
Endosulfan I	0.0100 - 0.520	116	0.0560	15	12.9	Yes
Endosulfan II	0.0200 - 1	116	0.0560	110	94.8	No
Endosulfan sulfate	0.0200 - 1	116	0.0560	110	94.8	No
Endrin	0.0200 - 1	116	0.0360	111	95.7	Yes
Endrin aldehyde	0.0200 - 1	45	0.0360	40	88.9	No
Endrin ketone	0.0500 - 1	106	0.0360	106	100	No
Ethoprop	1 - 1	1		0	0	No
Ethyl methanesulfonate	10 - 10	1		0	0	No
Ethylbenzene	0.200 - 10	306	3,200	0	0	Yes
Famphur	1.30 - 1.30	1		0	0	No
Fensulfothion	2 - 2	1		0	0	No
Fenthion	1 - 1	1		0	0	No
Fluoranthene	0.595 - 18	189	398	0	0	Yes
Fluorene	0.294 - 18	189	12	1	0.529	Yes
gamma-BHC (Lindane)	0.0100 - 0.520	116	0.0800	13	11.2	No
gamma-Chlordane	0 - 2.60	49		0	0	Yes
Heptachlor	0.0100 - 0.520	116	0.00380	116	100	No
Heptachlor epoxide	0.0100 - 0.520	116	0.00380	116	100	Yes
Hexachlorobenzene	1 - 18	189		0	0	No
Hexachlorobutadiene	0.100 - 18	236	9.30	72	30.5	Yes
Hexachlorocyclopentadiene	5 - 18	186		0	0	No

Table A1.2.NWAEU.1

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Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Hexachloroethane	1 - 18	189	540	0	0	No
Hexachlorophene	100 - 100	1		0	0	No
Hexachloropropene	10 - 10	1		0	0	No
Indeno(1,2,3-cd)pyrene	0.294 - 18	189		0	0	Yes
Isodrin	0.100 - 0.100	1		0	0	No
Isophorone	0.300 - 18	189	1,300	0	0	Yes
Isopropylbenzene	0.200 - 5	148		0	0	No
Isosafrole	10 - 10	1		0	0	No
Kepon	0.500 - 0.500	1		0	0	No
m,p-Xylene	0.200 - 2	54	35	0	0	No
Malathion	1 - 1	1		0	0	No
MCPA	10 - 10,000	24		0	0	No
MCPP	10 - 10,000	24		0	0	No
Merphos	5 - 5	1		0	0	No
Methapyrilene	10 - 10	1		0	0	No
Methoxychlor	0.0500 - 5.20	111		0	0	No
Methyl methanesulfonate	10 - 10	1		0	0	No
Methyl parathion	0.520 - 1	2		0	0	No
Mevinphos	2 - 2	1		0	0	No
Naled	5 - 5	1		0	0	No
Naphthalene	0.110 - 18	236	620	0	0	Yes
n-Butylbenzene	0.200 - 5	148		0	0	Yes
Nitrobenzene	5 - 18	189		0	0	No
Nitroquinoline-1-oxide	21 - 21	1		0	0	No
N-Nitrosodiethylamine	5 - 10	7		0	0	No
N-Nitrosodimethylamine	5 - 10	7		0	0	No
N-Nitrosodi-n-butylamine	5 - 10	7		0	0	No
N-Nitroso-di-n-propylamine	5 - 18	189		0	0	No
N-nitrosodiphenylamine	5 - 18	183		0	0	No
N-Nitrosomethylethylamine	10 - 10	1		0	0	No
N-Nitrosomorpholine	10 - 10	1		0	0	No
N-Nitrosopiperidine	52 - 52	1		0	0	No
N-Nitrosopyrrolidine	10 - 10	7		0	0	No
n-Propylbenzene	0.200 - 5	148		0	0	No
O,O,O-Triethyl phosphorothioate	0.520 - 0.520	1		0	0	No
o-Toluidine	10 - 10	1		0	0	No
o-Xylene	0.200 - 1	109	35	0	0	No
Parathion	0.520 - 0.520	1		0	0	No
PCB-1016	0.200 - 2.60	112	0.0140	112	100	No
PCB-1221	0.400 - 5	112	0.0140	112	100	No
PCB-1232	0.200 - 2.60	112	0.0140	112	100	No
PCB-1242	0.200 - 2.60	112	0.0140	112	100	No
PCB-1248	0.200 - 2.60	112	0.0140	112	100	No
PCB-1260	0.200 - 5.20	112	0.0140	112	100	No
Pentachlorobenzene	10 - 10	1		0	0	No
Pentachlorophenol	23 - 90	187	6.73	187	100	No
Phenacetin	10 - 10	1		0	0	No
Phenanthrene	0.672 - 18	189	2.40	169	89.4	Yes
Phenol	5 - 2,700	187	2,560	1	0.535	No
Phorate	0.520 - 1	2		0	0	No
Prometon	0.0900 - 0.380	76		0	0	No
Prometryn	0.180 - 0.760	76		0	0	No
Pronamide	10 - 10	1		0	0	No
Propazine	0.0900 - 0.380	76		0	0	Yes
Prothiophos	5 - 5	1		0	0	No
Pyrene	0.200 - 18	186	0.0250	186	100	Yes
Ronnel	1 - 1	1		0	0	No
Safrole	10 - 10	1		0	0	No

**Table A1.2.NWAEU.1**

**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Surface Water in the NW AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
sec-Butylbenzene	0.200 - 5	148		0	0	No
Simazine	0.0800 - 1	93	10	0	0	Yes
Simetryn	0.210 - 730	76		0	0	No
Styrene	0.100 - 10	286	160	0	0	No
Sulprofos	1 - 1	1		0	0	No
Terbutryn	0.500 - 0.630	52		0	0	No
Terbutylazine	0.0900 - 0.380	76		0	0	No
tert-Butylbenzene	0.200 - 5	148		0	0	No
Tetrachloroethane	1 - 1	1		0	0	No
Tetrachloroethene	0.0400 - 10	305	840	0	0	Yes
Tetrachlorvinphos	2 - 2	1		0	0	No
Tetraethyl dithiopyrophosphate	0.520 - 0.520	1		0	0	No
Thionazine	0.520 - 0.520	1		0	0	No
Toluene	0.100 - 10	306	1,750	0	0	Yes
Toxaphene	0.990 - 10	116		0	0	No
trans-1,2-Dichloroethene	0.100 - 5	168	1,500	0	0	No
trans-1,3-Dichloropropene	0.100 - 10	304	244	0	0	No
Tributyl phosphate	102 - 112	6		0	0	No
Trichloroethene	0.0400 - 29	306	21,900	0	0	Yes
Trichlorofluoromethane	0.200 - 7	168		0	0	Yes
Trichloronate	1 - 1	1		0	0	No
Vinyl acetate	10 - 10	133		0	0	No
Vinyl Chloride	0.200 - 10	306	930	0	0	Yes
Xylene	0.500 - 10	252	35	0	0	Yes

Table A1.2.NW AEU.2

Summary of Professional Judgment and Ecological Risk Potential for Analytes in Surface Water for the NW AEU

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE												ECOLOGICAL RISK POTENTIAL							
	Listed as Waste Constituent for NW AEU Historical IHSSs ? <sup>1</sup>	Historical RFETS Inventory <sup>2</sup> (1974/1988) (kg)	Max Conc. In NW AEU Surface Soil (µg/kg)	Percent Detects in NW AEU Surface Soil (µg/kg)	Max Conc. In NW AEU Sediment (µg/kg)	Percent Detects in NW AEU Sediment (%)	Max. Conc. In NW AEU Surface Water (µg/L)	Percent Detects in NW AEU Surface Water (%)	Maximum Conc. in Surface Water Sitewide (µg/L)	Detection Frequency in Sitewide Surface Water (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty Category <sup>3</sup>	ESL (µg/L) <sup>4</sup>	Acute Effects Value <sup>5</sup>	Maximum Reported Result for Non-Detects in NW AEU (µg/kg)	Maximum Reported Result for Non-Detects/ ESL	Potential for Chronic Effects if Detected at Reported Results Levels?	Maximum Reported Result for Non-Detects/ Acute Effects Value	Potential for Acute Effects if Detected at Reported Results Levels?	
2,4,6-trichlorophenol	No	0/.01	NA	0	ND	0.00	NA	0	NA	0	No	1	5	79	18	3.60	Yes	0.23	No	
4,4'-DDD	Yes(1)	0/.001	NA	0	ND	0.00	NA	0	0.1	0.6	No	2	0.06	0.6	1	16.67	Yes	1.67	Yes	
4,4'-DDT	Yes(1)	0/.001	NA	0	4.9	5.06	0.28	0.9	0.6	3.5	Yes	4	0.001	0.55	1	1000.00	Yes	1.82	Yes	
anthracene	Yes(2)	.5/.02	7300	41	970	38.46	2	0.5	2	0.2	Yes	4	0.73	13	18	24.66	Yes	1.38	Yes	
benzo(a)anthracene	Yes(2)	0/0	8900	65.8	1400	58.65	8	0.5	8	0.2	Yes	4	0.027	0.49	18	666.67	Yes	36.73	Yes	
benzo(a)pyrene	Yes(2)	0/.002	3200	57.8	1300	49.04	9	0.5	9	0.2	Yes	4	0.014	0.24	18	1285.71	Yes	75.00	Yes	
benzoic acid	No	0/0	510	5.7	2700	12.68	17.5	2.6	42	1.5	No	2.6	3	42	740	90	2.14	Yes	0.12	No
benzyl alcohol	No	.02/.02	2800	2	ND	0.00	860	2.4	860	1.8	Yes	4	8.6	150	860	100.00	Yes	5.73	Yes	
carbazole	No	0/.01	700	57.1	300	43.33	3	4	3	1.9	Yes	4	4	72	12	3.00	Yes	0.17	No	
carbon disulfide	No	3.3/5.9	NA	0	ND	0.00	5	1	8	0.3	No	3	0.92	17	10	10.87	Yes	0.59	No	
dibenzofuran	Yes(2)	.02/.01	2100	21.4	300	5.77	NA	0	2	1.6	No	3	4	72	18	4.50	Yes	0.25	No	
dieldrin	Yes(1)	0/.003	NA	0	ND	0.00	NA	0	NA	0.00	No	2	0.056	0.24	1	17.86	Yes	4.17	Yes	
dinoseb	Yes(1)	0/0	NA	0	ND	0.00	0.34	4.2	0.3	2.2	No	3	0.48	9.5	10	20.83	Yes	1.05	Yes	
endosulfan II	Yes(1)	0/.001	NA	0	ND	0.00	NA	0	NA	0	No	2	0.056	0.22	1	17.86	Yes	4.55	Yes	
endosulfan sulfate	Yes(1)	0/.001	NA	0	ND	0.00	NA	0	NA	0	No	2	0.056	0.22	1	17.86	Yes	4.55	Yes	
endrin	Yes(1)	0/.004	NA	0	ND	0.00	0.02	0.9	0.02	0.3	No	3	0.036	0.086	1	27.78	Yes	11.63	Yes	
endrin aldehyde	Yes(1)	0/.002	NA	0	ND	0.00	NA	0	NA	0.00	No	2	0.036	0.086	1	27.78	Yes	11.63	Yes	
endrin ketone	Yes(1)	0/0	NA	0	ND	0.00	NA	0	NA	0	No	2	0.036	0.086	1	27.78	Yes	11.63	Yes	
heptachlor	Yes(1)	0/.003	NA	0	ND	0.00	NA	0	NA	0	No	2	0.0038	0.52	0.52	136.84	Yes	1.00	No	
heptachlor epoxide	Yes(1)	0/.001	NA	0	ND	0.00	0.05	0.9	0.05	0.3	No	3	0.0038	0.52	0.52	136.84	Yes	1.00	No	
PCB-1016	Yes(3)	0/.006	19	0.9	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes	
PCB-1221	Yes(3)	0/.02	NA	0	ND	0.00	NA	0	NA	0.00	No	2	0.014	2	5	357.14	Yes	2.50	Yes	
PCB-1232	Yes(3)	0/.007	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.6	185.71	Yes	1.30	Yes	
PCB-1242	Yes(3)	0/.02	23	0.4	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes	
PCB-1248	Yes(3)	0/.007	42	1.6	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes	
PCB-1260	Yes(3)	0/.02	7800	21.1	180	1.65	NA	0	NA	0	Yes	4	0.014	2	5.2	371.43	Yes	2.60	Yes	
pentachlorophenol	No	.02/.02	39000	1.9	39	0.96	NA	0	5	0.4	Yes	3	6.7	17.4	90	13.43	Yes	5.17	Yes	
phenanthrene	Yes(2)	.02/.02	22000	70.1	3300	67.31	11	1.1	11	1.9	Yes	4	2.4	43	18	7.50	Yes	0.42	No	
pyrene	Yes(2)	.02/.02	14000	68.5	3900	64.42	12	2.2	12	1.3	Yes	4	0.025	NVA	18	720.00	Yes	No AEV	I	

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> ESLs based on chronic effects value.

<sup>5</sup> Chronic and acute effects values are listed in Appendix B, Table B-5, "Surface Water ESLs for Aquatic Receptors", Ref. DOE 2005a.

(1) The Pesticide Shed (PAC 300-702) is in the NW AEU.

(2) There are several historical IHSSs in the NW AEU where wastes were burned or there was a release of oil.

(3) There are several historical IHSSs in the NW AEU where transformers had leaked.

CDH – Colorado Department of Health  
DDE – dichlorodiphenyldichloroethylene  
DDT – dichlorodiphenyltrichloroethane  
DOE – Department of Energy  
ESL – Ecological Screening Level  
IHSS – Individual Hazardous Substance Site  
NW AEU – North Walnut Creek Aquatic Exposure Unit  
RFETS – Rocky Flats Environmental Technology Site

I - Inconclusive  
NA – Not applicable  
ND - Not detected  
NS - Not sampled  
No ESL – No chronic ESL available

No AEV – No acute effects level available  
NVA - No value

Table A1.2.NWAEU.3

## Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Sediment in the NW AEU

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Organic (ug/kg)</b>						
1,1,1,2-Tetrachloroethane	1.32 - 23	12		0	0	No
1,1,1-Trichloroethane	1.18 - 1,600	79	159	1	1.27	No
1,1,2,2-Tetrachloroethane	1.22 - 1,600	78	1,900	0	0	Yes
1,1,2-Trichloro-1,2,2-trifluoroethane	2 - 23	12		0	0	No
1,1,2-Trichloroethane	0.995 - 1,600	79		0	0	No
1,1-Dichloroethane	1.06 - 1,600	79		0	0	No
1,1-Dichloroethene	1.59 - 1,600	79		0	0	No
1,1-Dichloropropene	1.35 - 23	12		0	0	No
1,2,3-Trichlorobenzene	1.53 - 23	12	58.6	0	0	No
1,2,3-Trichloropropane	1.11 - 23	12		0	0	No
1,2,4-Trichlorobenzene	1.54 - 3,500	106	429	77	72.6	No
1,2,4-Trimethylbenzene	1.09 - 23	12	122	0	0	No
1,2-Dibromo-3-chloropropane	2.85 - 23	12		0	0	No
1,2-Dibromoethane	1.19 - 23	12		0	0	No
1,2-Dichlorobenzene	1.37 - 2,700	90		0	0	No
1,2-Dichloroethane	1.20 - 1,600	74		0	0	Yes
1,2-Dichloroethene	5 - 1,600	66		0	0	Yes
1,2-Dichloropropane	0.974 - 1,600	79		0	0	No
1,3,5-Trimethylbenzene	0.755 - 23	12	316	0	0	No
1,3-Dichlorobenzene	1.51 - 3,500	106	122	94	88.7	No
1,3-Dichloropropane	0.845 - 23	12		0	0	No
1,4-Dichlorobenzene	1.19 - 2,700	90		0	0	No
2,2-Dichloropropane	1.12 - 23	12		0	0	No
2,4,5-T	60 - 60	1		0	0	No
2,4,5-TP (Silvex)	60 - 60	1		0	0	No
2,4,5-Trichlorophenol	700 - 6,800	104		0	0	No
2,4,6-Trichlorophenol	350 - 3,500	104	59.3	104	100	No
2,4-D	180 - 180	1		0	0	No
2,4-DB	1,400 - 1,400	1		0	0	No
2,4-Dichlorophenol	350 - 3,500	104		0	0	No
2,4-Dimethylphenol	350 - 3,500	104		0	0	No
2,4-Dinitrophenol	860 - 18,000	99		0	0	No
2,4-Dinitrotoluene	350 - 3,500	104		0	0	No
2,6-Dinitrotoluene	350 - 3,500	104		0	0	No
2-Chloronaphthalene	350 - 3,500	104		0	0	No
2-Chlorophenol	350 - 3,500	104		0	0	No
2-Chlorotoluene	1.69 - 23	12		0	0	No
2-Hexanone	2.68 - 3,100	79		0	0	No
2-Methylphenol	350 - 3,500	103	6,970	0	0	Yes
2-Nitroaniline	860 - 18,000	104		0	0	No
2-Nitrophenol	350 - 3,500	104		0	0	No
3,3'-Dichlorobenzidine	350 - 6,900	103		0	0	No
3-Nitroaniline	860 - 18,000	98		0	0	No
4,4'-DDD	3.50 - 180	79	4.88	64	81.0	No
4,4'-DDE	3.50 - 180	79	3.16	79	100	No
4,6-Dinitro-2-methylphenol	860 - 18,000	100		0	0	No
4-Bromophenyl-phenylether	350 - 3,500	104	166	104	100	No
4-Chloro-3-methylphenol	350 - 6,900	104		0	0	No
4-Chloroaniline	350 - 6,900	102		0	0	No
4-Chlorophenyl-phenyl ether	350 - 3,500	104		0	0	No
4-Chlorotoluene	0.991 - 23	12		0	0	No
4-Methyl-2-pentanone	3.17 - 3,100	78		0	0	Yes
4-Methylphenol	350 - 3,500	104	12.3	104	100	No
4-Nitroaniline	860 - 18,000	104		0	0	No
4-Nitrophenol	860 - 18,000	104		0	0	No
Acenaphthylene	350 - 2,700	104	5.87	104	100	No

Table A1.2.NWAEU.3

## Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than 5 Percent in Sediment in the NW AEU

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Aldrin	1.80 - 89	77	8.25	52	67.5	Yes
alpha-BHC	1.80 - 89	79	43.9	2	2.53	No
alpha-Chlordane	1.80 - 890	79	3.24	59	74.7	No
Ametryne	50 - 50	1		0	0	No
Atraton	50 - 50	1		0	0	No
Benzene	0.918 - 1,600	78	260	1	1.28	Yes
Benzyl Alcohol	370 - 6,900	74	1.35	74	100	No
beta-BHC	1.80 - 89	79	93.6	0	0	No
beta-Chlordane	1.80 - 240	58	3.24	38	65.5	No
bis(2-Chloroethoxy) methane	350 - 3,500	104		0	0	No
bis(2-Chloroethyl) ether	350 - 3,500	104		0	0	No
bis(2-Chloroisopropyl) ether	350 - 3,500	103		0	0	No
Bromobenzene	1.39 - 23	12		0	0	No
Bromochloromethane	1.33 - 23	12		0	0	No
Bromodichloromethane	0.732 - 1,600	79		0	0	No
Bromoform	1.19 - 1,600	79		0	0	No
Bromomethane	1.71 - 3,100	79	3.43	72	91.1	No
Butylbenzylphthalate	350 - 3,500	101	11,400	0	0	Yes
Carbon Disulfide	1.55 - 1,600	79		0	0	No
Carbon Tetrachloride	1.26 - 1,600	79	7,890	0	0	No
Chlorobenzene	1.06 - 1,600	79		0	0	No
Chloroethane	2.83 - 3,100	79		0	0	No
Chloroform	0.957 - 1,600	79		0	0	No
Chloromethane	1.49 - 3,100	79		0	0	No
cis-1,2-Dichloroethene	1.34 - 12	12		0	0	No
cis-1,3-Dichloropropene	0.932 - 1,600	79		0	0	No
Dalapon	2,300 - 2,300	1		0	0	No
delta-BHC	1.80 - 89	78	2.37	65	83.3	Yes
Dibromochloromethane	1.07 - 1,600	79		0	0	No
Dibromomethane	1.18 - 23	12		0	0	No
Dicamba	96 - 96	1		0	0	No
Dichlorodifluoromethane	2.89 - 23	12		0	0	No
Dichloroprop	650 - 650	1		0	0	No
Dieldrin	3.50 - 180	79	5.94	59	74.7	No
Diethylphthalate	350 - 3,500	103	108	103	100	Yes
Dimethylphthalate	350 - 3,500	104		0	0	No
Di-n-octylphthalate	350 - 3,500	101		0	0	Yes
Dinoseb	84 - 84	1		0	0	No
Endosulfan I	1.80 - 89	78	0.690	78	100	Yes
Endosulfan II	3.50 - 180	79	0.690	79	100	No
Endosulfan sulfate	3.50 - 180	79	0.690	79	100	No
Endrin	3.50 - 180	79		0	0	No
Endrin aldehyde	3.50 - 27	30		0	0	No
Endrin ketone	3.50 - 180	70		0	0	No
Ethylbenzene	0.923 - 1,600	79	16,570	0	0	No
gamma-BHC (Lindane)	1.80 - 89	79	2.37	66	83.5	No
gamma-Chlordane	3.70 - 890	21	3.24	21	100	No
Gasoline	600 - 1,500	2		0	0	No
Heptachlor	1.80 - 89	79	0.132	79	100	No
Heptachlor epoxide	1.80 - 89	79	2.47	63	79.7	No
Hexachlorobenzene	350 - 3,500	104		0	0	No
Hexachlorobutadiene	1.62 - 3,500	106	23	94	88.7	No
Hexachlorocyclopentadiene	350 - 3,500	101		0	0	No
Hexachloroethane	350 - 3,500	104		0	0	No
Isophorone	350 - 3,500	104		0	0	No
Isopropylbenzene	1.38 - 23	12		0	0	No
MCPA	94,000 - 94,000	1		0	0	No

Table A1.2.NWAEU.3

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

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
MCPP	140,000 - 140,000	1		0	0	No
Methoxychlor	3.80 - 890	79	24	62	78.5	No
n-Butylbenzene	1.10 - 23	12		0	0	No
Nitrobenzene	350 - 3,500	104		0	0	No
N-Nitroso-di-n-propylamine	350 - 3,500	104		0	0	No
N-nitrosodiphenylamine	350 - 3,500	104		0	0	No
n-Propylbenzene	1.23 - 23	12		0	0	No
PCB-1016	35 - 890	121	40	111	91.7	No
PCB-1221	35 - 890	121	40	116	95.9	No
PCB-1232	35 - 890	121	40	111	91.7	No
PCB-1242	35 - 890	121	40	111	91.7	No
PCB-1248	35 - 890	121	40	111	91.7	No
PCB-1260	35 - 1,800	119	40	109	91.6	Yes
Pentachlorodibenzo-p-dioxin	0.00184 - 0.00474	4		0	0	No
Pentachlorophenol	860 - 18,000	103	255	103	100	Yes
Phenol	350 - 3,500	102	773	25	24.5	Yes
Prometon	50 - 50	1		0	0	No
Prometryn	50 - 50	1		0	0	No
Propazine	50 - 50	1		0	0	No
Pyridine	700 - 3,500	26		0	0	No
sec-Butylbenzene	1.16 - 23	12		0	0	No
Simazine	50 - 50	1		0	0	No
Simetryn	50 - 50	1		0	0	No
Styrene	1.12 - 1,600	79		0	0	No
Terbutryn	50 - 50	1		0	0	No
Terbutylazine	50 - 50	1		0	0	No
tert-Butylbenzene	1.21 - 23	12		0	0	No
Tetrachloroethene	1.46 - 1,600	78	3,050	0	0	Yes
Toxaphene	180 - 1,800	79		0	0	No
trans-1,2-Dichloroethene	1.49 - 12	12	657	0	0	No
trans-1,3-Dichloropropene	1.05 - 1,600	79		0	0	No
Trichloroethene	0.791 - 1,600	76	22,800	0	0	Yes
Trichlorofluoromethane	1.39 - 23	12		0	0	No
Vinyl acetate	10 - 38	39		0	0	No
Vinyl Chloride	2.87 - 3,100	79		0	0	No
Xylene	2.78 - 1,600	79	91	1	1.27	No

Table A1.2NWAEU.4

## Summary of Professional Judgment and Ecological Risk Potential for Analytes in Sediment for the NW AEU

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE									ECOLOGICAL RISK POTENTIAL					
	Listed as Waste Constituent for NW AEU Historical IHSSs ? <sup>1</sup>	Historical RFETS Inventory <sup>2</sup> (1974/1988) (kg)	MDC in NW AEU Surface Soil (ug/kg)	Percent Detects in NW AEU Surface Soil (%)	MDC in NW AEU Sediment (ug/kg)	Percent Detects in NW AEU Sediment (%)	MDC in Sediment Sitewide (ug/kg)	Percent Detects in Sitewide Sediment (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty Category <sup>3</sup>	ESL <sup>4</sup> (ug/kg)	LOEC <sup>5</sup>	Maximum Reported Result for Non-detects in NW AEU (ug/kg)	Maximum Reported Result/ LOEC	Potential for Adverse Effects if Detected at Reported Results Levels?
1,2,4-trichlorobenzene	No	.02/.02	NA	0	NA	0	2	0.3	No	2	429	NVA	3500	NA	I
1,3-dichlorobenzene	No	0/.01	NA	0	NA	0	NA	0	No	1	122	NVA	3500	NA	I
2,4,6-Trichlorophenol	No	0/.01	NA	0	NA	0	NA	0	No	1	59.3	NVA	3500	NA	I
4,4' DDD	Yes(1)	0/.001	NA	0	NA	0	4.1	0.4	No	2	4.88	NVA	180	NA	I
4,4' DDE	Yes(1)	0/.001	NA	0	NA	0	18	2.2	No	2	3.16	NVA	180	NA	I
4-bromophenyl-phenylether	No	0/.005	NA	0	NA	0	NA	0	No	1	166	NVA	3500	NA	I
4-methylphenol	No	0/.02	270	1.4	NA	0	1500	3.1	No	3	12.3	670	3500	5.2	Yes
acenaphthylene	Yes(2)	.02/.02	140	0.3	NA	0	NA	0	No	3	5.87	NVA	2700	NA	Yes
aldrin	Yes(1)	0/.003	NA	0	54	1.3	54	1.3	No	3	8.25	NVA	89	NA	I
alpha-chlordane	Yes(1)	0/0	NA	0	NA	0	NA	0	No	2	3.24	NVA	890	NA	I
benzyl alcohol	No	.02/.02	2800	2.0	NA	0	41	0.4	No	3	1.35	NVA	6900	NA	I
beta-chlordane	Yes(1)	0/0	2.6	1.0	NA	0	NA	0	No	3	3.24	NVA	240	NA	I
bromomethane	No	0/0	NA	0	NA	0	5	2.4	No	2	3.43	NVA	3100	NA	I
delta-BHC	Yes(1)	0/0	NA	0	13	1.3	13	1.3	No	3	2.37	NVA	89	NA	I
dieldrin	Yes(1)	0/.003	NA	0	NA	0	4.6	0.4	No	2	5.94	NVA	180	NA	I
diethylphthalate	Yes(2)	0/.03	NA	0	25	1.0	79	1.0	No	3	108	NVA	3500	NA	I
endosulfan I	Yes(1)	0/.001	NA	0	20	1.3	20	1.3	No	3	0.69	NVA	89	NA	I
endosulfan II	Yes(1)	0/.001	NA	0	NA	0	NA	0	No	2	0.69	NVA	180	NA	I
endosulfan sulfate	Yes(1)	0/.002	NA	0	NA	0	NA	0	No	2	0.69	NVA	180	NA	I
gamma-BHC (lindane)	Yes(1)	0/.002	NA	0	NA	0	25	0.9	No	3	2.37	NVA	89	NA	I
gamma-chlordane	Yes(1)	0/.003	NA	0	NA	0	NA	0	No	2	3.24	NVA	890	NA	I
heptachlor	Yes(1)	0/.003	NA	0	NA	0	3.1	1.3	No	3	0.132	16	89	5.6	Yes
heptachlor epoxide	Yes(1)	0/.001	NA	0	NA	0	33	1.3	No	3	2.47	16	89	5.6	Yes
hexachloro-butadiene	No	0/.005	NA	0	NA	0	2	0.3	No	2	23	NVA	3500	NA	I
methoxychlor	Yes(1)	0/.002	NA	0	NA	0	2.7	0.4	No	2	24	NVA	890	NA	I
PCB-1016	Yes(3)	0/.006	19	0.9	NA	0	NA	0	No	2	40	676	890	1	No
PCB-1221	Yes(3)	0/.02	NA	0	NA	0	NA	0	No	2	40	676	890	1	No
PCB-1232	Yes(3)	0/.007	NA	0	NA	0	NA	0	No	2	40	676	890	1	No
PCB-1242	Yes(3)	0/.02	23	0.4	NA	0	NA	0	No	2	40	676	890	1	No
PCB-1248	Yes(3)	0/.007	42	1.6	NA	0	NA	0	No	2	40	676	890	1	No
PCB-1260	Yes(3)	0/.02	7800	21.1	180	1.7	2000	2.3	Yes	4	40	676	1800	3	Yes
pentachlorophenol	No	.02/.02	39000	1.9	39	1.0	1500	2.1	No	3	255	360	18000	50	Yes

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> Basis for the NOEC.

<sup>5</sup> LOECs developed as described in Attachment 5 to Appendix A, Volumes 15B1 and 15B2 of the RI/FS report. LOEC for specific Aroclors is based on total PCBs.

(1) The Pesticide Shed (PAC 300-702) is in the NW AEU.

(2) There are several historical IHSSs in the NW AEU where wastes were burned or there was a release of oil. Phthalates may also be a component of oil.

(3) There are several historical IHSSs in the NW AEU where transformers had leaked.

CDH – Colorado Department of Health

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethylene

DOE – Department of Energy

ESL – Ecological Screening Level

IHSS – Individual Hazardous Substance Site

LOEC – Lowest Observed Effect Concentration

MDC – Maximum Detected Concentration

NOEC – No Observed Effect Concentration

NW AEU – North Walnut Creek Aquatic Exposure Unit

PCB – Polychlorinated Biphenyl

RFETS – Rocky Flats Environmental Technology Site

I – Inconclusive

NA – Not applicable

NVA – No value available

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

Analyte	Range of Nondetected Reported Results	Total Number of Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Inorganics (Dissolved) (mg/L)</b>						
Beryllium	2.00E-05 - 0.00160	576	0.00240	0	0	Yes
Mercury	2.30E-05 - 6.10E-04	572	7.70E-04	0	0	Yes
Sulfide	-	0		0	0	Yes
Thallium	1.00E-04 - 0.191	568	0.0150	5	0.880281746	Yes
<b>Inorganics (Total) (mg/L)</b>						
Beryllium	2.00E-05 - 0.0159	1,282	0.00240	44	3.43	Yes
Mercury	2.30E-05 - 0.00900	997	7.70E-04	6	0.602	Yes
Sulfide	4.00E-04 - 1.20	86		0	0	Yes
Thallium	2.70E-05 - 0.288	1,035	0.0150	7	0.676	Yes
<b>Organics (ug/L)</b>						
1,1,1,2-Tetrachloroethane	0.100 - 10	372		0	0	No
1,1,1,2,2-Tetrachloroethane	0.100 - 10	681	2,400	0	0	Yes
1,1,2-Trichloro-1,2,2-trifluoroethane	0.500 - 5	79	32	0	0	No
1,1,2-Trichlorobenzene	1 - 1	2		0	0	No
1,1,2-Trichloroethane	0.100 - 10	681	940	0	0	No
1,1-Dichloropropene	0.100 - 10	379		0	0	No
1,2,3-Trichlorobenzene	0.100 - 10	379	8	2	0.528	No
1,2,3-Trichloropropane	0.100 - 20	353		0	0	Yes
1,2,4,5-Tetrachlorobenzene	10 - 33	2		0	0	No
1,2,4-Trichlorobenzene	0.100 - 11	459	50	0	0	Yes
1,2,4-Trimethylbenzene	0.100 - 10	379	17	0	0	No
1,2-Dibromo-3-chloropropane	0.200 - 20	152		0	0	Yes
1,2-Dibromoethane	0.200 - 10	379		0	0	No
1,2-Dichlorobenzene	0.100 - 11	489	13	0	0	No
1,2-Dichloroethane	0.100 - 10	668	20,000	0	0	Yes
1,2-Dichloropropane	0.100 - 10	681	5,700	0	0	No
1,3 & 1,4-xylene	5 - 5	2	35	0	0	No
1,3,5-Trimethylbenzene	0.100 - 10	379	45	0	0	No
1,3,5-Trinitrobenzene	10 - 33	2		0	0	No
1,3-Dichlorobenzene	0.100 - 11	489	28	0	0	Yes
1,3-Dichloropropane	0.100 - 10	377		0	0	No
1,3-Dinitrobenzene	10 - 33	2		0	0	No
1,4-Dichlorobenzene	0.100 - 11	489	16	0	0	Yes
1,4-Naphthoquinone	10 - 33	2		0	0	No
1,4-Phenylenediamine	10 - 33	2		0	0	No
1-Naphthylamine	10 - 33	2		0	0	No
2,2-Dichloropropane	0.100 - 10	378		0	0	No
2,3,4,6-Tetrachlorophenol	10 - 33	2		0	0	No
2,4,5-T	0.200 - 10	9		0	0	No
2,4,5-TP (Silvex)	0.170 - 10	37		0	0	No
2,4,5-Trichlorophenol	9.80 - 84	130		0	0	No
2,4,6-Trichlorophenol	1 - 33	130	5	109	83.8	No
2,4-D	0.450 - 10	37		0	0	No
2,4-DB	0.910 - 10	9		0	0	No
2,4-Dichlorophenol	5 - 33	130	365	0	0	No
2,4-Dimethylphenol	5 - 33	130	212	0	0	No
2,4-Dinitrophenol	25 - 84	125		0	0	No
2,4-Dinitrotoluene	5 - 33	129		0	0	No
2,6-Dichlorophenol	10 - 33	2		0	0	No
2,6-Dinitrotoluene	5 - 11	129		0	0	No
2378-TCDD	1.40E-04 - 0.00500	34		0	0	No
2-Acetylaminofluorene	10 - 33	2		0	0	No
2-Butanone	1 - 100	352	2,200	0	0	Yes
2-Chloroethyl vinyl ether	0 - 10	36		0	0	Yes
2-Chloronaphthalene	5 - 33	131	630	0	0	No
2-Chlorophenol	5 - 33	130		0	0	No

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

Analyte	Range of Nondetected Reported Results	Total Number of Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
2-Chlorotoluene	0.200 - 10	379		0	0	No
2-Hexanone	2 - 50	373	99	0	0	Yes
2-Methylnaphthalene	5 - 33	126		0	0	No
2-Methylphenol	5 - 11	128	82	0	0	No
2-Naphthylamine	10 - 33	2		0	0	No
2-Nitroaniline	25 - 84	131		0	0	No
2-Nitrophenol	5 - 33	130		0	0	No
2-Picoline	10 - 33	2		0	0	No
3 & 4-methyl phenol	9.80 - 11	11		0	0	No
3,3'-Dichlorobenzidine	10 - 33	131		0	0	No
3,3'-Dimethylbenzidine	10 - 33	2		0	0	No
3-Methylcholanthrene	10 - 33	2		0	0	No
3-Nitroaniline	25 - 84	130		0	0	No
4,4'-DDD	0.0990 - 0.520	72	0.0600	72	100	Yes
4,4'-DDE	0.0130 - 0.520	72	105	0	0	Yes
4,6-Dinitro-2-methylphenol	25 - 84	127		0	0	No
4-Aminobiphenyl	10 - 33	2		0	0	No
4-Bromophenyl-phenylether	5 - 33	131		0	0	No
4-Chloro-3-methylphenol	5 - 33	130		0	0	No
4-Chloroaniline	5 - 33	130		0	0	No
4-Chlorophenyl-phenyl ether	5 - 33	131		0	0	No
4-Chlorotoluene	0.200 - 10	379		0	0	No
4-Isopropyltoluene	0.200 - 10	379		0	0	No
4-Methyl-2-pentanone	2 - 50	373	170	0	0	Yes
4-Methylphenol	5 - 28	117	25	1	0.855	Yes
4-Nitroaniline	5.30 - 84	129		0	0	Yes
4-Nitrophenol	25 - 84	130		0	0	No
5-Nitro-o-toluidine	10 - 33	2		0	0	No
7,12-Dimethylbenz(a)-anthracene	10 - 33	2		0	0	No
a,a-Dimethylphenethylamine	10 - 33	2		0	0	No
Acenaphthene	1 - 33	131	520	0	0	No
Acenaphthylene	1 - 33	131		0	0	No
Acetophenone	10 - 33	2		0	0	No
Acrylonitrile	10 - 10	15		0	0	No
Aldrin	0.0500 - 0.260	72	0.150	1	1.39	No
alpha-Chlordane	0 - 2.60	67		0	0	Yes
Ametryne	0.180 - 0.700	49		0	0	No
Anthracene	0.0300 - 33	131	0.730	112	85.5	No
Aramite	20 - 67	2		0	0	No
Atraton	0.520 - 0.700	35		0	0	No
Benzene	0.100 - 10	681	530	0	0	Yes
Benzidine	10 - 10	5		0	0	No
Benzo(a)anthracene	0.178 - 33	131	0.0270	131	100	No
Benzo(a)pyrene	0.140 - 33	131	0.0140	131	100	No
Benzo(b)fluoranthene	0.150 - 33	131		0	0	No
Benzo(g,h,i)perylene	0.594 - 33	120		0	0	No
Benzo(k)fluoranthene	0.0800 - 33	131		0	0	No
Benzoic Acid	25 - 56	112	42	96	85.7	No
Benzyl Alcohol	5 - 33	118	8.60	102	86.4	No
beta-BHC	0 - 0.260	72	2.20	0	0	Yes
beta-Chlordane	0.0500 - 0.540	30		0	0	No
bis(2-Chloroethoxy) methane	5 - 11	129		0	0	No
bis(2-Chloroethyl) ether	5 - 11	129		0	0	No
bis(2-Chloroisopropyl) ether	5 - 11	125	29	0	0	No
Bladex	0.300 - 0.300	14		0	0	No
Bromobenzene	0.200 - 10	379		0	0	No
Bromochloromethane	0.100 - 10	374		0	0	No

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

Analyte	Range of Nondetected Reported Results			Total Number of Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Bromodichloromethane	0.200	-	10	678	1,100	0	0	Yes
Bromoform	0.200	-	10	667	320	0	0	No
Bromomethane	0.200	-	20	672	35	0	0	No
Butylbenzylphthalate	0.500	-	33	131	67	0	0	Yes
Carbazole	10	-	11	12	4	12	100	No
Carbon Disulfide	1	-	10	377	0.920	377	100	No
Chlordane (NOS)	0.500	-	0.500	5		0	0	No
Chlorobenzene	0.100	-	10	681	47	0	0	Yes
Chlorobenzilate	10	-	33	2		0	0	No
Chloroethane	0.200	-	20	679		0	0	No
Chloromethane	0.200	-	20	678		0	0	Yes
Chrysene	0.400	-	33	131		0	0	Yes
cis-1,3-Dichloropropene	0.100	-	10	678	244	0	0	No
Dalapon	5.80	-	10	9		0	0	No
delta-BHC	0.0100	-	0.260	72	2.20	0	0	Yes
Diallate (cis or trans)	10	-	33	2		0	0	No
Dibenz(a,h)anthracene	1.01	-	33	122		0	0	No
Dibenzofuran	5	-	33	131	4	131	100	No
Dibromochloromethane	0.200	-	10	678		0	0	Yes
Dibromomethane	0.200	-	10	379		0	0	No
Dicamba	0.270	-	10	9	10	0	0	No
Dichlorodifluoromethane	0.200	-	20	409		0	0	Yes
Dichloroprop	0.650	-	10	9		0	0	No
Dieldrin	0.0990	-	0.520	72	0.0560	72	100	No
Diethylphthalate	2	-	11	131	110	0	0	Yes
Dimethylaminoazobenzene	10	-	33	2		0	0	No
Dimethylphthalate	0.930	-	33	131		0	0	Yes
Di-n-octylphthalate	3	-	33	131		0	0	Yes
Dinoseb	0.0700	-	10	9	0.480	4	44.4	No
Diphenylamine	9.80	-	33	13		0	0	No
Disulfoton	0.510	-	0.520	2		0	0	No
Endosulfan I	0.0500	-	0.260	72	0.0560	8	11.1	No
Endosulfan II	0.0990	-	0.520	72	0.0560	72	100	No
Endosulfan sulfate	0.0990	-	0.520	72	0.0560	72	100	No
Endrin	0.0990	-	0.520	72	0.0360	72	100	No
Endrin aldehyde	0.100	-	0.110	19	0.0360	19	100	No
Endrin ketone	0.0990	-	0.520	67	0.0360	67	100	No
Ethyl methanesulfonate	10	-	33	2		0	0	No
Ethylbenzene	0.100	-	10	681	3,200	0	0	No
Famphur	1.30	-	1.30	2		0	0	No
Fluoranthene	0.620	-	33	131	398	0	0	No
Fluorene	0.297	-	33	131	12	1	0.763	Yes
gamma-BHC (Lindane)	0	-	0.260	72	0.0800	5	6.94	Yes
Heptachlor	0	-	0.260	72	0.00380	71	98.6	Yes
Heptachlor epoxide	0.0500	-	0.260	72	0.00380	72	100	No
Hexachlorobenzene	1	-	33	131		0	0	No
Hexachlorobutadiene	0.100	-	11	459	9.30	71	15.5	No
Hexachlorocyclopentadiene	5	-	33	127		0	0	No
Hexachloroethane	1	-	33	131	540	0	0	No
Hexachlorophene	100	-	330	2		0	0	No
Hexachloropropene	10	-	33	2		0	0	No
Indeno(1,2,3-cd)pyrene	0.297	-	33	120		0	0	No
Isodrin	0.100	-	0.110	2		0	0	No
Isophorone	5	-	33	131	1,300	0	0	No
Isopropylbenzene	0.200	-	10	379		0	0	No
Isosafrole	10	-	33	2		0	0	No
Kepone	0.500	-	0.550	2		0	0	No

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

Analyte	Range of Nondetected Reported Results	Total Number of Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
m,p-Xylene	0.200 - 2	258	35	0	0	Yes
MCPA	250 - 10,000	9		0	0	No
MCPP	190 - 10,000	9		0	0	No
Methapyrilene	10 - 33	2		0	0	No
Methoxychlor	0.500 - 2.60	67		0	0	No
Methyl methanesulfonate	10 - 33	2		0	0	No
Methyl parathion	0.510 - 0.520	2		0	0	No
m-Xylene	0.500 - 0.500	3	35	0	0	No
Naphthalene	0.200 - 11	459	620	0	0	Yes
n-Butylbenzene	0.100 - 10	379		0	0	No
Nitrobenzene	5 - 33	131		0	0	No
Nitroquinoline-1-oxide	20 - 67	2		0	0	No
N-Nitrosodiethylamine	5 - 33	7		0	0	No
N-Nitrosodimethylamine	5 - 33	7		0	0	No
N-Nitrosodi-n-butylamine	5 - 33	7		0	0	No
N-Nitroso-di-n-propylamine	5 - 33	131		0	0	No
N-nitrosodiphenylamine	5 - 33	120		0	0	No
N-Nitrosomethylethylamine	10 - 33	2		0	0	No
N-Nitrosopiperidine	51 - 170	2		0	0	No
N-Nitrosopyrrolidine	10 - 33	7		0	0	No
n-Propylbenzene	0.200 - 10	379		0	0	No
O,O,O-Triethyl phosphorothioate	0.510 - 0.520	2		0	0	No
o-Toluidine	10 - 33	2		0	0	No
o-Xylene	0.200 - 5	285	35	0	0	No
Parathion	0.510 - 0.520	2		0	0	No
PCB-1016	0.500 - 2.60	70	0.0140	70	100	No
PCB-1221	0.500 - 2.60	70	0.0140	70	100	No
PCB-1232	0.500 - 2.60	70	0.0140	70	100	No
PCB-1242	0.500 - 2.60	70	0.0140	70	100	No
PCB-1248	0.500 - 2.60	70	0.0140	70	100	No
PCB-1254	0.990 - 24	70	0.0140	70	100	Yes
PCB-1260	0.990 - 5.20	70	0.0140	70	100	No
Pentachlorobenzene	10 - 33	2		0	0	No
Pentachloronitrobenzene	51 - 51	1		0	0	No
Pentachlorophenol	25 - 84	130	6.73	130	100	No
Phenacetin	10 - 33	2		0	0	No
Phenanthrene	0.700 - 33	131	2.40	102	77.9	Yes
Phenol	5 - 33	130	2,560	0	0	No
Phorate	0.510 - 0.520	2		0	0	No
Prometon	0.0900 - 0.350	49		0	0	No
Prometryn	0.180 - 0.700	49		0	0	No
Pronamide	10 - 33	2		0	0	No
p-Xylene	0.500 - 0.500	1	35	0	0	No
Pyrene	0.594 - 33	131	0.0250	131	100	No
Safrole	10 - 33	2		0	0	No
sec-Butylbenzene	0.100 - 10	379		0	0	No
Simazine	0.180 - 1	52	10	0	0	Yes
Simetryn	0.210 - 0.820	49		0	0	No
Styrene	0.100 - 10	651	160	0	0	No
Terbutryn	0.500 - 0.590	34		0	0	No
Terbutylazine	0.0900 - 0.350	49		0	0	No
tert-Butylbenzene	0.200 - 10	379		0	0	No
Tetrachloroethane	1 - 1	2		0	0	No
Tetraethyl dithiopyrophosphate	0.510 - 0.520	2		0	0	No
Thionazine	0.510 - 0.520	2		0	0	No
Toluene	0.100 - 10	681	1,750	0	0	Yes
Toxaphene	0.990 - 5.70	72		0	0	No

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

Analyte	Range of Nondetected Reported Results	Total Number of Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
trans-1,2-Dichloroethene	0.100 - 10	409	1,500	0	0	Yes
trans-1,3-Dichloropropene	0.100 - 10	676	244	0	0	No
Tributyl phosphate	98 - 110	11		0	0	No
Trichlorofluoromethane	0.200 - 10	409		0	0	Yes
Vinyl acetate	10 - 10	269		0	0	No
Xylene	0.500 - 10	417	35	0	0	Yes

Table A1.2.SW AEU.2

Summary of Professional Judgment and Ecological Risk Potential for Analytes in Surface Water for the SW AEU

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE												ECOLOGICAL RISK POTENTIAL						
	Listed as Waste Constituent for SW AEU Historical IHSSs ? <sup>1</sup>	Historical RFETS Inventory <sup>2</sup> (1974/1988) (kg)	Max Conc. In SW AEU Surface Soil (µg/kg)	Percent Detects in SW AEU Surface Soil (µg/kg)	Max Conc. In SW AEU Sediment (µg/kg)	Percent Detects in SW AEU Sediment (%)	Max. Conc. In SW AEU Surface Water (µg/L)	Percent Detects in SW AEU Surface Water (%)	Maximum Conc. in Surface Water Sitewide (µg/L)	Detection Frequency in Sitewide Surface Water (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty Category <sup>3</sup>	ESL (µg/L) <sup>4</sup>	Acute Effects Value <sup>5</sup>	Maximum Reported Result for Non-Detects in SW AEU (µg/kg)	Maximum Reported Result for Non-Detects/ ESL	Potential for Chronic Effects if Detected at Reported Results Levels?	Maximum Reported Result for Non-Detects/ Acute Effects Value	Potential for Acute Effects if Detected at Reported Results Levels?
2,4,6-trichlorophenol	No	0/01	950	0.2	ND	0.00	NA	0	NA	0	No	3	5	79	33	6.60	Yes	0.42	No
4,4'-DDD	No	0/001	10	1.4	ND	0.00	0.1	1.4	0.1	0.6	No	3	0.06	0.6	0.52	8.67	Yes	0.87	No
anthracene	Yes(1)	.5/02	1500	19.8	430	33.73	NA	0	2	0.2	No	3	0.73	13	33	45.21	Yes	2.54	Yes
benzo(a)anthracene	Yes(1)	0/0	2300	47.5	1400	56.63	NA	0	8	0.2	No	3	0.027	0.49	33	1222.22	Yes	67.35	Yes
benzo(a)pyrene	Yes(1)	0/002	2300	38.4	1300	53.01	NA	0	9	0.2	No	3	0.014	0.24	33	2357.14	Yes	137.50	Yes
benzoic acid	No	0/0	1100	8.2	1400	10.45	NA	0	42	1.5	No	3	42	740	56	1.33	Yes	0.08	No
Benzyl alcohol	No	.02/02	NA	0	41	1.49	NA	0	860	1.8	No	3	8.6	150	33	3.84	Yes	0.22	No
carbazole	No	0/01	500	54.5	290	37.50	NA	0	3	1.9	No	3	4	72	11	2.75	Yes	0.15	No
Carbon disulfide	No	3.3/5.9	4	0.3	ND	0.00	NA	0	8	0.3	No	3	0.92	17	10	10.87	Yes	0.59	No
dibenzofuran	No	.02/01	490	7.4	65	4.82	NA	0	2	1.6	No	3	4	72	33	8.25	Yes	0.46	No
dieldrin	No	0/003	92	6.8	4.6	1.52	NA	0	NA	0	No	3	0.056	0.24	0.52	9.29	Yes	2.17	Yes
endosulfan II	No	0/001	9.9	2	ND	0.00	NA	0	NA	0	No	3	0.056	0.22	0.52	9.29	Yes	2.36	Yes
endosulfan sulfate	No	0/001	11	1.4	ND	0.00	NA	0	NA	0	No	3	0.056	0.22	0.52	9.29	Yes	2.36	Yes
Endrin	No	0/004	17	4.1	ND	0.00	NA	0	0.02	0.3	No	3	0.036	0.086	0.52	14.44	Yes	6.05	Yes
Endrin aldehyde	No	0/002	9.2	4.2	ND	0.00	NA	0	NA	0	No	3	0.036	0.086	0.11	3.06	Yes	1.28	Yes
endrin ketone	No	0/0	NA	0	ND	0.00	NA	0	NA	0	No	1	0.036	0.086	0.52	14.44	Yes	6.05	Yes
heptachlor	No	0/003	NA	0	ND	0.00	0	1.4	NA	0	No	2	0.0038	0.52	0.26	68.42	Yes	0.50	No
heptachlor epoxide	No	0/001	7.2	0.7	33	1.52	NA	0	0.05	0.3	No	3	0.0038	0.52	0.26	68.42	Yes	0.50	No
PCB-1016	Yes(2)	0/006	95	16	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes
PCB-1221	Yes(2)	0/02	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.6	185.71	Yes	1.30	Yes
PCB-1232	Yes(2)	0/007	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.6	185.71	Yes	1.30	Yes
PCB-1242	Yes(2)	0/02	350	0.4	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes
PCB-1248	Yes(2)	0/007	840	0.7	ND	0.00	NA	0	NA	0	No	3	0.014	2	2.6	185.71	Yes	1.30	Yes
PCB-1254	Yes(2)	0/017	3200	15.1	3100	26.80	24	1.4	24	2.3	Yes	4	0.014	2	24	1714.29	Yes	12.00	Yes
PCB-1260	Yes(2)	0/02	6800	20.9	2000	5.15	NA	0	NA	0	Yes	4	0.014	2	5.2	371.43	Yes	2.60	Yes
pentachlorophenol	No	.02/02	470	0.8	1100	3.57	NA	0	5	0.4	No	3	6.7	17.4	84	12.54	Yes	4.83	Yes
phenanthrene	Yes(1)	.02/02	6100	53.4	1800	61.45	1	0.81	11	1.9	Yes	4	2.4	43	33	13.75	Yes	0.77	No
Pyrene	Yes(1)	.02/02	5900	53.8	1700	7.00	NA	0	12	1.3	Yes	4	0.025	NVA	33	1320.00	Yes	No AEV	I

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> ESLs based on chronic effects value.

<sup>5</sup> Chronic and acute effects values are listed in Appendix B, Table B-5, "Surface Water ESLs for Aquatic Receptors", Ref. DOE 2005a.

(1) The Pesticide Shed (PAC 300-702) is in the NW AEU.

(2) There are several historical IHSSs in the NW AEU where wastes were burned or there was a release of oil.

(3) There are several historical IHSSs in the NW AEU where transformers had leaked.

CDH – Colorado Department of Health

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

DOE – Department of Energy

ESL – Ecological Screening Level

IHSS – Individual Hazardous Substance Site

SW AEU – South Walnut Creek Aquatic Exposure Unit

RFETS – Rocky Flats Environmental Technology Site

I - Inconclusive

NA – Not applicable

ND - Not detected

NS - Not sampled

No ESL – No chronic ESL available

No AEV – No acute effects level available

NVA - No value

**Table A1.2.SWAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the SW AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Inorganic (mg/kg)</b>						
Nitrite	0.0200 - 2.50	13		0	0	No
Uranium	0.960 - 20	54		0	0	No
<b>Organics (ug/kg)</b>						
1,1,1,2-Tetrachloroethane	1.23 - 8	26		0	0	No
1,1,1-Trichloroethane	1.09 - 1,300	80	159	2	2.50	No
1,1,2,2-Tetrachloroethane	0.958 - 1,300	80	1,900	0	0	No
1,1,2-Trichloro-1,2,2-trifluoroethane	0.970 - 8	26		0	0	No
1,1,2-Trichloroethane	0.922 - 1,300	80		0	0	No
1,1-Dichloroethane	0.773 - 1,300	80		0	0	No
1,1-Dichloroethene	1.47 - 1,300	78		0	0	Yes
1,1-Dichloropropene	1.15 - 8	26		0	0	No
1,2,3-Trichlorobenzene	0.696 - 8	25	58.6	0	0	Yes
1,2,3-Trichloropropane	1.03 - 8	26		0	0	No
1,2,4-Trichlorobenzene	0.963 - 3,600	102	429	54	52.9	Yes
1,2,4-Trimethylbenzene	0.720 - 8	26	122	0	0	No
1,2-Dibromo-3-chloropropane	1.79 - 8	26		0	0	No
1,2-Dibromoethane	0.816 - 8	26		0	0	No
1,2-Dichlorobenzene	0.727 - 780	81		0	0	No
1,2-Dichloroethane	0.991 - 1,300	80		0	0	No
1,2-Dichloroethene	5 - 1,300	54		0	0	No
1,2-Dichloropropane	0.851 - 1,300	80		0	0	No
1,3,5-Trimethylbenzene	0.836 - 8	26	316	0	0	No
1,3-Dichlorobenzene	1.01 - 3,600	103	122	77	74.8	No
1,3-Dichloropropane	0.576 - 8	26		0	0	No
1,4-Dichlorobenzene	1.10 - 780	81		0	0	No
1,4-Dioxane	500 - 500	1		0	0	No
2,2-Dichloropropane	1.01 - 8	26		0	0	No
2,4,5-Trichlorophenol	330 - 3,800	84		0	0	No
2,4,6-Trichlorophenol	330 - 3,600	84	59.3	84	100	No
2,4-Dichlorophenol	350 - 3,600	83		0	0	No
2,4-Dimethylphenol	350 - 3,600	83		0	0	No
2,4-Dinitrophenol	880 - 18,000	79		0	0	No
2,4-Dinitrotoluene	330 - 3,600	84		0	0	No
2,6-Dinitrotoluene	350 - 3,600	83		0	0	No
2-Chloronaphthalene	350 - 3,600	83		0	0	No
2-Chlorophenol	350 - 3,600	83		0	0	No
2-Chlorotoluene	0.985 - 8	26		0	0	No
2-Hexanone	7.93 - 1,300	75		0	0	No
2-Methyl-1-propanol	100 - 100	1		0	0	No
2-Methylnaphthalene	350 - 3,600	82	20.2	82	100	Yes
2-Methylphenol	330 - 3,600	84	6,970	0	0	No
2-Nitroaniline	880 - 18,000	83		0	0	No
2-Nitrophenol	350 - 3,600	83		0	0	No
3,3'-Dichlorobenzidine	350 - 7,100	82		0	0	No
3-Nitroaniline	880 - 18,000	76		0	0	No
4,4'-DDD	3.50 - 41	66	4.88	52	78.8	No
4,4'-DDE	3.50 - 41	65	3.16	65	100	Yes
4,4'-DDT	3.50 - 41	66	4.16	54	81.8	No
4,6-Dinitro-2-methylphenol	880 - 18,000	82		0	0	No
4-Bromophenyl-phenylether	350 - 3,600	83	166	83	100	No
4-Chloro-3-methylphenol	350 - 7,100	83		0	0	No
4-Chloroaniline	350 - 7,100	79		0	0	No
4-Chlorophenyl-phenyl ether	350 - 3,600	83		0	0	No
4-Chlorotoluene	0.918 - 8	26		0	0	No
4-Isopropyltoluene	1.08 - 8	26		0	0	No
4-Methyl-2-pentanone	6 - 1,300	80		0	0	No

**Table A1.2.SWAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the SW AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
4-Methylphenol	330 - 3,600	83	12.3	83	100	Yes
4-Nitroaniline	880 - 18,000	82		0	0	No
4-Nitrophenol	880 - 18,000	83		0	0	No
Acenaphthylene	350 - 1,800	83	5.87	83	100	No
Acetonitrile	100 - 100	1		0	0	No
Aldrin	1.80 - 23	65	8.25	50	76.9	No
alpha-BHC	1.80 - 23	66	43.9	0	0	No
alpha-Chlordane	1.80 - 200	64	3.24	49	76.6	No
Ametryne	50 - 50	1		0	0	No
Atraton	50 - 50	1		0	0	No
Atrazine	50 - 50	1	16.8	1	100	No
Benzene	0.809 - 1,300	79	260	1	1.27	No
Benzyl Alcohol	350 - 7,100	66	1.35	66	100	Yes
beta-BHC	1.80 - 23	65	93.6	0	0	Yes
beta-Chlordane	1.80 - 200	61	3.24	46	75.4	No
bis(2-Chloroethoxy) methane	350 - 3,600	83		0	0	No
bis(2-Chloroethyl) ether	350 - 3,600	83		0	0	No
bis(2-Chloroisopropyl) ether	350 - 3,600	83		0	0	No
Bromobenzene	1.08 - 8	26		0	0	No
Bromochloromethane	1.15 - 8	26		0	0	No
Bromodichloromethane	0.678 - 1,300	80		0	0	No
Bromoform	0.668 - 1,300	80		0	0	No
Carbon Disulfide	2.74 - 1,300	80		0	0	No
Carbon Tetrachloride	1.07 - 21	78	7,890	0	0	Yes
Chlordane	23 - 94	2	3.24	2	100	No
Chlorobenzene	0.979 - 1,300	79		0	0	No
Chloroethane	1.68 - 1,300	80		0	0	No
Chloromethane	1.26 - 1,300	79		0	0	No
cis-1,2-Dichloroethene	1.05 - 8	25		0	0	Yes
cis-1,3-Dichloropropene	0.814 - 1,300	80		0	0	No
delta-BHC	1.80 - 23	66	2.37	52	78.8	No
Dibenzofuran	350 - 3,600	79	325	79	100	Yes
Dibromochloromethane	0.720 - 1,300	80		0	0	No
Dibromomethane	0.752 - 8	26		0	0	No
Dichlorodifluoromethane	1.88 - 13	26		0	0	No
Dieldrin	3.50 - 41	65	5.94	50	76.9	Yes
Diethylphthalate	350 - 3,600	82	108	82	100	Yes
Dimethylphthalate	350 - 3,600	79		0	0	Yes
Endosulfan I	1.80 - 23	66	0.690	66	100	No
Endosulfan II	3.50 - 41	66	0.690	66	100	No
Endosulfan sulfate	3.50 - 41	66	0.690	66	100	No
Endrin	3.50 - 41	66		0	0	No
Endrin aldehyde	3.50 - 23	18		0	0	No
Endrin ketone	3.50 - 41	65		0	0	No
Ether	10 - 10	1		0	0	No
ethyl acetate	10 - 10	1		0	0	No
Ethylbenzene	1.02 - 1,300	78	16,570	0	0	Yes
gamma-BHC (Lindane)	1.80 - 23	64	2.37	50	78.1	Yes
gamma-Chlordane	92 - 130	3	3.24	3	100	No
Heptachlor	1.80 - 23	66	0.132	66	100	No
Heptachlor epoxide	1.80 - 89	65	2.47	50	76.9	Yes
Hexachlorobenzene	330 - 3,600	84		0	0	No
Hexachlorobutadiene	1.23 - 3,600	102	23	77	75.5	Yes
Hexachlorocyclopentadiene	350 - 3,600	83		0	0	No
Hexachloroethane	330 - 3,600	84		0	0	No
Isophorone	350 - 3,600	83		0	0	No
Isopropylbenzene	1.28 - 8	26		0	0	No

**Table A1.2.SWAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the SW AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Methoxychlor	18 - 200	65	24	50	76.9	Yes
Naphthalene	0.815 - 3,600	98	176	74	75.5	Yes
n-Butanol	100 - 100	1		0	0	No
n-Butylbenzene	1.02 - 8	26		0	0	No
Nitrobenzene	330 - 3,600	84		0	0	No
N-Nitroso-di-n-propylamine	350 - 3,600	83		0	0	No
N-nitrosodiphenylamine	350 - 3,600	83		0	0	No
n-Propylbenzene	0.972 - 8	26		0	0	No
PCB-1016	35 - 520	97	40	80	82.5	No
PCB-1221	35 - 520	97	40	91	93.8	No
PCB-1232	35 - 520	97	40	80	82.5	No
PCB-1242	35 - 520	97	40	80	82.5	No
PCB-1248	35 - 520	97	40	80	82.5	No
Pentachlorophenol	330 - 18,000	81	255	81	100	Yes
Phenol	350 - 3,600	82	773	21	25.6	Yes
Prometon	50 - 50	1		0	0	No
Prometryn	50 - 50	1		0	0	No
Propazine	50 - 50	1		0	0	No
Pyridine	370 - 3,600	29		0	0	No
sec-Butylbenzene	1.08 - 8	26		0	0	No
Simazine	50 - 50	1		0	0	No
Simetryn	50 - 50	1		0	0	No
Styrene	0.874 - 1,300	80		0	0	No
Terbutryn	50 - 50	1		0	0	No
Terbutylazine	50 - 50	1		0	0	No
tert-Butylbenzene	1.05 - 8	26		0	0	No
Tetrachloroethene	1.25 - 1,300	77	3,050	0	0	Yes
Toxaphene	170 - 2,300	66		0	0	No
trans-1,2-Dichloroethene	1.38 - 8	25	657	0	0	Yes
trans-1,3-Dichloropropene	0.923 - 1,300	80		0	0	No
Trichloroethene	0.655 - 1,300	78	22,800	0	0	Yes
Vinyl acetate	10 - 24	36		0	0	No
Vinyl Chloride	2.90 - 1,300	79		0	0	Yes
Xylene	2.65 - 1,300	77	91	2	2.60	Yes

Table A1.2SWAEU.4

Summary of Professional Judgment and Ecological Risk Potential for Analytes in Sediment for the SW AEU

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE										ECOLOGICAL RISK POTENTIAL				
	Listed as Waste Constituent for SW AEU Historical IHSSs ? <sup>1</sup>	Historical RFETS Inventory <sup>2</sup> (1974/1988) (kg)	MDC in SW AEU Surface Soil (ug/kg)	Percent Detects in SW AEU Surface Soil (%)	MDC in SW AEU Sediment (ug/kg)	Percent Detects in SW AEU Sediment (%)	MDC in Sediment Sitewide (ug/kg)	Percent Detects in Sitewide Sediment (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty Category <sup>3</sup>	ESL <sup>4</sup> (ug/kg)	LOEC <sup>5</sup>	Maximum Reported Result for Non-detects in SW AEU (ug/kg)	Maximum Reported Result/ LOEC	Potential for Adverse Effects if Detected at Reported Results Levels?
1,2,4-trichlorobenzene	No	.02/.02	150	0.5	2	1.0	2	0.3	No	3	429	NVA	3600	NA	I
1,3-dichlorobenzene	No	0/.01	NA	0	NA	0	NA	0	No	1	122	NVA	3600	NA	I
2,4,6-trichlorophenol	No	0/.01	950	0.2	NA	0	NA	0	No	3	59.3	NVA	3600	NA	I
2-methylnaphthalene	No	0/.110	290	5.2	41	1.2	2000	3.1	No	3	20.2	201	3600	200	Yes
4,4' DDD	No	0/.001	10	1.4	NA	0	4.1	0.4	No	3	4.88	NVA	41	NA	I
4,4' DDE	No	0/.001	7.2	4.7	4.1	1.5	18	2.2	No	3	3.16	NVA	41	NA	I
4,4' DDT	No	0/.001	26	1.4	NA	0	18	2.2	No	3	4.16	62.9	41	0.7	No
4-bromophenyl-phenylether	No	0/.005	NA	0	NA	0	NA	0	No	1	166	NVA	3600	NA	I
4-methylphenol	No	0/.02	NA	0	47	1.2	1500	3.1	No	3	12.3	670	3600	5.4	Yes
acenaphthylene	Yes(1)	.02/.02	NA	0	NA	0	NA	0	No	2	5.87	NVA	1800	NA	I
aldrin	No	0/.003	2.5	2.1	NA	0	54	1.3	No	3	8.25	NVA	23	NA	I
alpha-chlordane	No	0/0	NA	0	NA	0	NA	0	No	1	3.24	NVA	200	NA	I
benzyl alcohol	No	.02/.02	NA	0	41	1.5	41	0.4	No	3	1.35	NVA	7100	NA	I
beta-chlordane	No	0/0	NA	0	NA	0	NA	0	No	1	3.24	NVA	200	NA	I
chlordane	No	0/.003	NA	0	NA	0	NA	0	No	1	3.24	NVA	94	NA	I
delta-BHC	No	0/0	23	0.7	NA	0	13	1.3	No	3	2.37	NVA	23	NA	I
dibenzofuran	No	.02/.01	490	7.4	65	4.8	300	3.8	No	3	325	NVA	3600	NA	I
dieldrin	No	0/.003	92	6.8	4.6	1.5	4.6	0.4	No	3	5.94	NVA	41	NA	I
diethylphthalate	Yes(1)	0/.03	420	1.2	53	1.2	79	1.0	No	3	108	NVA	3600	NA	I
endosulfan I	No	0/.001	7.4	1.4	NA	0	20	1.3	No	3	0.69	NVA	23	NA	I
endosulfan II	No	0/.001	9.9	2.0	NA	0	NA	0	No	3	0.69	NVA	41	NA	I
endosulfan sulfate	No	0/.002	11	1.4	NA	0	NA	0	No	3	0.69	NVA	41	NA	I
gamma-BHC (lindane)	No	0/.002	8.3	0.7	25	1.5	25	0.9	No	3	2.37	NVA	23	NA	I
gamma-chlordane	No	0/.003	NA	0	NA	0	NA	0	No	1	3.24	NVA	130	NA	I
heptachlor	No	0/.003	NA	0	NA	0	3.1	1.3	No	3	0.132	16	23	1	No
heptachlor epoxide	No	0/.001	7.2	0.7	33	1.5	33	1.3	No	3	2.47	16	89	6	Yes
hexachloro-butadiene	No	0/.005	2.2	0.2	2	1.0	2	0.3	No	3	23	NVA	3600	NA	I
methoxychlor	No	0/.002	12	4.7	2.7	1.5	2.7	0.4	No	3	24	NVA	200	NA	I
naphthalene	No	1.8/.922	760	13.2	59	4.9	320	6.4	No	3	176	561	3600	6	Yes
PCB-1016	Yes(2)	0/.006	95	1.6	NA	0	NA	0	No	3	40	676	520	0.9	No
PCB-1221	Yes(2)	0/.02	NA	0	NA	0	NA	0	No	2	40	676	520	0.9	No
PCB-1232	Yes(2)	0/.007	NA	0	NA	0	NA	0	No	2	40	676	520	0.9	No
PCB-1242	Yes(2)	0/.02	350	0.4	NA	0	NA	0	No	3	40	676	520	0.9	No
PCB-1248	Yes(2)	0/.007	840	0.7	NA	0	NA	0	No	3	40	676	520	0.9	No
pentachlorophenol	No	.02/.02	470	0.8	1100	3.6	1500	2.1	No	3	255	360	18000	50	Yes

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> Basis for the NOEC.

<sup>5</sup> LOECs developed as described in Attachment 5 to Appendix A, Volumes 15B1 and 15B2 of the RI/FS report. The LOEC for specific Aroclors is based on total PCBs.

(1) There are several historical IHSSs in the SW AEU where wastes were burned or there was a release of oil. Phthalates may also be a component of oil.

(2) There are several historical IHSSs in the SW AEU where transformers had leaked.

CDH – Colorado Department of Health

DDD - dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

DOE – Department of Energy

ESL – Ecological Screening Level

IHSS – Individual Hazardous Substance Site

LOEC –Lowest Observed Effect Concentration

MDC – Maximum Detected Concentration

NOEC - No Observed Effect Concentration

SW AEU – South Walnut Creek Aquatic Exposure Unit

PCB – Polychlorinated Biphenyl

RFETS – Rocky Flats Environmental Technology Site

I - Inconclusive

NA – Not applicable

**Table A1.2.WCAEU.1**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Surface Water in the WC AEU**

Analyte	Range of Nondetected Reported Results		Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Inorganics (Dissolved) (mg/L)</b>							
Bromide	-	-	0		0	0	No
Cerium	1.00E-04	- 1.00E-04	2		0	0	No
Cyanide	-	-	0	5.00E-04	0	0	Yes
Phosphate	0.0200	- 0.0200	12		0	0	No
Thallium	1.00E-04	- 0.109	249	0.0150	7	2.81	Yes
Tin	0.00100	- 0.136	201	0.0730	3	1.49	Yes
<b>Inorganics (Total) (mg/L)</b>							
Bromide	0.500	- 0.500	3		0	0	No
Cerium	0.00120	- 0.00128	2		0	0	No
Cyanide	0	- 0.0500	173	5.00E-04	168	97.1	Yes
Phosphate	0.0100	- 0.160	46		0	0	No
Thallium	2.00E-05	- 5.20	554	0.0150	5	0.903	Yes
Tin	4.80E-04	- 0.136	480	0.0730	3	0.625	Yes
<b>Organics (Total) (ug/L)</b>							
1,1,1,2-Tetrachloroethane	0.100	- 1	57		0	0	No
1,1,1-Trichloroethane	0.100	- 10	281	89	0	0	Yes
1,1,2,2-Tetrachloroethane	0.100	- 10	281	2,400	0	0	No
1,1,2-Trichloro-1,2,2-trifluoroethane	5	- 5	11	32	0	0	No
1,1,2-Trichloroethane	0.100	- 10	281	940	0	0	No
1,1-Dichloroethane	0.100	- 10	281	740	0	0	No
1,1-Dichloroethene	0.200	- 10	281	65	0	0	No
1,1-Dichloropropene	0.100	- 1	60		0	0	No
1,2,3-Trichlorobenzene	0.100	- 1	60	8	0	0	No
1,2,3-Trichloropropane	0.100	- 1	60		0	0	No
1,2,4-Trichlorobenzene	0.100	- 16	150	50	0	0	No
1,2,4-Trimethylbenzene	0.100	- 1	60	17	0	0	No
1,2-Dibromo-3-chloropropane	0.200	- 2	54		0	0	No
1,2-Dibromoethane	0.200	- 1	60		0	0	No
1,2-Dichlorobenzene	0.100	- 16	155	13	2	1.29	No
1,2-Dichloroethane	0.100	- 14	279	20,000	0	0	Yes
1,2-Dichloroethene	5	- 21	229	1,100	0	0	Yes
1,2-Dichloropropane	0.100	- 10	281	5,700	0	0	No
1,3,5-Trimethylbenzene	0.100	- 1	60	45	0	0	No
1,3-Dichlorobenzene	0.100	- 16	155	28	0	0	No
1,3-Dichloropropane	0.100	- 1	60		0	0	No
1,4-Dichlorobenzene	0.100	- 16	155	16	0	0	Yes
2,2-Dichloropropane	0.100	- 1	59		0	0	No
2,4,5-T	0.100	- 10	11		0	0	No
2,4,5-TP (Silvex)	0.100	- 10	27		0	0	No
2,4,5-Trichlorophenol	10	- 78	128		0	0	No
2,4,6-Trichlorophenol	1	- 16	128	5	114	89.1	No
2,4-D	0.460	- 10	27		0	0	No
2,4-DB	0.910	- 10	11		0	0	No
2,4-Dichlorophenol	5	- 16	128	365	0	0	No
2,4-Dimethylphenol	5	- 16	128	212	0	0	No
2,4-Dinitrophenol	25	- 78	121		0	0	No
2,4-Dinitrotoluene	5	- 16	128		0	0	No
2,6-Dinitrotoluene	5	- 16	130		0	0	No
2378-TCDD	2.70E-04	- 0.00400	14		0	0	No
2-Butanone	2	- 17	207	2,200	0	0	Yes
2-Chloroethyl vinyl ether	0	- 10	17		0	0	No
2-Chloronaphthalene	5	- 16	130	630	0	0	No
2-Chlorophenol	5	- 16	128		0	0	No
2-Chlorotoluene	0.200	- 1	60		0	0	No
2-Hexanone	10	- 10	234	99	0	0	No
2-Methylnaphthalene	5	- 16	130		0	0	No
2-Methylphenol	5	- 16	128	82	0	0	No
2-Nitroaniline	25	- 78	130		0	0	No
2-Nitrophenol	5	- 16	128		0	0	No

**Table A1.2.WCAEU.1**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Surface Water in the WC AEU**

Analyte	Range of Nondetected Reported Results		Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
3 & 4-methyl phenol	10	- 11	10		0	0	No
3,3'-Dichlorobenzidine	10	- 31	119		0	0	No
3-Nitroaniline	25	- 78	128		0	0	No
4,4'-DDD	0.0460	- 0.500	109	0.0600	108	99.1	Yes
4,4'-DDE	0.0190	- 0.500	109	105	0	0	Yes
4,4'-DDT	0.0100	- 0.500	109	0.00100	109	100	Yes
4,6-Dinitro-2-methylphenol	25	- 78	126		0	0	No
4-Bromophenyl-phenylether	5	- 16	130		0	0	No
4-Chloro-3-methylphenol	5	- 22	128		0	0	No
4-Chloroaniline	5	- 22	129		0	0	No
4-Chlorophenyl-phenyl ether	5	- 16	130		0	0	No
4-Chlorotoluene	0.200	- 1	60		0	0	No
4-Isopropyltoluene	0.200	- 1	60		0	0	No
4-Methyl-2-pentanone	10	- 10	231	170	0	0	No
4-Methylphenol	5	- 16	118	25	0	0	No
4-Nitroaniline	25	- 78	122		0	0	No
4-Nitrophenol	25	- 78	124		0	0	No
Acenaphthene	1	- 16	130	520	0	0	No
Acenaphthylene	1	- 16	130		0	0	No
Acrylonitrile	10	- 10	14		0	0	No
Aldrin	0.0490	- 0.250	109	0.150	2	1.83	No
alpha-BHC	0.0490	- 0.250	109	2.20	0	0	No
alpha-Chlordane	0.0500	- 2.50	106		0	0	No
Ametryne	0.180	- 0.670	35		0	0	No
Anthracene	0.0297	- 16	130	0.730	121	93.1	No
Atraton	0.510	- 0.670	22		0	0	No
Benzene	0.100	- 10	281	530	0	0	Yes
Benzidine	10	- 10	4		0	0	No
Benzo(a)anthracene	0.178	- 16	130	0.0270	130	100	No
Benzo(a)pyrene	0.139	- 16	130	0.0140	130	100	No
Benzo(b)fluoranthene	0.148	- 16	130		0	0	No
Benzo(g,h,i)perylene	0.594	- 16	128		0	0	No
Benzo(k)fluoranthene	0.0792	- 16	130		0	0	No
Benzoic Acid	6	- 78	110	42	99	90	Yes
Benzyl Alcohol	3	- 22	115	8.60	104	90.4	Yes
beta-BHC	0.0100	- 0.250	109	2.20	0	0	Yes
beta-Chlordane	0.0500	- 1	72		0	0	No
bis(2-Chloroethoxy) methane	5	- 16	130		0	0	No
bis(2-Chloroethyl) ether	5	- 16	130		0	0	No
bis(2-Chloroisopropyl) ether	5	- 16	128	29	0	0	No
Bladex	0.300	- 0.300	13		0	0	No
Bromobenzene	0.200	- 1	60		0	0	No
Bromochloromethane	0.500	- 1	57		0	0	No
Bromodichloromethane	0.200	- 10	281	1,100	0	0	No
Bromoform	0.200	- 10	281	320	0	0	Yes
Bromomethane	0.200	- 10	272	35	0	0	No
Butylbenzylphthalate	0.700	- 16	130	67	0	0	Yes
Carbazole	10	- 11	14	4	14	100	No
Carbon Disulfide	5	- 10	240	0.920	240	100	Yes
Carbon Tetrachloride	0.200	- 76	275	3,520	0	0	Yes
Chlordane (NOS)	0.500	- 0.500	3		0	0	No
Chlorobenzene	0.100	- 10	281	47	0	0	Yes
Chloroethane	0.200	- 10	273		0	0	No
Chloroform	0.100	- 22	281	1,240	0	0	Yes
Chloromethane	0.200	- 10	280		0	0	Yes
Chrysene	0.515	- 16	130		0	0	No
cis-1,3-Dichloropropene	0.100	- 10	278	244	0	0	No
Dalapon	1.10	- 10	11		0	0	No
delta-BHC	0.0200	- 0.250	109	2.20	0	0	Yes
Dibenz(a,h)anthracene	1.01	- 16	130		0	0	No

**Table A1.2.WCAEU.1**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Surface Water in the WC AEU**

Analyte	Range of Nondetected Reported Results		Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Dibenzofuran	5	- 16	130	4	130	100	No
Dibromochloromethane	0.200	- 10	281		0	0	No
Dibromomethane	0.200	- 1.10	60		0	0	No
Dicamba	0.100	- 10	11	10	0	0	No
Dichlorodifluoromethane	0.200	- 1	65		0	0	No
Dichloroprop	0.500	- 10	11		0	0	No
Dieldrin	0.0980	- 0.500	109	0.0560	109	100	No
Diethylphthalate	2	- 16	130	110	0	0	Yes
Dimethylphthalate	5	- 16	130		0	0	No
Di-n-octylphthalate	5	- 16	130		0	0	No
Dinoseb	0.0700	- 10	11	0.480	7	63.6	No
Diphenylamine	10	- 11	11		0	0	No
Endosulfan I	0.0490	- 0.250	109	0.0560	13	11.9	No
Endosulfan II	0.0980	- 0.500	109	0.0560	109	100	No
Endosulfan sulfate	0.0980	- 0.500	109	0.0560	109	100	No
Endrin	0.0980	- 0.500	109	0.0360	109	100	No
Endrin aldehyde	0.100	- 0.110	19	0.0360	19	100	No
Endrin ketone	0.0980	- 0.500	106	0.0360	106	100	No
Ethylbenzene	0.200	- 10	281	3,200	0	0	No
Fluoranthene	0.614	- 16	130	398	0	0	No
Fluorene	0.297	- 16	130	12	3	2.31	No
gamma-BHC (Lindane)	0.0490	- 0.250	109	0.0800	7	6.42	No
gamma-Chlordane	0.490	- 2.50	34		0	0	No
Heptachlor	0.0490	- 0.250	109	0.00380	109	100	No
Heptachlor epoxide	0.0490	- 0.250	109	0.00380	109	100	No
Hexachlorobenzene	1	- 16	130		0	0	No
Hexachlorobutadiene	0.100	- 16	150	9.30	86	57.3	No
Hexachlorocyclopentadiene	5	- 16	129		0	0	No
Hexachloroethane	1	- 16	130	540	0	0	No
Indeno(1,2,3-cd)pyrene	0.297	- 16	130		0	0	No
Isophorone	5	- 16	130	1,300	0	0	No
Isopropylbenzene	0.200	- 1	60		0	0	No
m,p-Xylene	0.200	- 2	24	35	0	0	No
MCPA	100	- 10,000	11		0	0	No
MCPP	100	- 10,000	11		0	0	No
Methoxychlor	0.490	- 2.50	106		0	0	No
Naphthalene	0.200	- 16	150	620	0	0	No
n-Butylbenzene	0.200	- 1	60		0	0	No
Nitrobenzene	5	- 16	130		0	0	No
N-Nitrosodiethylamine	5	- 5	4		0	0	No
N-Nitrosodimethylamine	5	- 5	4		0	0	No
N-Nitrosodi-n-butylamine	5	- 5	4		0	0	No
N-Nitroso-di-n-propylamine	5	- 16	130		0	0	No
N-nitrosodiphenylamine	5	- 16	119		0	0	No
N-Nitrosopyrrolidine	10	- 10	4		0	0	No
n-Propylbenzene	0.200	- 1	60		0	0	No
o-Xylene	0.200	- 1	37	35	0	0	No
PCB-1016	0.490	- 2.50	106	0.0140	106	100	No
PCB-1221	0.490	- 2.50	106	0.0140	106	100	No
PCB-1232	0.490	- 2.50	106	0.0140	106	100	No
PCB-1242	0.490	- 2.50	106	0.0140	106	100	No
PCB-1248	0.490	- 2.50	106	0.0140	106	100	No
PCB-1254	0.980	- 5	106	0.0140	106	100	No
PCB-1260	0.980	- 5	106	0.0140	106	100	No
Pentachlorophenol	5	- 78	128	6.73	127	99.2	Yes
Phenanthrene	0.693	- 16	130	2.40	118	90.8	No
Phenol	5	- 16	128	2,560	0	0	No
Prometon	0.0900	- 0.330	35		0	0	Yes
Prometryn	0.180	- 0.670	35		0	0	No
Propazine	0.0900	- 0.330	35		0	0	No

**Table A1.2.WCAEU.1**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Surface Water in the WC AEU**

Analyte	Range of Nondetected Reported Results			Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
Pyrene	0.594	-	16	129	0.0250	129	100	Yes
sec-Butylbenzene	0.200	-	1	60		0	0	No
Simazine	0.180	-	1.10	40	10	0	0	No
Simetryn	0.210	-	0.780	35		0	0	No
Styrene	0.100	-	10	276	160	0	0	No
Terbutryn	0.0100	-	0.560	22		0	0	No
Terbutylazine	0.0900	-	0.330	35		0	0	No
tert-Butylbenzene	0.200	-	1	60		0	0	No
Toluene	0.100	-	10	282	1,750	0	0	Yes
Toxaphene	0.980	-	5.70	109		0	0	No
trans-1,2-Dichloroethene	0.100	-	1	65	1,500	0	0	No
trans-1,3-Dichloropropene	0.100	-	10	278	244	0	0	No
Tributyl phosphate	100	-	110	11		0	0	No
Trichlorofluoromethane	0.200	-	1	65		0	0	No
Vinyl acetate	10	-	10	209		0	0	No
Vinyl Chloride	0.200	-	10	281	930	0	0	No
Xylene	0.500	-	10	263	35	0	0	Yes

**Table A1.2.WC AEU.2  
Summary of Professional Judgment and Ecological Risk Potential for Analytes in Surface Water for the WC AEU**

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE												ECOLOGICAL RISK POTENTIAL						
	Listed as Waste Constituent for WC AEU Historical IHSSs ?1	Historical RFETS Inventory 2 (1974/1988) (kg)	Max Conc. In WC AEU Surface Soil (µg/kg)	Percent Detects in WC AEU Surface Soil (µg/kg)	Max Conc. In WC AEU Sediment (µg/kg)	Percent Detects in WC AEU Sediment (%)	Max. Conc. In WC AEU Surface Water (µg/L)	Percent Detects in WC AEU Surface Water (%)	Maximum Conc. in Surface Water Sitewide (µg/L)	Detection Frequency in Sitewide Surface Water (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty Category3	ESL (µg/L) 4	Acute Effects Value5	Maximum Reported Result for Non-Detects in WC AEU (µg/kg)	Maximum Reported Result for Non-Detects/ ESL	Potential for Chronic Effects if Detected at Reported Results Levels?	Maximum Reported Result for Non-Detects/ Acute Effects Value	Potential for Acute Effects if Detected at Reported Results Levels?
Cyanide6	No	0/48.2	NA	0	NS	0.00	0.016	1.7	0.146	7.9	No	4	0.0005	0.005	0.05	100.00	Yes	10.00	Yes
2,4,6-trichlorophenol	No	0/01	NA	0	ND	0.00	NA	0	NA	0	No	1	5	79	16	3.20	Yes	0.20	No
4,4'-DDD	Yes(1)	0/001	NA	0	ND	0.00	0.046	0.9	0.1	0.6	No	3	0.06	0.6	0.5	8.33	Yes	0.83	No
4,4'-DDT	Yes(1)	0/001	21	0.8	18	1.69	0.073	4.6	18	0.58	No	4	0.001	0.55	0.5	500.00	Yes	0.91	No
anthracene	Yes(2)	.5/02	47000	14.5	470	9.84	NA	0	2	0.2	Yes	3	0.73	13	16	21.92	Yes	1.23	Yes
benzo(a)anthracene	Yes(2)	0/0	45000	30.7	1200	18.03	NA	0	8	0.2	Yes	3	0.027	0.49	16	592.59	Yes	32.65	Yes
benzo(a)pyrene	Yes(2)	0/002	43000	22.8	970	13.11	NA	0	9	0.2	Yes	3	0.014	0.24	16	1142.86	Yes	66.67	Yes
benzoic acid	No	0/0	1100	17.5	660	10.53	42	1.8	42	1.5	No	3	42	740	78	1.86	Yes	0.11	No
benzyl alcohol	No	.02/02	270	0.5	ND	0.00	3	0.9	860	1.8	Yes	3	8.6	150	22	2.56	Yes	0.15	No
carbazole	No	0/01	39	33.3	ND	0.00	NA	0	3	1.9	Yes	3	4	72	11	2.75	Yes	0.15	No
carbon disulfide	No	3.3/5.9	NA	0	ND	0.00	8	0.4	8	0.3	No	3	0.92	17	10	10.87	Yes	0.59	No
dibenzofuran	Yes(2)	.02/01	20000	5.8	230	1.64	NA	0	2	1.6	No	3	4	72	16	4.00	Yes	0.22	No
dieldrin	Yes(1)	0/003	34	0.8	ND	0.00	NA	0	NA	0	No	3	0.056	0.24	0.5	8.93	Yes	2.08	Yes
dinoseb	No	0/0	NA	0	NS	0.00	NA	0	0.34	2.2	No	2	0.48	9.5	10	20.83	Yes	1.05	Yes
endosulfan II	Yes(1)	0/001	NA	0	ND	0.00	NA	0	NA	0	No	2	0.056	0.22	0.5	8.93	Yes	2.27	Yes
endosulfan sulfate	Yes(1)	0/001	24	0.8	ND	0.00	NA	0	NA	0	No	3	0.056	0.22	0.5	8.93	Yes	2.27	Yes
endrin	Yes(1)	0/004	NA	0	ND	0.00	NA	0	0.02	0.3	No	2	0.036	0.086	0.5	13.89	Yes	5.81	Yes
endrin aldehyde	Yes(1)	0/002	NA	0	ND	0.00	NA	0	NA	0	No	2	0.036	0.086	0.11	3.06	Yes	1.28	Yes
endrin ketone	Yes(1)	0/0	36	0.8	ND	0.00	NA	0	NA	0	No	3	0.036	0.086	0.5	13.89	Yes	5.81	Yes
heptachlor	Yes(1)	0/003	NA	0	3.1	5.08	NA	0	NA	0	No	3	0.0038	0.52	0.25	65.79	Yes	0.48	No
heptachlor epoxide	Yes(1)	0/001	10	0.8	0	3.39	NA	0	0.05	0.3	No	3	0.0038	0.52	0.25	65.79	Yes	0.48	No
hexachlorobutadiene	No	0/005	NA	0	ND	0.00	NA	0	0.29	0.1	No	2	9.3	90	16	1.72	Yes	0.18	No
PCB-1016	Yes(3)	0/006	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.5	178.57	Yes	1.25	Yes
PCB-1221	Yes(3)	0/02	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.5	178.57	Yes	1.25	Yes
PCB-1232	Yes(3)	0/007	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.5	178.57	Yes	1.25	Yes
PCB-1242	Yes(3)	0/02	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.5	178.57	Yes	1.25	Yes
PCB-1248	Yes(3)	0/007	NA	0	ND	0.00	NA	0	NA	0	No	2	0.014	2	2.5	178.57	Yes	1.25	Yes
PCB-1254	Yes(3)	0/017	3900	18.2	250	17.39	NA	0	24	2.3	No	3	0.014	2	5	357.14	Yes	2.50	Yes
PCB-1260	Yes(3)	0/02	3300	9.4	ND	0.00	NA	0	NA	0	Yes	3	0.014	2	5	357.14	Yes	2.50	Yes
pentachlorophenol	No	.02/02	NA	0	950	1.64	5	0.8	5	0.4	Yes	3	6.7	17.4	78	11.64	Yes	4.48	Yes
phenanthrene	Yes(2)	.02/02	170000	34.8	2900	25.81	NA	0	11	1.9	Yes	4	2.4	43	16	6.67	Yes	0.37	No
pyrene	Yes(2)	.02/02	120000	43	3100	22.58	2	0.8	12	1.3	Yes	4	0.025	NVA	16	640.00	Yes	No AEV	I

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> ESLs based on chronic effects value.

<sup>5</sup> Chronic and acute effects values are listed in Appendix B, Table B-5, "Surface Water ESLs for Aquatic Receptors", Ref. DOE 2005a.

(1) The Pesticide Shed (PAC 300-702) is in the WC AEU.

(2) There are several historical IHSSs in the WC AEU where wastes were burned or there was a release of oil.

(3) There are several historical IHSSs in the WC AEU where transformers had leaked.

CDH – Colorado Department of Health  
DDE – dichlorodiphenyldichloroethylene  
DDT – dichlorodiphenyltrichloroethane  
DOE – Department of Energy  
ESL – Ecological Screening Level  
IHSS – Individual Hazardous Substance Site  
WC AEU – Woman Creek Aquatic Exposure Unit  
RFETS – Rocky Flats Environmental Technology Site

I - Inconclusive  
NA – Not applicable

**Table A1.2.WCAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the WC AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
<b>Inorganic (mg/kg)</b>						
Chloride	25 - 25	2		0	0	No
Nitrite	0.300 - 2.50	3		0	0	No
Sulfate	25 - 25	2		0	0	No
Uranium	2 - 18	15		0	0	No
<b>Inorganic (ug/kg)</b>						
1,1,1,2-Tetrachloroethane	0.952 - 0.952	1		0	0	No
1,1,1-Trichloroethane	0.841 - 16	54	159	0	0	No
1,1,2,2-Tetrachloroethane	0.928 - 16	54	1,900	0	0	No
1,1,2-Trichloro-1,2,2-trifluoroethane	0.840 - 0.840	1		0	0	No
1,1,2-Trichloroethane	1.57 - 16	54		0	0	No
1,1-Dichloroethane	0.782 - 16	54		0	0	No
1,1-Dichloroethene	0.873 - 16	54		0	0	No
1,1-Dichloropropene	0.606 - 0.606	1		0	0	No
1,2,3-Trichlorobenzene	2.05 - 2.05	1	58.6	0	0	No
1,2,3-Trichloropropane	1.08 - 1.08	1		0	0	No
1,2,4-Trichlorobenzene	1.76 - 2,100	61	429	46	75.4	No
1,2,4-Trimethylbenzene	1.20 - 1.20	1	122	0	0	No
1,2-Dibromo-3-chloropropane	2.21 - 2.21	1		0	0	No
1,2-Dibromoethane	1.34 - 1.34	1		0	0	No
1,2-Dichlorobenzene	1.08 - 2,100	55		0	0	No
1,2-Dichloroethane	1.17 - 16	54		0	0	No
1,2-Dichloroethene	5 - 16	53		0	0	No
1,2-Dichloropropane	0.747 - 16	54		0	0	No
1,3,5-Trimethylbenzene	0.942 - 0.942	1	316	0	0	No
1,3-Dichlorobenzene	0.911 - 2,100	61	122	60	98.4	No
1,3-Dichloropropane	0.850 - 0.850	1		0	0	No
1,4-Dichlorobenzene	1.32 - 2,100	55		0	0	No
1234789-HpCDF	0.00226 - 0.00271	2		0	0	No
123478-HxCDD	0.00226 - 0.00271	2		0	0	No
123678-HxCDD	0.00226 - 0.00271	2		0	0	No
123789-HxCDD	0.00226 - 0.00271	2		0	0	No
123789-HxCDF	0.00226 - 0.00271	2		0	0	No
12378-PeCDF	0.00226 - 0.00271	2		0	0	No
2,2-Dichloropropane	0.667 - 0.667	1		0	0	No
2,4,5-Trichlorophenol	410 - 10,000	61		0	0	No
2,4,6-Trichlorophenol	350 - 2,100	61	59.3	61	100	No
2,4-Dichlorophenol	350 - 2,100	61		0	0	No
2,4-Dimethylphenol	350 - 2,100	61		0	0	No
2,4-Dinitrophenol	960 - 10,000	56		0	0	Yes
2,4-Dinitrotoluene	350 - 2,100	61		0	0	No
2,6-Dinitrotoluene	350 - 2,100	61		0	0	No
2378-TCDD	9.04E-04 - 0.00108	2	0.00850	0	0	No
2378-TCDF	9.04E-04 - 0.00108	2		0	0	No
2-Chloronaphthalene	350 - 2,100	61		0	0	No
2-Chlorophenol	350 - 2,100	61		0	0	No
2-Chlorotoluene	0.680 - 0.680	1		0	0	No
2-Hexanone	2.20 - 32	52		0	0	No
2-Methylnaphthalene	350 - 2,100	60	20.2	60	100	Yes
2-Methylphenol	350 - 2,100	61	6,970	0	0	No
2-Nitroaniline	960 - 10,000	61		0	0	No
2-Nitrophenol	270 - 2,100	61		0	0	No
3,3'-Dichlorobenzidine	380 - 4,100	60		0	0	No
3-Nitroaniline	960 - 10,000	61		0	0	No
4,4'-DDD	3.80 - 200	59	4.88	57	96.6	No
4,4'-DDE	3.80 - 200	59	3.16	59	100	No
4,4'-DDT	3.80 - 200	58	4.16	56	96.6	Yes

**Table A1.2.WCAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the WC AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
4,6-Dinitro-2-methylphenol	960 - 10,000	58		0	0	Yes
4-Bromophenyl-phenylether	350 - 2,100	61	166	61	100	No
4-Chloro-3-methylphenol	350 - 3,100	61		0	0	No
4-Chloroaniline	350 - 3,100	61		0	0	No
4-Chlorophenyl-phenyl ether	350 - 2,100	61		0	0	No
4-Chlorotoluene	0.891 - 0.891	1		0	0	No
4-Isopropyltoluene	0.990 - 0.990	1		0	0	No
4-Methyl-2-pentanone	2.78 - 32	53		0	0	Yes
4-Nitroaniline	960 - 10,000	57		0	0	No
4-Nitrophenol	960 - 10,000	61		0	0	No
Acenaphthylene	350 - 2,100	61	5.87	61	100	No
Aldrin	1.90 - 99	57	8.25	53	93.0	Yes
alpha-BHC	1.90 - 99	59	43.9	6	10.2	No
alpha-Chlordane	1.90 - 990	57	3.24	54	94.7	Yes
Ametryne	50 - 50	2		0	0	No
Atraton	50 - 50	2		0	0	No
Atrazine	50 - 410	3	16.8	3	100	No
Benzene	0.900 - 16	54	260	0	0	No
Benzyl Alcohol	350 - 3,100	58	1.35	58	100	No
beta-BHC	1.90 - 99	57	93.6	1	1.75	Yes
beta-Chlordane	1.90 - 330	29	3.24	26	89.7	No
bis(2-Chloroethoxy) methane	350 - 2,100	61		0	0	No
bis(2-Chloroethyl) ether	350 - 2,100	61		0	0	No
bis(2-Chloroisopropyl) ether	350 - 2,100	59		0	0	No
Bromobenzene	0.954 - 0.954	1		0	0	No
Bromochloromethane	1.03 - 1.03	1		0	0	No
Bromodichloromethane	1.08 - 16	54		0	0	No
Bromoform	1.18 - 16	54		0	0	No
Bromomethane	4.43 - 32	54	3.43	54	100	No
Butylbenzylphthalate	350 - 2,100	59	11,400	0	0	Yes
Carbazole	380 - 480	3	25.2	3	100	No
Carbon Disulfide	0.898 - 16	54		0	0	No
Carbon Tetrachloride	0.823 - 16	54	7,890	0	0	No
Chlorobenzene	0.717 - 16	54		0	0	No
Chloroethane	2.23 - 32	54		0	0	No
Chloroform	0.777 - 16	54		0	0	No
Chloromethane	2.51 - 32	51		0	0	No
cis-1,2-Dichloroethene	1.13 - 1.13	1		0	0	No
cis-1,3-Dichloropropene	1.13 - 16	54		0	0	No
delta-BHC	1.90 - 99	57	2.37	55	96.5	Yes
Dibenz(a,h)anthracene	350 - 2,100	58	33	58	100	Yes
Dibenzofuran	350 - 2,100	60	325	60	100	Yes
Dibromochloromethane	1.17 - 16	54		0	0	No
Dibromomethane	1.12 - 1.12	1		0	0	No
Dichlorodifluoromethane	2.76 - 2.76	1		0	0	No
Dieldrin	3.80 - 200	59	5.94	56	94.9	No
Diethylphthalate	350 - 2,100	61	108	61	100	Yes
Dimethylphthalate	350 - 2,100	61		0	0	No
Di-n-octylphthalate	350 - 2,100	59		0	0	Yes
Endosulfan I	1.90 - 99	57	0.690	57	100	Yes
Endosulfan II	3.80 - 200	59	0.690	59	100	No
Endosulfan sulfate	3.80 - 200	59	0.690	59	100	No
Endrin	3.80 - 200	59		0	0	No
Endrin aldehyde	3.80 - 11	4		0	0	No
Endrin ketone	3.80 - 200	59		0	0	No
Ethylbenzene	0.657 - 16	54	16,570	0	0	No
Fluorene	350 - 2,100	60	77.4	60	100	Yes

**Table A1.2.WCAEU.3**  
**Evaluation of Reported Results for Nondetected Analytes and Analytes with a Detection Frequency less than**  
**5 Percent in Sediment in the WC AEU**

Analyte	Range of Nondetected Reported Results	Total Number of Nondetected Results	Lowest ESL	Number of Nondetected Results > ESL	Percent Nondetected Results > ESL	Analyte Detected?
gamma-BHC (Lindane)	1.90 - 99	58	2.37	56	96.6	Yes
Heptachlor epoxide	1.90 - 99	57	2.47	54	94.7	Yes
Hexachlorobenzene	350 - 2,100	61		0	0	No
Hexachlorobutadiene	1.13 - 2,100	61	23	60	98.4	No
Hexachlorocyclopentadiene	350 - 2,100	60		0	0	No
Hexachloroethane	350 - 2,100	61		0	0	No
Isophorone	270 - 2,100	61		0	0	No
Isopropylbenzene	0.516 - 0.516	1		0	0	No
Methoxychlor	19 - 990	59	24	56	94.9	No
Naphthalene	350 - 2,100	59	176	59	100	Yes
n-Butylbenzene	1.34 - 1.34	1		0	0	No
Nitrobenzene	350 - 2,100	61		0	0	No
N-Nitroso-di-n-propylamine	350 - 2,100	61		0	0	No
N-nitrosodiphenylamine	350 - 2,100	61		0	0	No
n-Propylbenzene	0.828 - 0.828	1		0	0	No
PCB-1016	36 - 990	68	40	66	97.1	No
PCB-1221	36 - 990	68	40	67	98.5	No
PCB-1232	36 - 990	68	40	66	97.1	No
PCB-1242	36 - 990	68	40	66	97.1	No
PCB-1248	36 - 990	68	40	66	97.1	No
PCB-1260	38 - 2,000	66	40	65	98.5	No
Pentachlorophenol	960 - 10,000	60	255	60	100	Yes
Phenol	350 - 2,100	60	773	14	23.3	Yes
Prometon	50 - 50	2		0	0	No
Prometryn	50 - 50	2		0	0	No
Propazine	50 - 50	2		0	0	No
Pyridine	820 - 1,600	6		0	0	No
sec-Butylbenzene	0.786 - 0.786	1		0	0	No
Simazine	50 - 50	2		0	0	No
Simetryn	50 - 50	2		0	0	No
Styrene	0.900 - 16	54		0	0	No
Terbutryn	50 - 50	2		0	0	No
Terbutylazine	50 - 50	2		0	0	No
tert-Butylbenzene	1.06 - 1.06	1		0	0	No
Tetrachloroethene	5 - 16	52	3,050	0	0	Yes
Toxaphene	85 - 2,000	59		0	0	No
trans-1,2-Dichloroethene	1.09 - 1.09	1	657	0	0	No
trans-1,3-Dichloropropene	1.09 - 16	54		0	0	No
Trichloroethene	0.715 - 16	54	22,800	0	0	Yes
Trichlorofluoromethane	0.935 - 0.935	1		0	0	No
Vinyl acetate	11 - 32	49		0	0	No
Vinyl Chloride	2.45 - 32	54		0	0	No
Xylene	3.50 - 16	53	91	0	0	Yes

ND - Not detected  
NS - Not sampled  
No ESL – No chronic ESL available  
No AEV – No acute effects level available  
NVA - No value

Table A1.2 WCAEU.4

Summary of Professional Judgment and Ecological Risk Potential for Analytes in Sediment for the WC AEU

ANALYTE	SUMMARY OF PROCESS KNOWLEDGE										ECOLOGICAL RISK POTENTIAL				
	Listed as Waste Constituent for WC AEU Historical IHSSs <sup>1</sup>	Historical RFETS Inventory <sup>2</sup> (1974/1988) (kg)	Max Conc. in WC AEU Surface Soil (ug/kg)	Percent Detects in WC AEU Surface Soil (%)	Max Conc. in WC AEU Sediment (ug/kg)	Percent Detects in WC AEU Sediment (%)	Max Conc. in Sediment Sitewide (ug/kg)	Percent Detects in Sitewide Sediment (%)	Potential to be Site-Related Contaminant Based on Professional Judgment?	Uncertainty <sup>3</sup>	ESL <sup>4</sup> (ug/kg)	LOEC <sup>5</sup>	Maximum Reported Result for Non-detects in WC AEU (ug/kg)	Maximum Reported Result/ LOEC	Potential for Adverse Effects if Detected at Reported Results Levels?
1,2,4-trichlorobenzene	No	.02/.02	1.3	0.6	NA	0	2	0.3	No	3	429	NVA	2100	NA	I
1,3-dichlorobenzene	No	0/.01	NA	0	NA	0	NA	0	No	1	122	NVA	2100	NA	I
2,4,6-trichlorophenol	No	0/.01	NA	0	NA	0	NA	0	No	1	59.3	NVA	2100	NA	I
2-methylnaphthalene	No	0/.110	12000	3.1	110	1.6	2000	3.1	No	3	20.2	201	2100	10	Yes
4,4'DDD	Yes(1)	0/.001	NA	0	NA	0	NA	0	No	2	4.88	NVA	200	NA	I
4,4'DDE	Yes(1)	0/.001	NA	0	NA	0	4.1	0.4	No	3	3.16	NVA	200	NA	I
4,4'DDT	Yes(1)	0/.001	21	0.8	18	1.7	18	2.2	No	3	4.16	62.9	200	3	Yes
4-bromophenyl-phenylether	No	0/.005	NA	0	NA	0	NA	0	No	1	166	NVA	2100	NA	I
acenaphthylene	Yes(2)	.02/.02	600	1.1	NA	0	NA	0	No	3	5.87	NVA	2100	NA	Yes
Aldrin <sup>6</sup>	Yes(1)	0/.003	17	0.8	0	3.4	54	1.3	No	3	8.25	NVA	99	NA	I
alpha-chlordane <sup>6</sup>	Yes(1)	0/0	NA	0	0	3.4	NA	0	No	2	3.24	NVA	990	NA	I
atrazine	Yes(1)	0/7.57	NS	NS	NA	0	120	20	No	2	7.3	100	410	4	Yes
benzyl alcohol	No	.02/.02	270	0.5	NA	0	41	0.4	No	3	1.35	NVA	3100	NA	I
beta-chlordane	Yes(1)	0/0	NA	0	NA	0	NA	0	No	2	3.24	NVA	330	NA	I
bromomethane	No	0/0	NA	0	NA	0	5	2.4	No	2	35	640	32	.05	No
carbazole	No	0/.01	39	33.3	NA	0	300	38	No	3	4	72	480	7	Yes
delta-BHC <sup>6</sup>	Yes(1)	0/0	NA	0	0	3.4	13	1.3	No	2	2.37	NVA	99	NA	I
dibenz(a,h)anthracene	Yes(2)	0/.005	9200	6.0	530	3.3	530	7.6	No	4	33	NVA	2100	NA	I
dibenzofuran	Yes(2)	.02/.01	20000	5.8	230	1.6	300	3.8	No	4	325	NVA	2100	NA	I
dieldrin	Yes(1)	0/.003	34	0.8	NA	0	4.6	0.4	No	3	5.94	NVA	200	NA	I
diethylphthalate	Yes(2)	0/.03	NA	0	79	1.6	79	1.0	No	3	108	NVA	2100	NA	I
endosulfan I <sup>6</sup>	Yes(1)	0/.001	NA	0	0	3.4	20	1.3	No	2	0.69	NVA	99	NA	I
endosulfan II	Yes(1)	0/.001	NA	0	NA	0	NA	0	No	2	0.69	NVA	200	NA	I
endosulfan sulfate	Yes(1)	0/.002	24	0.8	NA	0	NA	0	No	3	0.69	NVA	200	NA	I
fluorene	Yes(2)	.02/.015	39000	10.2	400	1.6	650	9.6	No	4	12	220	2100	10	Yes
gamma-BHC (lindane)	Yes(1)	0/.002	NA	0	4.4	1.7	25	0.9	No	3	2.37	NVA	99	NA	I
heptachlor epoxide <sup>6</sup>	Yes(1)	0/.001	10	0.8	0	3.4	33	1.3	No	3	2.47	16	99	6	Yes
hexachlorobutadiene	No	0/.005	NA	0	NA	0	2	0.3	No	2	23	NVA	2100	NA	I
methoxychlor	Yes(1)	0/.002	450	0.8	NA	0	2.7	0.4	No	3	24	NVA	990	NA	I
naphthalene	Yes(2)	1.8/.922	41000	6.0	300	3.3	320	6.4	No	4	176	561	2100	4	Yes
PCB-1016	Yes(3)	0/.006	NA	0	NA	0	NA	0	No	2	40	NVA	990	NA	I
PCB-1221	Yes(3)	0/.02	NA	0	NA	0	NA	0	No	2	40	NVA	990	NA	I
PCB-1232	Yes(3)	0/.007	NA	0	NA	0	NA	0	No	2	40	NVA	990	NA	I
PCB-1242	Yes(3)	0/.02	NA	0	NA	0	NA	0	No	2	40	NVA	990	NA	I
PCB-1260	Yes(3)	0/.018	3300	9.4	NA	0	2000	2.25	No	3	40	NVA	2000	NA	I
pentachlorophenol	No	.02/.02	NA	0	950	1.6	1500	2.1	No	3	255	360	10000	27.8	Yes

<sup>1</sup> Includes listing of the class of compound, e.g., herbicides, pesticides, chlorinated solvents, polynuclear aromatic hydrocarbons, etc. Ref. DOE, 2005b.

<sup>2</sup> CDH, 1991.

<sup>3</sup> See text for explanation.

<sup>4</sup> Basis for the NOEC.

<sup>5</sup> LOECs developed as described in Attachment 5 to Appendix A, Volumes 15B1 and 15B2 of the RI/FS report.

<sup>6</sup> Detected concentrations were reported by the laboratory as zero with a qualifier code of I – Interference.

(1) The Former Pesticide Storage Area (PAC 600-1005) is in the WC AEU

(2) There are historical IHSSs in the WC AEU where wastes were burned or there was a release of oil. Phthalates may also be a component of oil.

(3) There are historical IHSSs in the WC AEU where transformers had leaked.

CDH – Colorado Department of Health

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

DOE – Department of Energy

ESL – Ecological Screening Level

IHSS – Individual Hazardous Substance Site

LOEC –Lowest Observed Effect Concentration

NOEC - No Observed Effect Concentration

WC AEU – Woman Creek Aquatic Exposure Unit

PCB – Polychlorinated Biphenyl

RFETS – Rocky Flats Environmental Technology Site

I - Inconclusive

NA – Not applicable

NS – No samples (there were no CRA records associated with this analyte in the matrix indicated)

NVA – No value available

**COMPREHENSIVE RISK ASSESSMENT  
NO NAME GULCH AQUATIC EXPOSURE UNIT, ROCK CREEK AQUATIC  
EXPOSURE UNIT, MCKAY DITCH AQUATIC EXPOSURE UNIT,  
SOUTHEAST AQUATIC EXPOSURE UNIT**

**VOLUME 15B2: ATTACHMENT 2**

**Data Quality Assessment**

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## ACRONYMS AND ABBREVIATIONS

AA	atomic absorption
AEU	aquatic exposure unit
ASD	Analytical Services Division
COC	contaminant of concern
CRA	Comprehensive Risk Assessment
CRDL	contract required detection limit
DAR	data adequacy report
DER	duplicate error ratio
DOE	U.S. Department of Energy
DQA	Data Quality Assessment
DQO	data quality objective
DRC	data review checklist
ECOPC	ecological contaminant of potential concern
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESL	ecological screening level
EU	exposure unit
FD	field duplicate
HQ	hazard quotient
IAG	Interagency Agreement
ICP	inductively couple plasma
IDL	instrument detection limit

LCS	laboratory control sample
MDA	minimum detectable activity
MDL	method detection limit
MS	matrix spike
MSA	method of standard additions
MSD	matrix spike duplicate
NW AEU	North Walnut Creek Aquatic Exposure Unit
N/A	not applicable
PARCC	precision, accuracy, representativeness, completeness, and comparability
PPT	Pipette
PRG	preliminary remediation goal
PCB	polychlorinated biphenyl
QC	quality control
RDL	required detection limit
RFETS	Rocky Flats Environmental Technology Site
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SDP	standard data package
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 used in the ecological risk assessments for the three aquatic exposure units (AEUs) presented in this volume of the Comprehensive Risk Assessment (CRA). The three AEUs include the North Walnut Creek AEU (NW AEU), the South Walnut Creek AEU (SW AEU), and the Woman Creek AEU (WC AEU).

The data quality was evaluated against standard precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters by the data validator under the multiple work plans that guided the data collection over the past 15 years, as well as the requirements for the PARCC parameters provided in the CRA Methodology (DOE 2005). The details of this data quality assessment (DQA) process are presented in the Sitewide DQA contained in Appendix A, Volume 2, Attachment 2 of the Remedial Investigation/Feasibility Study (RI/FS).

As described in Section 2.0 of the Sitewide DQA, data processing steps were followed to prepare the data set used in the CRA. A total of 194,491 environmental sampling records associated with the NW AEU, were reduced to 86,107 records that were used in the NW AEU risk assessment. Of the 316,221 records associated with the SW AEU, 122,525 were used in the SW AEU CRA data set. The WC AEU CRA data set contained 68,642 of the 225,224 analytical records available from the database.

Of the 86,107 analytical records existing in the NW AEU CRA data set, 63 percent (54,636 records) have undergone verification or validation (V&V). The V&V review involved applying observation notes and qualifiers flags or observation notes without qualifier flags to the data. Eighty-three percent (101,437 records) of the SW AEU data set, and 75 percent (51,337 records) of the WC AEU data set underwent V&V. The percentage of data in each EU that underwent V&V is presented by analyte group and matrix in Tables A2.1.0 through A2.1.2.

PARCC parameter analysis was used to determine if the data quality could affect the risk assessment decisions (i.e., have significant impact on risk calculations or selection of ecological contaminants of potential concern [ECOPCs]). In consultation with the data users and project team, the primary ways in which the PARCC parameters could impact the risk assessment decisions were identified and these include the following:

- Detect results are falsely identified as nondetects;
- Nondetect results are falsely identified as detects;
- Issues that cause detection limit uncertainty;
- Issues that cause significant overestimation of detect results; and
- Issues that cause significant underestimation of detect results.

## 2.0 SUMMARY OF FINDINGS

### 2.1 PARCC Findings

A summary of V&V observations and the associated, affected PARCC parameter is presented in Tables A2.2.0 through A2.2.2 by analyte group and matrix (i.e. sediment and surface water). Tables A2.3.0 through A2.3.2 present the percentage of the V&V data that were qualified as estimated and/or undetected also by analyte group and matrix. Overall, approximately 14 percent of the NW AEU, 16 percent of the SW AEU, and 15 percent of the WC AEU V&V data were qualified as estimated or undetected. Less than 3 percent of the data reported as detected by the laboratory were qualified as undetected by the validator due to blank contamination in all three AEU. The summaries of data qualified as estimated due to blank contamination is presented in Tables A2.4.0 through A2.4.2. In general, data qualified as estimated or undetected are marked as such because of various laboratory noncompliance issues that are not serious enough to render the data unusable. The precision between field duplicate (FD)/target sample analyte pairs is summarized in Tables A2.5.0 through A2.5.2.

Of the 63 percent of the NW AEU data set that underwent V&V, 83 percent were qualified as having no QC issues, and 14 percent were qualified as estimated or undetected. The remaining 3 percent of the V&V data are qualified with additional flags indicating acceptable and non-estimated data such as “A”, “C”, or “E”.

Of the 83 percent of the SW AEU data set that underwent V&V, 81 percent were qualified as having no issues, and 16 percent were qualified as estimated or undetected. The remaining 3 percent of the V&V data are qualified with additional flags indicating acceptable and non-estimated data such as “A”, “C”, or “E”.

Of the 75 percent of the WC AEU data set that underwent V&V, 82 percent were qualified as having no QC issues, and 15 percent were qualified as estimated or undetected. The remaining 3 percent of the V&V data are qualified with additional flags indicating acceptable and non-estimated data such as “A”, “C”, or “E”.

Rejected data comprises less than 4 percent of all data related to the NW AEU, only approximately 2 percent of the entire SW AEU data set, and approximately 6 percent of the WC AEU. All rejected data were removed from the AEU CRA data sets during the data processing as described in Section 2.0 of the Sitewide DQA.

The general discussion below summarizes the data quality as presented by the data validator’s observations. The relationship between these observations and the PARCC parameters can be found in the Sitewide DQA. Several observations have no impact on data quality because they represent issues that were noted but corrected, or represent other, general observations such as missing documentation that was not required for data assessment. Approximately 17 percent of the NW AEU, 19 percent of the SW AEU, and 15 percent of the WC AEU V&V data were marked with these V&V observations that have no affect on any of the PARCC parameters.

Of the V&V data, approximately 2 percent of the data in each of the three AEU were noted for observations related to precision. Generally, 99 percent of that 2 percent were noted for issues related to sample matrices. Result confirmation and instrument setup observations make up the other 1 percent.

Approximately 26 percent of the NW AEU, and 25 percent of each of the SW and WC AEU V&V data sets were noted for accuracy-related observations. Most observations are laboratory practice issues, although sample specific accuracy issues related to data accuracy were also noted. It is important to note that not all accuracy-related observations resulted in data qualifications however, only approximately 15 percent of each AEU CRA data set was qualified as estimated and/or undetected (Tables A2.3.0 through A2.3.2).

The data were determined to meet the representativeness parameter because sampling locations are spatially distributed such that contaminant randomness and bias considerations are addressed based on the site-specific history (see the Data Adequacy Report [DAR] in Appendix A, Volume 2, Attachment 3). Samples were also analyzed by the SW-846 or alpha-spectroscopy methods and results were documented as quality records according to approved procedures and guidelines (V&V).

Of the V&V data, approximately 30 percent of the NW AEU, 39 percent of the SW AEU, and 37 percent of the WC AEU data sets were noted for observations related to representativeness. Blank and holding time observations make up the majority of that percentage. Others include documentation, matrix, laboratory control sample (LCS), instrument set-up and sensitivity, sample preparation, and other issues. Reportable levels of target analytes were not routinely detected in the laboratory blanks greater than the laboratory RLs and samples were generally stored and preserved properly.

The CRA Methodology specifies completeness criteria based on data adequacy and these criteria and the findings are discussed in the DAR in Appendix A, Volume 2, Attachment 3 of the RI/FS. Additionally, it should be noted that very little V&V data (approximately 2 to 6 percent depending on the AEU) were rejected. See Tables A2.6.0 through A2.6.2 for a summary of the V&V data that were rejected per analyte group and matrix.

Comparability of the AEU CRA data sets is ensured as all analytical results have been converted into common units. Comparability is addressed more specifically in Appendix A, Volume 2, Attachment 2 of the RI/FS.

## **2.2 PARCC Findings Potential Impact on Data Usability**

PARCC parameter influence on data usability is discussed below with an emphasis on the risk assessment decisions as described in the Introduction to this document.

Tables A2.3.0 through A2.3.2 summarize the overall percentage of qualified data, independent of validation observation. These tables are used for overall guidance in selecting analyte group and matrix combinations of interest in the analysis of the risk

assessment decisions, the impact on data usability is better analyzed using Tables A2.5.0 through A2.7.2, as these can be more directly related to the 5 key risk assessment decision factors described in the introduction.

A summary of FD/target sample precision information can be found in Tables A2.5.0 through A2.5.2. Where there are analyte group and matrix combinations failures that have the potential to impact risk assessment decisions, the data quality is discussed in further detail in the Sections 2.1 through 2.3 below.

Tables A2.7.0 through A2.7.2 list V&V observations where the number of observations by analyte group and matrix exceeds 5 percent of the associated records (see column “Percent Observed”), with the exception of those observations that were determined to have no impact on any of the PARCC parameters. Such observations are identified in Tables A2.2.0 through A2.2.2 by an “Affected PARCC Parameter” of not applicable (N/A). Additionally, in Tables A2.7.0 through A2.7.2, the analyte group and matrix is broken down further in the columns “Percent Qualified U” and “Percent Qualified J”. Data qualifications that are considered to have potential impact on risk assessment decisions were reviewed and are discussed in detail in Sections 2.1 through 2.3 below. Other issues are not considered to have the potential for significant impacts on the results of the risk assessments because the uncertainty associated with these data quality issues is assumed to be less than the overall uncertainty in the risk assessment process (e.g., uncertainties such as exposure assumptions, toxicity values, and statistical methods for calculating exposure point concentrations).

### **2.3 North Walnut Creek Aquatic Exposure Unit**

Issues that have the potential to impact the NW AEU risk assessment decisions include the following:

- Approximately 13 percent of the dioxin and furan/surface water data was qualified as estimated and noted with the V&V observation that internal standards did not meet criteria. While this data quality issue has the possibility to impact the accuracy of the associated data, it is important to note that not only are the associated records nondetect results, but also that nonqualified data show that dioxins and furans were never detected in NW AEU surface water. The impact on the NW AEU is determined to be minimal.
- Approximately 11 percent of all metal/sediment FD/target sample analyte pairs associated with the NW AEU failed relative percent difference (RPD) criteria (Table A2.5.0). While this data quality issue may indicate some imprecision in the associated data, it is important to note that all field duplicate results were reported within an order of magnitude of the associated target sample results. Additionally, the great majority of the results that did not meet RPD criteria were reported from only 3 of the 13 total FD pairs. However, as several metals were selected as ECOPCs in the NW AEU, and several of the calculated hazard quotients (HQs)

exceed one, there is some uncertainty in the associated risk estimates indicated by this data quality observation.

- Several V&V observations related to the wet chemistry/sediment analyte group and matrix combination resulted in data qualifications in notable percentages of the data set. It is important to note, however, that this analyte group contains general chemistry parameters such as ions/anions and alkalinity that are not directly related to site characterization. Therefore, the impact of these qualifications on risk assessment results is determined to be minimal.

## **2.4 South Walnut Creek Aquatic Exposure Unit**

Issues that have the potential to impact the SW AEU risk assessment decisions include the following:

- Approximately 10 percent of the volatile organic compound (VOC)/surface water data that were qualified as estimated were also noted with the V&V observation that allowed sample holding times were exceeded. All associated records are nondetect results. While this data quality issue has the possibility to impact the accuracy of the associated data, it is important to note that no VOCs were selected as ECOPCs in the SW AEU and all nondetect results noted with this V&V observation were reported well below the associated surface water ESL. The impact on the SW AEU risk assessment is determined to be minimal.
- Approximately 17 percent of the metal/sediment FD/target sample analyte pairs exceeded RPD criteria. The impact on the SW AEU risk assessment, however, is determined to be minimal. All field duplicate results were reported within an order of magnitude of the associated target sample results, and the great majority of the results that did not meet RPD criteria were reported from only 2 of the 12 total FD pairs.
- Several V&V observations related to the wet chemistry/sediment analyte group and matrix combination resulted in data qualifications in notable percentages of the data set. It is important to note, however, that this analyte group contains general chemistry parameters such as ions/anions and alkalinity that are not directly related to site characterization. Therefore, the impact of these qualifications on risk assessment results is determined to be minimal.

## **2.5 Woman Creek Aquatic Exposure Unit**

Issues that have the potential to impact the WC AEU risk assessment decisions include the following:

- Greater than 15 percent of the metal/sediment data were qualified as estimated and noted with V&V observations related to laboratory control sample (LCS) analyses that did not meet recovery criteria. All associated records are detect

results. While this data quality issue has the possibility to impact the accuracy of the associated data, it is important to note that all records noted for this V&V observation are detect results that were generally reported well above the detection limit. The impact on risk assessment decisions is determined to be minimal, as the affect on the ECOPC selection process and the calculated hazard quotients (HQs) is not significant enough to have changed risk assessment decisions.

- Similar to the discussion in Section 2.1 above, greater than 24 percent of the metal/sediment FD/target samples analyte pairs exceeded RPD criteria. It is determined that the data imprecision indicated by this data quality observations has the possibility to have some impact on the outcome of the risk assessment calculations. The RPD exceedances are not limited to a select group of FD pairs, they are dispersed throughout all the FD samples collected from WC AEU sediments. In addition, several metals were selected as ECOPCs in the WC AEU, and some associated HQs exceed one. This data quality issue may add some uncertainty to the WC AEU risk assessment.
- Approximately 12 percent of each of the polychlorinated biphenyl (PCB)/surface water and the pesticide/surface water data sets were qualified as estimated and noted with the V&V observation that surrogate recoveries were not met. Surrogate analyses that do not meet recovery criteria have the potential to impact the accuracy of the associated data. As all associated records are nondetect results, the impact of possible false nondetect data to WC AEU risk assessment decisions was reviewed. Although neither PCBs nor pesticides were selected as ECOPCs in the WC AEU, and very few PCBs and pesticides were even detected in WC AEU surface waters, most records noted with this V&V observation were reported as nondetect at concentrations that exceed the associated surface water ESL. The noted inaccuracy is determined to contribute some uncertainty to the WC AEU risk assessment decisions.
- Several V&V observations related to the wet chemistry/sediment analyte group and matrix combination resulted in data qualifications in notable percentages of the data set (Table A2.7.2). It is important to note, however, that this analyte group contains general chemistry parameters such as ions/anions and alkalinity that are not directly related to site characterization. Therefore, the impact of these qualifications on risk assessment results is determined to be minimal.

### 3.0 CONCLUSIONS

This review concludes that the quality of the data used in the NW, SW, and WC AEU is acceptable and the CRA objectives for PARCC performance have generally been met. Where either CRA Methodology or V&V guidance have not been met, the data are either flagged by the V&V process, or for those instances where the frequency of issues may influence the risk assessment decisions, the data quality issues were reviewed for potential impact on risk assessment results.

Those elements of data quality that could affect risk assessment decisions in the NW, SW, and WC AEUs have been analyzed and it was concluded that most noted deviations from the PARCC parameter criteria have minimal impact on risk assessment calculations and decisions. Some noted RPD exceedances in the sediments throughout the NW and WC AEUs, however, indicate possible imprecision in the associated metals data. Data inaccuracies indicated by poor surrogate recoveries in the WC AEU PCB and pesticide data sets also add uncertainty to the risk assessment.

#### **4.0 REFERENCES**

DOE, 2002, Final Work Plan for the Development of the Remedial Investigation and Feasibility Study Report, Rocky Flats Environmental Technology Site, Golden, Colorado, March.

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

## **TABLES**

**Table A2.1.0  
NW AEU - CRA Data V&V Summary**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of CRA V&amp;V Records</b>	<b>Total No. of CRA Records</b>	<b>Percent V&amp;V (%)</b>
Dioxins and Furans	Sediment	68	68	100.00
Dioxins and Furans	Surface Water	24	24	100.00
Herbicide	Sediment	101	115	87.83
Herbicide	Surface Water	121	581	20.83
Metal	Sediment	3,147	3,191	98.62
Metal	Surface Water	19,900	25,173	79.05
PCB	Sediment	703	850	82.71
PCB	Surface Water	280	784	35.71
Pesticide	Sediment	1,267	1,710	74.09
Pesticide	Surface Water	781	3,233	24.16
Radionuclide	Sediment	790	1,025	77.07
Radionuclide	Surface Water	6,267	11,195	55.98
SVOC	Sediment	5,330	6,090	87.52
SVOC	Surface Water	4,719	11,298	41.77
VOC	Sediment	2,873	3,356	85.61
VOC	Surface Water	6,950	14,403	48.25
Wet Chem	Sediment	71	158	44.94
Wet Chem	Surface Water	1,244	2,853	43.60
	<b>Total</b>	<b>54,636</b>	<b>86,107</b>	<b>63.45%</b>

**Table A2.1.1  
SW AEU - CRA Data V&V Summary**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of CRA V&amp;V Records</b>	<b>Total No. of CRA Records</b>	<b>Percent V&amp;V (%)</b>
Dioxins and Furans	Surface Water	34	34	100.00
Herbicide	Sediment	79	84	94.05
Herbicide	Surface Water	110	325	33.85
Metal	Sediment	3,597	3,601	99.89
Metal	Surface Water	40,618	44,381	91.52
PCB	Sediment	602	679	88.66
PCB	Surface Water	189	490	38.57
Pesticide	Sediment	1,182	1,425	82.95
Pesticide	Surface Water	665	2,007	33.13
Radionuclide	Sediment	922	1,142	80.74
Radionuclide	Surface Water	10,144	14,313	70.87
SVOC	Sediment	4,690	4,930	95.13
SVOC	Surface Water	5,621	8,749	64.25
VOC	Sediment	3,511	3,699	94.92
VOC	Surface Water	26,424	32,016	82.53
Wet Chem	Sediment	75	141	53.19
Wet Chem	Surface Water	2,974	4,509	65.96
	<b>Total</b>	<b>101,437</b>	<b>122,525</b>	<b>82.79%</b>

**Table A2.1.2  
WC AEU - CRA Data V&V Summary**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of CRA V&amp;V Records</b>	<b>Total No. of CRA Records</b>	<b>Percent V&amp;V (%)</b>
Dioxins and Furans	Sediment	34	34	100.00
Dioxins and Furans	Surface Water	14	14	100.00
Herbicide	Sediment	60	63	95.24
Herbicide	Surface Water	141	301	46.84
Metal	Sediment	2,472	2,482	99.60
Metal	Surface Water	19,194	23,006	83.43
PCB	Sediment	398	475	83.79
PCB	Surface Water	546	742	73.58
Pesticide	Sediment	1,088	1,263	86.14
Pesticide	Surface Water	1,713	2,631	65.11
Radionuclide	Sediment	771	860	89.65
Radionuclide	Surface Water	4,708	9,589	49.10
SVOC	Sediment	3,520	3,590	98.05
SVOC	Surface Water	5,425	7,676	70.67
VOC	Sediment	1,854	2,099	88.33
VOC	Surface Water	7,582	11,293	67.14
Wet Chem	Sediment	76	88	86.36
Wet Chem	Surface Water	1,741	2,436	71.47
	<b>Total</b>	<b>51,337</b>	<b>68,642</b>	<b>74.79%</b>

**Table A2.2.0**  
**NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Dioxins and Furans	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	1	68	1.47	Accuracy
Dioxins and Furans	Surface Water	Documentation Issues	Record added by the validator	No	2	24	8.33	N/A
Dioxins and Furans	Surface Water	Documentation Issues	Transcription error	No	7	24	29.17	N/A
Dioxins and Furans	Surface Water	Internal Standards	Internal standards did not meet criteria	No	3	24	12.50	Accuracy
Herbicide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	4	101	3.96	Accuracy
Herbicide	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	5	101	4.95	N/A
Herbicide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	4	101	3.96	N/A
Herbicide	Sediment	Documentation Issues	Transcription error	No	10	101	9.90	N/A
Herbicide	Sediment	Internal Standards	Internal standards did not meet criteria	No	1	101	0.99	Accuracy
Herbicide	Sediment	Other	See hard copy for further explanation	No	3	101	2.97	N/A
Herbicide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	1	101	0.99	Accuracy
Herbicide	Surface Water	Calculation Errors	Calculation error	No	1	121	0.83	N/A
Herbicide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	12	121	9.92	Accuracy
Herbicide	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	2	121	1.65	N/A
Herbicide	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	5	121	4.13	N/A
Herbicide	Surface Water	Documentation Issues	Record added by the validator	No	1	121	0.83	N/A
Herbicide	Surface Water	Documentation Issues	Transcription error	No	36	121	29.75	N/A
Herbicide	Surface Water	Holding Times	Holding times were exceeded	No	7	121	5.79	Representativeness
Herbicide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	2	121	1.65	Accuracy
Herbicide	Surface Water	Other	Sample results were not validated due to re-analysis	No	10	121	8.26	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Herbicide	Surface Water	Other	See hard copy for further explanation	No	13	121	10.74	N/A
Metal	Sediment	Blanks	Calibration verification blank contamination	No	48	3,147	1.53	Representativeness
Metal	Sediment	Blanks	Calibration verification blank contamination	Yes	6	3,147	0.19	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	129	3,147	4.10	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	17	3,147	0.54	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	No	23	3,147	0.73	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	Yes	33	3,147	1.05	Representativeness
Metal	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	1	3,147	0.03	Accuracy
Metal	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	38	3,147	1.21	N/A
Metal	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	181	3,147	5.75	N/A
Metal	Sediment	Documentation Issues	Record added by the validator	Yes	1	3,147	0.03	N/A
Metal	Sediment	Documentation Issues	Transcription error	No	16	3,147	0.51	N/A
Metal	Sediment	Documentation Issues	Transcription error	Yes	102	3,147	3.24	N/A
Metal	Sediment	Holding Times	Holding times were exceeded	No	2	3,147	0.06	Representativeness
Metal	Sediment	Holding Times	Holding times were exceeded	Yes	2	3,147	0.06	Representativeness
Metal	Sediment	Instrument Set-up	Interference was indicated in the interference check sample	No	3	3,147	0.10	Accuracy
Metal	Sediment	Instrument Set-up	Interference was indicated in the interference check sample	Yes	2	3,147	0.06	Accuracy
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	No	31	3,147	0.99	Accuracy
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	Yes	26	3,147	0.83	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	No	94	3,147	2.99	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	204	3,147	6.48	Accuracy

**Table A2.2.0**  
**NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	No	27	3,147	0.86	Accuracy
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	Yes	26	3,147	0.83	Accuracy
Metal	Sediment	Matrices	Duplicate sample precision criteria were not met	Yes	74	3,147	2.35	Precision
Metal	Sediment	Matrices	LCS/LCSD precision criteria were not met	Yes	3	3,147	0.10	Precision
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	No	7	3,147	0.22	Accuracy
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	Yes	9	3,147	0.29	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	82	3,147	2.61	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	225	3,147	7.15	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery was < 30 percent	No	2	3,147	0.06	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	2	3,147	0.06	Accuracy
Metal	Sediment	Matrices	Serial dilution criteria were not met	No	1	3,147	0.03	Accuracy
Metal	Sediment	Matrices	Serial dilution criteria were not met	Yes	45	3,147	1.43	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	No	59	3,147	1.87	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	245	3,147	7.79	Accuracy
Metal	Sediment	Other	Result obtained through dilution	Yes	4	3,147	0.13	N/A
Metal	Surface Water	Blanks	Calibration verification blank contamination	No	723	19,900	3.63	Representativeness
Metal	Surface Water	Blanks	Calibration verification blank contamination	Yes	161	19,900	0.81	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	No	296	19,900	1.49	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	Yes	394	19,900	1.98	Representativeness
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	No	184	19,900	0.92	Representativeness

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	Yes	115	19,900	0.58	Representativeness
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	No	1	19,900	0.01	N/A
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	Yes	7	19,900	0.04	N/A
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	No	41	19,900	0.21	Accuracy
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	Yes	3	19,900	0.02	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	20	19,900	0.10	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	17	19,900	0.09	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	No	15	19,900	0.08	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	Yes	27	19,900	0.14	Accuracy
Metal	Surface Water	Documentation Issues	Key data fields incorrect	No	82	19,900	0.41	N/A
Metal	Surface Water	Documentation Issues	Key data fields incorrect	Yes	403	19,900	2.03	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	86	19,900	0.43	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	Yes	79	19,900	0.40	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	44	19,900	0.22	Representativeness
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	Yes	44	19,900	0.22	Representativeness
Metal	Surface Water	Documentation Issues	No raw data submitted by the laboratory	No	2	19,900	0.01	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	257	19,900	1.29	N/A
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	719	19,900	3.61	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	No	22	19,900	0.11	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	31	19,900	0.16	Representativeness
Metal	Surface Water	Documentation Issues	Original documentation not provided	No	4	19,900	0.02	N/A
Metal	Surface Water	Documentation Issues	Original documentation not provided	Yes	4	19,900	0.02	N/A
Metal	Surface Water	Documentation Issues	Record added by the validator	No	108	19,900	0.54	N/A
Metal	Surface Water	Documentation Issues	Record added by the validator	Yes	122	19,900	0.61	N/A
Metal	Surface Water	Documentation Issues	Transcription error	No	318	19,900	1.60	N/A
Metal	Surface Water	Documentation Issues	Transcription error	Yes	281	19,900	1.41	N/A
Metal	Surface Water	Holding Times	Holding times were exceeded	No	107	19,900	0.54	Representativeness
Metal	Surface Water	Holding Times	Holding times were exceeded	Yes	65	19,900	0.33	Representativeness
Metal	Surface Water	Holding Times	Holding times were grossly exceeded	No	1	19,900	0.01	Representativeness
Metal	Surface Water	Holding Times	Holding times were grossly exceeded	Yes	2	19,900	0.01	Representativeness
Metal	Surface Water	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	1	19,900	0.01	Precision
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	No	27	19,900	0.14	Accuracy
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	Yes	77	19,900	0.39	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	No	76	19,900	0.38	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	Yes	106	19,900	0.53	Accuracy
Metal	Surface Water	LCS	LCS recovery criteria were not met	No	61	19,900	0.31	Accuracy

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	LCS	LCS recovery criteria were not met	Yes	161	19,900	0.81	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	No	118	19,900	0.59	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	Yes	279	19,900	1.40	Accuracy
Metal	Surface Water	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	7	19,900	0.04	Representativeness
Metal	Surface Water	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	12	19,900	0.06	Representativeness
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	No	15	19,900	0.08	Precision
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	Yes	86	19,900	0.43	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	No	15	19,900	0.08	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	Yes	48	19,900	0.24	Precision
Metal	Surface Water	Matrices	MS/MSD precision criteria were not met	No	7	19,900	0.04	Precision
Metal	Surface Water	Matrices	MS/MSD precision criteria were not met	Yes	1	19,900	0.01	Precision
Metal	Surface Water	Matrices	MSA calibration correlation coefficient < 0.995	Yes	6	19,900	0.03	Accuracy
Metal	Surface Water	Matrices	MSA was required, but not performed	Yes	3	19,900	0.02	Representativeness
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	No	182	19,900	0.91	Accuracy
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	Yes	40	19,900	0.20	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	No	223	19,900	1.12	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	Yes	372	19,900	1.87	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	No	2	19,900	0.01	Accuracy

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	Yes	19	19,900	0.10	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	No	10	19,900	0.05	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	Yes	505	19,900	2.54	Accuracy
Metal	Surface Water	Matrices	Site samples were not used for sample matrix QC	No	5	19,900	0.03	Representativeness
Metal	Surface Water	Matrices	Site samples were not used for sample matrix QC	Yes	21	19,900	0.11	Representativeness
Metal	Surface Water	Other	Analysis was not requested according to the statement of work	No	1	19,900	0.01	N/A
Metal	Surface Water	Other	Analysis was not requested according to the statement of work	Yes	1	19,900	0.01	N/A
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	No	250	19,900	1.26	Accuracy
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	Yes	766	19,900	3.85	Accuracy
Metal	Surface Water	Other	Incorrect analysis sequence	No	1	19,900	0.01	Representativeness
Metal	Surface Water	Other	Incorrect analysis sequence	Yes	2	19,900	0.01	Representativeness
Metal	Surface Water	Other	QC sample frequency does not meet method requirements	No	6	19,900	0.03	Representativeness
Metal	Surface Water	Other	QC sample frequency does not meet method requirements	Yes	5	19,900	0.03	Representativeness
Metal	Surface Water	Other	See hard copy for further explanation	No	116	19,900	0.58	N/A
Metal	Surface Water	Other	See hard copy for further explanation	Yes	175	19,900	0.88	N/A
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	266	19,900	1.34	Representativeness
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	Yes	845	19,900	4.25	Representativeness
Metal	Surface Water	Sensitivity	IDL changed due to a significant figure discrepancy	No	5	19,900	0.03	Representativeness

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Sensitivity	Instrument detection limit > the associated RDL	Yes	1	19,900	0.01	Representativeness
PCB	Sediment	Confirmation	Confirmation percent difference criteria not met	Yes	11	703	1.56	Precision
PCB	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	62	703	8.82	N/A
PCB	Sediment	Documentation Issues	Missing deliverables (not required for validation)	Yes	1	703	0.14	N/A
PCB	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	35	703	4.98	N/A
PCB	Sediment	Matrices	MS/MSD precision criteria were not met	No	27	703	3.84	Precision
PCB	Sediment	Matrices	MS/MSD precision criteria were not met	Yes	1	703	0.14	Precision
PCB	Sediment	Matrices	Percent solids < 30 percent	Yes	3	703	0.43	Representativeness
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	No	21	703	2.99	Accuracy
PCB	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	14	280	5.00	Representativeness
PCB	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	35	280	12.50	N/A
PCB	Surface Water	Documentation Issues	Record added by the validator	No	7	280	2.50	N/A
PCB	Surface Water	Documentation Issues	Transcription error	No	14	280	5.00	N/A
PCB	Surface Water	Holding Times	Holding times were exceeded	No	7	280	2.50	Representativeness
PCB	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	14	280	5.00	Accuracy
Pesticide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	18	1,267	1.42	Accuracy
Pesticide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,267	0.08	Accuracy
Pesticide	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	185	1,267	14.60	N/A
Pesticide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	104	1,267	8.21	N/A
Pesticide	Sediment	Internal Standards	Internal standards did not meet criteria	No	1	1,267	0.08	Accuracy
Pesticide	Sediment	Matrices	MS/MSD precision criteria were not met	No	80	1,267	6.31	Precision
Pesticide	Sediment	Other	See hard copy for further explanation	No	1	1,267	0.08	N/A

**Table A2.2.0**  
**NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	61	1,267	4.81	Accuracy
Pesticide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	27	781	3.46	Accuracy
Pesticide	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	1	781	0.13	Accuracy
Pesticide	Surface Water	Calibration	Independent calibration verification criteria not met	No	1	781	0.13	Accuracy
Pesticide	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	2	781	0.26	N/A
Pesticide	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	38	781	4.87	Representativeness
Pesticide	Surface Water	Documentation Issues	Missing deliverables (required for validation)	Yes	2	781	0.26	Representativeness
Pesticide	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	103	781	13.19	N/A
Pesticide	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	2	781	0.26	N/A
Pesticide	Surface Water	Documentation Issues	Record added by the validator	No	21	781	2.69	N/A
Pesticide	Surface Water	Documentation Issues	Transcription error	No	6	781	0.77	N/A
Pesticide	Surface Water	Documentation Issues	Transcription error	Yes	3	781	0.38	N/A
Pesticide	Surface Water	Holding Times	Holding times were exceeded	No	43	781	5.51	Representativeness
Pesticide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	2	781	0.26	Accuracy
Pesticide	Surface Water	Other	See hard copy for further explanation	Yes	4	781	0.51	N/A
Pesticide	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	42	781	5.38	Accuracy
Radionuclide	Sediment	Blanks	Blank recovery criteria were not met	Yes	4	790	0.51	Representativeness
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	1	790	0.13	Representativeness
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	42	790	5.32	Representativeness
Radionuclide	Sediment	Calculation Errors	Calculation error	Yes	12	790	1.52	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	118	790	14.94	Accuracy
Radionuclide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	12	790	1.52	N/A
Radionuclide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	33	790	4.18	N/A
Radionuclide	Sediment	Documentation Issues	Record added by the validator	Yes	2	790	0.25	N/A
Radionuclide	Sediment	Documentation Issues	Results were not included on Data Summary Table	No	3	790	0.38	N/A
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	No	1	790	0.13	Representativeness
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	159	790	20.13	Representativeness
Radionuclide	Sediment	Documentation Issues	Transcription error	No	4	790	0.51	N/A
Radionuclide	Sediment	Documentation Issues	Transcription error	Yes	206	790	26.08	N/A
Radionuclide	Sediment	Holding Times	Holding times were grossly exceeded	Yes	15	790	1.90	Representativeness
Radionuclide	Sediment	Instrument Set-up	Detector efficiency did not meet requirements	Yes	24	790	3.04	Accuracy
Radionuclide	Sediment	Instrument Set-up	Resolution criteria were not met	Yes	24	790	3.04	Representativeness
Radionuclide	Sediment	LCS	LCS recovery > +/- 3 sigma	Yes	24	790	3.04	Accuracy
Radionuclide	Sediment	LCS	LCS recovery criteria were not met	Yes	3	790	0.38	Accuracy
Radionuclide	Sediment	LCS	LCS relative percent error criteria not met	Yes	46	790	5.82	Accuracy
Radionuclide	Sediment	Matrices	Recovery criteria were not met	Yes	4	790	0.51	Accuracy
Radionuclide	Sediment	Matrices	Replicate analysis was not performed	Yes	2	790	0.25	Precision
Radionuclide	Sediment	Matrices	Replicate precision criteria were not met	Yes	21	790	2.66	Precision
Radionuclide	Sediment	Matrices	Replicate recovery criteria were not met	Yes	15	790	1.90	Accuracy
Radionuclide	Sediment	Other	Lab results not verified due to unsubmitted data	No	8	790	1.01	Representativeness
Radionuclide	Sediment	Other	Lab results not verified due to unsubmitted data	Yes	8	790	1.01	Representativeness
Radionuclide	Sediment	Other	Sample exceeded efficiency curve weight limit	Yes	1	790	0.13	Accuracy
Radionuclide	Sediment	Other	See hard copy for further explanation	No	1	790	0.13	N/A
Radionuclide	Sediment	Other	See hard copy for further explanation	Yes	26	790	3.29	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Sediment	Sensitivity	MDA exceeded the RDL	No	8	790	1.01	Representativeness
Radionuclide	Sediment	Sensitivity	MDA exceeded the RDL	Yes	10	790	1.27	Representativeness
Radionuclide	Sediment	Sensitivity	MDA was calculated by reviewer	Yes	269	790	34.05	N/A
Radionuclide	Sediment	Sensitivity	Results considered qualitative not quantitative	No	4	790	0.51	Accuracy
Radionuclide	Sediment	Sensitivity	Results considered qualitative not quantitative	Yes	4	790	0.51	Accuracy
Radionuclide	Surface W	Blanks	Blank correction was not performed	No	4	6,267	0.06	Representativeness
Radionuclide	Surface W	Blanks	Blank correction was not performed	Yes	6	6,267	0.10	Representativeness
Radionuclide	Surface W	Blanks	Blank recovery criteria were not met	No	6	6,267	0.10	Representativeness
Radionuclide	Surface W	Blanks	Blank recovery criteria were not met	Yes	17	6,267	0.27	Representativeness
Radionuclide	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	27	6,267	0.43	Representativeness
Radionuclide	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	126	6,267	2.01	Representativeness
Radionuclide	Surface W	Calculation Errors	Calculation error	No	31	6,267	0.49	N/A
Radionuclide	Surface W	Calculation Errors	Calculation error	Yes	35	6,267	0.56	N/A
Radionuclide	Surface W	Calibration	Continuing calibration verification criteria were not met	No	12	6,267	0.19	Accuracy
Radionuclide	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	121	6,267	1.93	Accuracy
Radionuclide	Surface W	Documentation Issues	Information missing from case narrative	No	14	6,267	0.22	N/A
Radionuclide	Surface W	Documentation Issues	Information missing from case narrative	Yes	15	6,267	0.24	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	10	6,267	0.16	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	22	6,267	0.35	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (required for validation)	No	11	6,267	0.18	Representativeness
Radionuclide	Surface W	Documentation Issues	Missing deliverables (required for validation)	Yes	16	6,267	0.26	Representativeness
Radionuclide	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	88	6,267	1.40	N/A
Radionuclide	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	222	6,267	3.54	N/A
Radionuclide	Surface W	Documentation Issues	Record added by the validator	Yes	4	6,267	0.06	N/A
Radionuclide	Surface W	Documentation Issues	Sample analysis was not requested	No	1	6,267	0.02	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Documentation Issues	Sample analysis was not requested	Yes	9	6,267	0.14	N/A
Radionuclide	Surface W	Documentation Issues	Sufficient documentation not provided by the laboratory	No	2	6,267	0.03	Representativeness
Radionuclide	Surface W	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	70	6,267	1.12	Representativeness
Radionuclide	Surface W	Documentation Issues	Transcription error	No	101	6,267	1.61	N/A
Radionuclide	Surface W	Documentation Issues	Transcription error	Yes	87	6,267	1.39	N/A
Radionuclide	Surface W	Holding Times	Holding times were exceeded	No	18	6,267	0.29	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were exceeded	Yes	64	6,267	1.02	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	No	7	6,267	0.11	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	Yes	15	6,267	0.24	Representativeness
Radionuclide	Surface W	Instrument Set-up	Resolution criteria were not met	No	1	6,267	0.02	Representativeness
Radionuclide	Surface W	Instrument Set-up	Resolution criteria were not met	Yes	6	6,267	0.10	Representativeness
Radionuclide	Surface W	Instrument Set-up	Transformed spectral index external site criteria were not met	No	1	6,267	0.02	Representativeness
Radionuclide	Surface W	LCS	Expected LCS value not submitted/verifiable	Yes	3	6,267	0.05	Representativeness
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	No	49	6,267	0.78	Accuracy
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	Yes	55	6,267	0.88	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	No	4	6,267	0.06	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	Yes	11	6,267	0.18	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	No	39	6,267	0.62	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	Yes	89	6,267	1.42	Accuracy
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	No	2	6,267	0.03	Precision
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	Yes	10	6,267	0.16	Precision
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	No	11	6,267	0.18	Precision
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	17	6,267	0.27	Precision
Radionuclide	Surface W	Matrices	Recovery criteria were not met	No	6	6,267	0.10	Accuracy
Radionuclide	Surface W	Matrices	Recovery criteria were not met	Yes	10	6,267	0.16	Accuracy
Radionuclide	Surface W	Matrices	Replicate analysis was not performed	Yes	24	6,267	0.38	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	No	46	6,267	0.73	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	Yes	145	6,267	2.31	Precision
Radionuclide	Surface W	Matrices	Replicate recovery criteria were not met	No	2	6,267	0.03	Accuracy
Radionuclide	Surface W	Matrices	Replicate recovery criteria were not met	Yes	1	6,267	0.02	Accuracy

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	7	6,267	0.11	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	No	27	6,267	0.43	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	Yes	42	6,267	0.67	Representativeness
Radionuclide	Surface W	Other	Sample or control analyses not chemically separated	Yes	6	6,267	0.10	Representativeness
Radionuclide	Surface W	Other	See hard copy for further explanation	No	91	6,267	1.45	N/A
Radionuclide	Surface W	Other	See hard copy for further explanation	Yes	116	6,267	1.85	N/A
Radionuclide	Surface W	Other	Tracer requirements were not met	No	16	6,267	0.26	Accuracy
Radionuclide	Surface W	Other	Tracer requirements were not met	Yes	58	6,267	0.93	Accuracy
Radionuclide	Surface W	Sample Preparation	Excessive solids on planchet	Yes	2	6,267	0.03	Accuracy
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	13	6,267	0.21	Representativeness
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	15	6,267	0.24	Representativeness
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	No	1	6,267	0.02	N/A
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	Yes	7	6,267	0.11	N/A
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	No	44	6,267	0.70	Representativeness
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	Yes	74	6,267	1.18	Representativeness
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	No	7	6,267	0.11	N/A
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	Yes	272	6,267	4.34	N/A
SVOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	27	5,330	0.51	Representativeness
SVOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	1	5,330	0.02	Representativeness
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	22	5,330	0.41	Accuracy
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	18	5,330	0.34	Accuracy
SVOC	Sediment	Calibration	Independent calibration verification criteria not met	No	13	5,330	0.24	Accuracy
SVOC	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	232	5,330	4.35	N/A
SVOC	Sediment	Documentation Issues	Missing deliverables (not required for validation)	Yes	58	5,330	1.09	N/A

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
SVOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	191	5,330	3.58	N/A
SVOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	41	5,330	0.77	N/A
SVOC	Sediment	Documentation Issues	Transcription error	Yes	1	5,330	0.02	N/A
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	71	5,330	1.33	Accuracy
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	Yes	11	5,330	0.21	Accuracy
SVOC	Sediment	Matrices	MS/MSD precision criteria were not met	Yes	4	5,330	0.08	Precision
SVOC	Sediment	Other	See hard copy for further explanation	No	143	5,330	2.68	N/A
SVOC	Sediment	Other	See hard copy for further explanation	Yes	33	5,330	0.62	N/A
SVOC	Sediment	Surrogates	Surrogate recovery criteria were not met	No	57	5,330	1.07	Accuracy
SVOC	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	5	5,330	0.09	Accuracy
SVOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	15	4,719	0.32	Representativeness
SVOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	2	4,719	0.04	Representativeness
SVOC	Surface W	Calculation Errors	Calculation error	No	8	4,719	0.17	N/A
SVOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	50	4,719	1.06	Accuracy
SVOC	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	2	4,719	0.04	Accuracy
SVOC	Surface W	Calibration	Independent calibration verification criteria not met	No	5	4,719	0.11	Accuracy
SVOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	119	4,719	2.52	N/A
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	296	4,719	6.27	N/A
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	3	4,719	0.06	N/A
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	3	4,719	0.06	Representativeness
SVOC	Surface W	Documentation Issues	Record added by the validator	No	41	4,719	0.87	N/A
SVOC	Surface W	Documentation Issues	Transcription error	No	107	4,719	2.27	N/A
SVOC	Surface W	Holding Times	Holding times were exceeded	No	312	4,719	6.61	Representativeness
SVOC	Surface W	Holding Times	Holding times were exceeded	Yes	3	4,719	0.06	Representativeness
SVOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	144	4,719	3.05	Accuracy
SVOC	Surface W	Internal Standards	Internal standards did not meet criteria	Yes	1	4,719	0.02	Accuracy

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
SVOC	Surface W	Other	Sample results were not validated due to re-analysis	No	3	4,719	0.06	N/A
SVOC	Surface W	Other	See hard copy for further explanation	No	162	4,719	3.43	N/A
SVOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	9	4,719	0.19	Representativeness
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	80	2,873	2.78	Representativeness
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	8	2,873	0.28	Representativeness
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	25	2,873	0.87	Accuracy
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	11	2,873	0.38	Accuracy
VOC	Sediment	Calibration	Independent calibration verification criteria not met	No	3	2,873	0.10	Accuracy
VOC	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	172	2,873	5.99	N/A
VOC	Sediment	Documentation Issues	Missing deliverables (not required for validation)	Yes	9	2,873	0.31	N/A
VOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	168	2,873	5.85	N/A
VOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	9	2,873	0.31	N/A
VOC	Sediment	Documentation Issues	Transcription error	No	34	2,873	1.18	N/A
VOC	Sediment	Documentation Issues	Transcription error	Yes	3	2,873	0.10	N/A
VOC	Sediment	Holding Times	Holding times were exceeded	No	60	2,873	2.09	Representativeness
VOC	Sediment	Holding Times	Holding times were exceeded	Yes	5	2,873	0.17	Representativeness
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	62	2,873	2.16	Accuracy
VOC	Sediment	Other	See hard copy for further explanation	No	12	2,873	0.42	N/A
VOC	Sediment	Surrogates	Surrogate recovery criteria were not met	No	62	2,873	2.16	Accuracy
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	26	6,950	0.37	Representativeness
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	18	6,950	0.26	Representativeness
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	124	6,950	1.78	Accuracy

**Table A2.2.0**  
**NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	6	6,950	0.09	Accuracy
VOC	Surface W	Calibration	Independent calibration verification criteria not met	No	3	6,950	0.04	Accuracy
VOC	Surface W	Calibration	Independent calibration verification criteria not met	Yes	6	6,950	0.09	Accuracy
VOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	94	6,950	1.35	N/A
VOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	6	6,950	0.09	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	183	6,950	2.63	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	12	6,950	0.17	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	56	6,950	0.81	Representativeness
VOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	5	6,950	0.07	Representativeness
VOC	Surface W	Documentation Issues	Record added by the validator	No	108	6,950	1.55	N/A
VOC	Surface W	Documentation Issues	Record added by the validator	Yes	2	6,950	0.03	N/A
VOC	Surface W	Documentation Issues	Transcription error	No	649	6,950	9.34	N/A
VOC	Surface W	Documentation Issues	Transcription error	Yes	15	6,950	0.22	N/A
VOC	Surface W	Holding Times	Holding times were exceeded	No	337	6,950	4.85	Representativeness
VOC	Surface W	Holding Times	Holding times were exceeded	Yes	3	6,950	0.04	Representativeness
VOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	No	32	6,950	0.46	Accuracy
VOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	53	6,950	0.76	Accuracy
VOC	Surface W	LCS	LCS recovery criteria were not met	Yes	1	6,950	0.01	Accuracy
VOC	Surface W	Matrices	MS/MSD precision criteria were not met	No	1	6,950	0.01	Precision
VOC	Surface W	Other	Sample results were not validated due to re-analysis	No	45	6,950	0.65	N/A
VOC	Surface W	Other	Sample results were not validated due to re-analysis	Yes	1	6,950	0.01	N/A
VOC	Surface W	Other	See hard copy for further explanation	No	5	6,950	0.07	N/A
VOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	213	6,950	3.06	Representativeness
VOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	2	6,950	0.03	Representativeness

**Table A2.2.0**  
**NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Surface W	Surrogates	Surrogate recovery criteria were not met	No	27	6,950	0.39	Accuracy
Wet Chem	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	3	71	4.23	Representativeness
Wet Chem	Sediment	Documentation Issues	Transcription error	No	1	71	1.41	N/A
Wet Chem	Sediment	Holding Times	Holding times were exceeded	No	1	71	1.41	Representativeness
Wet Chem	Sediment	Holding Times	Holding times were exceeded	Yes	2	71	2.82	Representativeness
Wet Chem	Sediment	Holding Times	Holding times were grossly exceeded	Yes	3	71	4.23	Representativeness
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	6	71	8.45	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	13	71	18.31	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	20	71	28.17	Accuracy
Wet Chem	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	4	71	5.63	Accuracy
Wet Chem	Sediment	Other	Lab results not verified due to unsubmitted data	Yes	1	71	1.41	Representativeness
Wet Chem	Sediment	Other	Result obtained through dilution	Yes	1	71	1.41	N/A
Wet Chem	Surface W	Blanks	Negative bias indicated in the blanks	Yes	2	1,244	0.16	Representativeness
Wet Chem	Surface W	Calculation Errors	Control limits not assigned correctly	Yes	4	1,244	0.32	N/A
Wet Chem	Surface W	Calibration	Calibration correlation coefficient did not meet requirements	Yes	1	1,244	0.08	Accuracy
Wet Chem	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,244	0.08	Accuracy
Wet Chem	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	1	1,244	0.08	N/A
Wet Chem	Surface W	Documentation Issues	Missing deliverables (required for validation)	Yes	3	1,244	0.24	Representativeness
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	26	1,244	2.09	N/A
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	2	1,244	0.16	Representativeness
Wet Chem	Surface W	Documentation Issues	Record added by the validator	No	17	1,244	1.37	N/A
Wet Chem	Surface W	Documentation Issues	Record added by the validator	Yes	16	1,244	1.29	N/A
Wet Chem	Surface W	Documentation Issues	Transcription error	No	2	1,244	0.16	N/A
Wet Chem	Surface W	Documentation Issues	Transcription error	Yes	23	1,244	1.85	N/A
Wet Chem	Surface W	Holding Times	Holding times were exceeded	No	19	1,244	1.53	Representativeness

**Table A2.2.0  
NW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Wet Chem	Surface W	Holding Times	Holding times were exceeded	Yes	19	1,244	1.53	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	No	2	1,244	0.16	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	Yes	6	1,244	0.48	Representativeness
Wet Chem	Surface W	LCS	LCS recovery criteria were not met	No	1	1,244	0.08	Accuracy
Wet Chem	Surface W	LCS	LCS recovery criteria were not met	Yes	1	1,244	0.08	Accuracy
Wet Chem	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	2	1,244	0.16	Precision
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	No	5	1,244	0.40	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	Yes	21	1,244	1.69	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery was < 30 percent	Yes	1	1,244	0.08	Accuracy
Wet Chem	Surface W	Matrices	Site samples were not used for sample matrix QC	Yes	11	1,244	0.88	Representativeness
Wet Chem	Surface W	Other	IDL is older than 3 months from date of analysis	Yes	1	1,244	0.08	Accuracy
Wet Chem	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	3	1,244	0.24	Representativeness
Wet Chem	Surface W	Other	See hard copy for further explanation	No	1	1,244	0.08	N/A
Wet Chem	Surface W	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	21	1,244	1.69	Representativeness
Wet Chem	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	2	1,244	0.16	Representativeness
Wet Chem	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	39	1,244	3.14	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Dioxins and Furans	Surface Water	Documentation Issues	Record added by the validator	No	4	34	11.76	N/A
Dioxins and Furans	Surface Water	Documentation Issues	Transcription error	No	6	34	17.65	N/A
Dioxins and Furans	Surface Water	Internal Standards	Internal standards did not meet criteria	No	1	34	2.94	Accuracy
Herbicide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	4	79	5.06	Accuracy
Herbicide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1	79	1.27	N/A
Herbicide	Sediment	Holding Times	Holding times were exceeded	No	1	79	1.27	Representativeness
Herbicide	Sediment	Other	Sample results were not validated due to re-analysis	No	1	79	1.27	N/A
Herbicide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	2	79	2.53	Accuracy
Herbicide	Surface Water	Calculation Errors	Calculation error	No	2	110	1.82	N/A
Herbicide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	1	110	0.91	Accuracy
Herbicide	Surface Water	Documentation Issues	Record added by the validator	No	8	110	7.27	N/A
Herbicide	Surface Water	Documentation Issues	Transcription error	No	19	110	17.27	N/A
Herbicide	Surface Water	Holding Times	Holding times were exceeded	No	9	110	8.18	Representativeness
Herbicide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	2	110	1.82	Accuracy
Herbicide	Surface Water	Other	Lab results not verified due to unsubmitted data	No	1	110	0.91	Representativeness
Herbicide	Surface Water	Other	See hard copy for further explanation	No	5	110	4.55	N/A
Herbicide	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	10	110	9.09	Representativeness
Herbicide	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	2	110	1.82	Accuracy
Metal	Sediment	Blanks	Calibration verification blank contamination	No	96	3,597	2.67	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	Blanks	Calibration verification blank contamination	Yes	16	3,597	0.44	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	153	3,597	4.25	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	19	3,597	0.53	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	No	11	3,597	0.31	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	Yes	19	3,597	0.53	Representativeness
Metal	Sediment	Calculation Errors	Control limits not assigned correctly	Yes	1	3,597	0.03	N/A
Metal	Sediment	Documentation Issues	Information missing from case narrative	No	6	3,597	0.17	N/A
Metal	Sediment	Documentation Issues	Information missing from case narrative	Yes	21	3,597	0.58	N/A
Metal	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	6	3,597	0.17	N/A
Metal	Sediment	Documentation Issues	Missing deliverables (not required for validation)	Yes	45	3,597	1.25	N/A
Metal	Sediment	Documentation Issues	Missing deliverables (required for validation)	No	1	3,597	0.03	Representativeness
Metal	Sediment	Documentation Issues	Missing deliverables (required for validation)	Yes	1	3,597	0.03	Representativeness
Metal	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	38	3,597	1.06	N/A
Metal	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	153	3,597	4.25	N/A
Metal	Sediment	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	3,597	0.03	Representativeness
Metal	Sediment	Documentation Issues	Transcription error	No	35	3,597	0.97	N/A
Metal	Sediment	Documentation Issues	Transcription error	Yes	185	3,597	5.14	N/A
Metal	Sediment	Holding Times	Holding times were exceeded	No	10	3,597	0.28	Representativeness
Metal	Sediment	Holding Times	Holding times were exceeded	Yes	22	3,597	0.61	Representativeness
Metal	Sediment	Instrument Set-up	Interference was indicated in the interference check sample	Yes	3	3,597	0.08	Accuracy
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	No	29	3,597	0.81	Accuracy

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	Yes	33	3,597	0.92	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	No	92	3,597	2.56	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	203	3,597	5.64	Accuracy
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	No	52	3,597	1.45	Accuracy
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	Yes	53	3,597	1.47	Accuracy
Metal	Sediment	Matrices	Duplicate sample precision criteria were not met	No	2	3,597	0.06	Precision
Metal	Sediment	Matrices	Duplicate sample precision criteria were not met	Yes	53	3,597	1.47	Precision
Metal	Sediment	Matrices	LCS/LCSD precision criteria were not met	Yes	63	3,597	1.75	Precision
Metal	Sediment	Matrices	MSA calibration correlation coefficient < 0.995	Yes	1	3,597	0.03	Accuracy
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	No	10	3,597	0.28	Accuracy
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	Yes	14	3,597	0.39	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	89	3,597	2.47	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	237	3,597	6.59	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery was < 30 percent	No	1	3,597	0.03	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	7	3,597	0.19	Accuracy
Metal	Sediment	Matrices	Serial dilution criteria were not met	No	1	3,597	0.03	Accuracy
Metal	Sediment	Matrices	Serial dilution criteria were not met	Yes	74	3,597	2.06	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	No	13	3,597	0.36	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	20	3,597	0.56	Accuracy
Metal	Sediment	Other	Primary standard exceeded the expiration date	Yes	1	3,597	0.03	Accuracy
Metal	Sediment	Other	Result obtained through dilution	No	1	3,597	0.03	N/A
Metal	Sediment	Other	Result obtained through dilution	Yes	4	3,597	0.11	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	Sample Preparation	Sample pretreatment or preparation method was incorrect	No	5	3,597	0.14	Representativeness
Metal	Sediment	Sample Preparation	Sample pretreatment or preparation method was incorrect	Yes	44	3,597	1.22	Representativeness
Metal	Surface Water	Blanks	Calibration verification blank contamination	No	916	40,618	2.26	Representativeness
Metal	Surface Water	Blanks	Calibration verification blank contamination	Yes	223	40,618	0.55	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	No	1,029	40,618	2.53	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	Yes	1,021	40,618	2.51	Representativeness
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	No	492	40,618	1.21	Representativeness
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	Yes	314	40,618	0.77	Representativeness
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	No	8	40,618	0.02	N/A
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	Yes	3	40,618	0.01	N/A
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	No	194	40,618	0.48	Accuracy
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	Yes	15	40,618	0.04	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	16	40,618	0.04	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	16	40,618	0.04	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	No	8	40,618	0.02	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	Yes	32	40,618	0.08	Accuracy
Metal	Surface Water	Documentation Issues	Information missing from case narrative	No	1	40,618	0.00	N/A
Metal	Surface Water	Documentation Issues	Key data fields incorrect	No	96	40,618	0.24	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Documentation Issues	Key data fields incorrect	Yes	538	40,618	1.32	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	72	40,618	0.18	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	Yes	102	40,618	0.25	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	26	40,618	0.06	Representativeness
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	Yes	30	40,618	0.07	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	620	40,618	1.53	N/A
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1,413	40,618	3.48	N/A
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	No	9	40,618	0.02	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	6	40,618	0.01	Representativeness
Metal	Surface Water	Documentation Issues	Original documentation not provided	No	2	40,618	0.00	N/A
Metal	Surface Water	Documentation Issues	Original documentation not provided	Yes	2	40,618	0.00	N/A
Metal	Surface Water	Documentation Issues	Record added by the validator	No	109	40,618	0.27	N/A
Metal	Surface Water	Documentation Issues	Record added by the validator	Yes	131	40,618	0.32	N/A
Metal	Surface Water	Documentation Issues	Transcription error	No	247	40,618	0.61	N/A
Metal	Surface Water	Documentation Issues	Transcription error	Yes	176	40,618	0.43	N/A
Metal	Surface Water	Holding Times	Holding times were exceeded	No	132	40,618	0.32	Representativeness
Metal	Surface Water	Holding Times	Holding times were exceeded	Yes	104	40,618	0.26	Representativeness
Metal	Surface Water	Holding Times	Holding times were grossly exceeded	No	1	40,618	0.00	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Holding Times	Holding times were grossly exceeded	Yes	3	40,618	0.01	Representativeness
Metal	Surface Water	Instrument Set-up	AA duplicate injection precision criteria were not met	No	4	40,618	0.01	Precision
Metal	Surface Water	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	1	40,618	0.00	Precision
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	No	41	40,618	0.10	Accuracy
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	Yes	153	40,618	0.38	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	No	156	40,618	0.38	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	Yes	134	40,618	0.33	Accuracy
Metal	Surface Water	LCS	LCS recovery criteria were not met	No	86	40,618	0.21	Accuracy
Metal	Surface Water	LCS	LCS recovery criteria were not met	Yes	355	40,618	0.87	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	No	147	40,618	0.36	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	Yes	266	40,618	0.65	Accuracy
Metal	Surface Water	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	19	40,618	0.05	Representativeness
Metal	Surface Water	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	25	40,618	0.06	Representativeness
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	No	90	40,618	0.22	Precision
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	Yes	152	40,618	0.37	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	No	20	40,618	0.05	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	Yes	61	40,618	0.15	Precision
Metal	Surface Water	Matrices	MS/MSD precision criteria were not met	No	6	40,618	0.01	Precision

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Matrices	MS/MSD precision criteria were not met	Yes	2	40,618	0.00	Precision
Metal	Surface Water	Matrices	MSA calibration correlation coefficient < 0.995	No	3	40,618	0.01	Accuracy
Metal	Surface Water	Matrices	MSA calibration correlation coefficient < 0.995	Yes	5	40,618	0.01	Accuracy
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	No	384	40,618	0.95	Accuracy
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	Yes	70	40,618	0.17	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	No	445	40,618	1.10	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	Yes	475	40,618	1.17	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	No	1	40,618	0.00	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	Yes	20	40,618	0.05	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	No	13	40,618	0.03	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	Yes	727	40,618	1.79	Accuracy
Metal	Surface Water	Matrices	Site samples were not used for sample matrix QC	No	1	40,618	0.00	Representativeness
Metal	Surface Water	Other	Analysis was not requested according to the statement of work	Yes	1	40,618	0.00	N/A
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	No	223	40,618	0.55	Accuracy
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	Yes	730	40,618	1.80	Accuracy
Metal	Surface Water	Other	Incorrect analysis sequence	No	1	40,618	0.00	Representativeness
Metal	Surface Water	Other	Incorrect analysis sequence	Yes	3	40,618	0.01	Representativeness
Metal	Surface Water	Other	QC sample frequency does not meet method requirements	No	7	40,618	0.02	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Other	QC sample frequency does not meet method requirements	Yes	10	40,618	0.02	Representativeness
Metal	Surface Water	Other	Result obtained through dilution	No	4	40,618	0.01	N/A
Metal	Surface Water	Other	Result obtained through dilution	Yes	2	40,618	0.00	N/A
Metal	Surface Water	Other	See hard copy for further explanation	No	510	40,618	1.26	N/A
Metal	Surface Water	Other	See hard copy for further explanation	Yes	666	40,618	1.64	N/A
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	312	40,618	0.77	Representativeness
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	Yes	1,085	40,618	2.67	Representativeness
Metal	Surface Water	Sensitivity	IDL changed due to a significant figure discrepancy	No	2	40,618	0.00	Representativeness
PCB	Sediment	Calculation Errors	Calculation error	Yes	1	602	0.17	N/A
PCB	Sediment	Confirmation	Confirmation percent difference criteria not met	Yes	1	602	0.17	Precision
PCB	Sediment	Documentation Issues	Transcription error	Yes	1	602	0.17	N/A
PCB	Sediment	Other	See hard copy for further explanation	Yes	1	602	0.17	N/A
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	No	19	602	3.16	Accuracy
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	2	602	0.33	Accuracy
PCB	Surface Water	Documentation Issues	Record added by the validator	No	28	189	14.81	N/A
PCB	Surface Water	Holding Times	Holding times were exceeded	No	7	189	3.70	Representativeness
PCB	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	7	189	3.70	Accuracy
Pesticide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	28	1,182	2.37	Accuracy
Pesticide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,182	0.08	Accuracy
Pesticide	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1	1,182	0.08	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Pesticide	Sediment	Documentation Issues	Transcription error	No	47	1,182	3.98	N/A
Pesticide	Sediment	Holding Times	Holding times were exceeded	No	1	1,182	0.08	Representativeness
Pesticide	Sediment	Other	Sample results were not validated due to re-analysis	No	1	1,182	0.08	N/A
Pesticide	Sediment	Other	See hard copy for further explanation	No	1	1,182	0.08	N/A
Pesticide	Sediment	Other	See hard copy for further explanation	Yes	1	1,182	0.08	N/A
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	79	1,182	6.68	Accuracy
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	3	1,182	0.25	Accuracy
Pesticide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	13	665	1.95	Accuracy
Pesticide	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	No	1	665	0.15	Representativeness
Pesticide	Surface Water	Documentation Issues	Record added by the validator	No	88	665	13.23	N/A
Pesticide	Surface Water	Documentation Issues	Transcription error	No	5	665	0.75	N/A
Pesticide	Surface Water	Holding Times	Holding times were exceeded	No	23	665	3.46	Representativeness
Pesticide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	3	665	0.45	Accuracy
Pesticide	Surface Water	Other	Lab results not verified due to unsubmitted data	No	1	665	0.15	Representativeness
Pesticide	Surface Water	Other	See hard copy for further explanation	No	7	665	1.05	N/A
Pesticide	Surface Water	Other	See hard copy for further explanation	Yes	2	665	0.30	N/A
Pesticide	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	12	665	1.80	Representativeness
Pesticide	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	21	665	3.16	Accuracy
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	2	922	0.22	Representativeness
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	57	922	6.18	Representativeness
Radionuclide	Sediment	Calculation Errors	Calculation error	No	8	922	0.87	N/A
Radionuclide	Sediment	Calculation Errors	Calculation error	Yes	15	922	1.63	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	103	922	11.17	Accuracy
Radionuclide	Sediment	Documentation Issues	Record added by the validator	Yes	3	922	0.33	N/A
Radionuclide	Sediment	Documentation Issues	Results were not included on Data Summary Table	No	7	922	0.76	N/A
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	150	922	16.27	Representativeness
Radionuclide	Sediment	Documentation Issues	Transcription error	No	7	922	0.76	N/A
Radionuclide	Sediment	Documentation Issues	Transcription error	Yes	154	922	16.70	N/A
Radionuclide	Sediment	Instrument Set-up	Detector efficiency did not meet requirements	Yes	4	922	0.43	Accuracy
Radionuclide	Sediment	Instrument Set-up	Resolution criteria were not met	Yes	5	922	0.54	Representativeness
Radionuclide	Sediment	LCS	LCS recovery > +/- 3 sigma	Yes	20	922	2.17	Accuracy
Radionuclide	Sediment	LCS	LCS recovery criteria were not met	No	1	922	0.11	Accuracy
Radionuclide	Sediment	LCS	LCS recovery criteria were not met	Yes	20	922	2.17	Accuracy
Radionuclide	Sediment	LCS	LCS relative percent error criteria not met	Yes	23	922	2.49	Accuracy
Radionuclide	Sediment	Matrices	Recovery criteria were not met	Yes	4	922	0.43	Accuracy
Radionuclide	Sediment	Matrices	Replicate analysis was not performed	Yes	1	922	0.11	Precision
Radionuclide	Sediment	Matrices	Replicate precision criteria were not met	Yes	17	922	1.84	Precision
Radionuclide	Sediment	Matrices	Replicate recovery criteria were not met	Yes	8	922	0.87	Accuracy
Radionuclide	Sediment	Other	Lab results not verified due to unsubmitted data	No	3	922	0.33	Representativeness
Radionuclide	Sediment	Other	Lab results not verified due to unsubmitted data	Yes	1	922	0.11	Representativeness
Radionuclide	Sediment	Other	QC sample does not meet method requirements	Yes	1	922	0.11	Representativeness
Radionuclide	Sediment	Other	Sample exceeded efficiency curve weight limit	Yes	2	922	0.22	Accuracy
Radionuclide	Sediment	Other	See hard copy for further explanation	No	1	922	0.11	N/A
Radionuclide	Sediment	Other	See hard copy for further explanation	Yes	14	922	1.52	N/A
Radionuclide	Sediment	Sensitivity	Incorrect reported activity or MDA	No	3	922	0.33	N/A
Radionuclide	Sediment	Sensitivity	MDA exceeded the RDL	No	1	922	0.11	Representativeness
Radionuclide	Sediment	Sensitivity	MDA exceeded the RDL	Yes	8	922	0.87	Representativeness
Radionuclide	Sediment	Sensitivity	MDA was calculated by reviewer	No	3	922	0.33	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Sediment	Sensitivity	MDA was calculated by reviewer	Yes	219	922	23.75	N/A
Radionuclide	Sediment	Sensitivity	Results considered qualitative not quantitative	No	1	922	0.11	Accuracy
Radionuclide	Sediment	Sensitivity	Results considered qualitative not quantitative	Yes	1	922	0.11	Accuracy
Radionuclide	Surface W	Blanks	Blank correction was not performed	No	5	10,144	0.05	Representativeness
Radionuclide	Surface W	Blanks	Blank correction was not performed	Yes	3	10,144	0.03	Representativeness
Radionuclide	Surface W	Blanks	Blank recovery criteria were not met	No	11	10,144	0.11	Representativeness
Radionuclide	Surface W	Blanks	Blank recovery criteria were not met	Yes	35	10,144	0.35	Representativeness
Radionuclide	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	98	10,144	0.97	Representativeness
Radionuclide	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	232	10,144	2.29	Representativeness
Radionuclide	Surface W	Calculation Errors	Calculation error	No	48	10,144	0.47	N/A
Radionuclide	Surface W	Calculation Errors	Calculation error	Yes	51	10,144	0.50	N/A
Radionuclide	Surface W	Calibration	Calibration counting statistics did not meet criteria	No	47	10,144	0.46	Accuracy
Radionuclide	Surface W	Calibration	Calibration counting statistics did not meet criteria	Yes	9	10,144	0.09	Accuracy
Radionuclide	Surface W	Calibration	Calibration requirements affecting data quality have not been met	No	1	10,144	0.01	Accuracy
Radionuclide	Surface W	Calibration	Continuing calibration verification criteria were not met	No	81	10,144	0.80	Accuracy
Radionuclide	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	575	10,144	5.67	Accuracy
Radionuclide	Surface W	Documentation Issues	Information missing from case narrative	No	28	10,144	0.28	N/A
Radionuclide	Surface W	Documentation Issues	Information missing from case narrative	Yes	46	10,144	0.45	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	12	10,144	0.12	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	35	10,144	0.35	N/A
Radionuclide	Surface W	Documentation Issues	Missing deliverables (required for validation)	No	19	10,144	0.19	Representativeness
Radionuclide	Surface W	Documentation Issues	Missing deliverables (required for validation)	Yes	10	10,144	0.10	Representativeness
Radionuclide	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	144	10,144	1.42	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	360	10,144	3.55	N/A
Radionuclide	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	3	10,144	0.03	Representativeness
Radionuclide	Surface W	Documentation Issues	Record added by the validator	Yes	43	10,144	0.42	N/A
Radionuclide	Surface W	Documentation Issues	Sample analysis was not requested	No	3	10,144	0.03	N/A
Radionuclide	Surface W	Documentation Issues	Sufficient documentation not provided by the laboratory	No	5	10,144	0.05	Representativeness
Radionuclide	Surface W	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	237	10,144	2.34	Representativeness
Radionuclide	Surface W	Documentation Issues	Transcription error	No	331	10,144	3.26	N/A
Radionuclide	Surface W	Documentation Issues	Transcription error	Yes	194	10,144	1.91	N/A
Radionuclide	Surface W	Holding Times	Holding times were exceeded	No	50	10,144	0.49	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were exceeded	Yes	95	10,144	0.94	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	No	16	10,144	0.16	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	Yes	25	10,144	0.25	Representativeness
Radionuclide	Surface W	Instrument Set-up	Resolution criteria were not met	Yes	10	10,144	0.10	Representativeness
Radionuclide	Surface W	Instrument Set-up	Transformed spectral index external site criteria were not met	No	2	10,144	0.02	Representativeness
Radionuclide	Surface W	LCS	Expected LCS value not submitted/verifiable	No	16	10,144	0.16	Representativeness
Radionuclide	Surface W	LCS	Expected LCS value not submitted/verifiable	Yes	28	10,144	0.28	Representativeness
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	No	210	10,144	2.07	Accuracy
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	Yes	170	10,144	1.68	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	No	5	10,144	0.05	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	Yes	33	10,144	0.33	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	No	80	10,144	0.79	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	Yes	173	10,144	1.71	Accuracy
Radionuclide	Surface W	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	No	1	10,144	0.01	Representativeness
Radionuclide	Surface W	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	1	10,144	0.01	Representativeness
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	No	4	10,144	0.04	Precision
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	Yes	8	10,144	0.08	Precision
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	No	2	10,144	0.02	Precision

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	16	10,144	0.16	Precision
Radionuclide	Surface W	Matrices	Laboratory duplicate was not analyzed	No	1	10,144	0.01	Precision
Radionuclide	Surface W	Matrices	Recovery criteria were not met	No	16	10,144	0.16	Accuracy
Radionuclide	Surface W	Matrices	Recovery criteria were not met	Yes	27	10,144	0.27	Accuracy
Radionuclide	Surface W	Matrices	Replicate analysis was not performed	No	10	10,144	0.10	Precision
Radionuclide	Surface W	Matrices	Replicate analysis was not performed	Yes	44	10,144	0.43	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	No	85	10,144	0.84	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	Yes	196	10,144	1.93	Precision
Radionuclide	Surface W	Matrices	Replicate recovery criteria were not met	No	1	10,144	0.01	Accuracy
Radionuclide	Surface W	Matrices	Replicate recovery criteria were not met	Yes	15	10,144	0.15	Accuracy
Radionuclide	Surface W	Other	Lab results not verified due to unsubmitted data	No	1	10,144	0.01	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	No	23	10,144	0.23	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	Yes	27	10,144	0.27	Representativeness
Radionuclide	Surface W	Other	Sample exceeded efficiency curve weight limit	Yes	4	10,144	0.04	Accuracy
Radionuclide	Surface W	Other	Sample or control analyses not chemically separated	No	1	10,144	0.01	Representativeness
Radionuclide	Surface W	Other	Sample or control analyses not chemically separated	Yes	5	10,144	0.05	Representativeness
Radionuclide	Surface W	Other	Sample results were not validated due to re-analysis	No	1	10,144	0.01	N/A
Radionuclide	Surface W	Other	Sample results were not validated due to re-analysis	Yes	4	10,144	0.04	N/A
Radionuclide	Surface W	Other	See hard copy for further explanation	No	150	10,144	1.48	N/A
Radionuclide	Surface W	Other	See hard copy for further explanation	Yes	149	10,144	1.47	N/A
Radionuclide	Surface W	Other	Tracer requirements were not met	No	33	10,144	0.33	Accuracy
Radionuclide	Surface W	Other	Tracer requirements were not met	Yes	59	10,144	0.58	Accuracy
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	28	10,144	0.28	Representativeness
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	18	10,144	0.18	Representativeness
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	No	22	10,144	0.22	N/A
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	Yes	4	10,144	0.04	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	No	75	10,144	0.74	Representativeness
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	Yes	86	10,144	0.85	Representativeness
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	No	20	10,144	0.20	N/A
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	Yes	456	10,144	4.50	N/A
SVOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	21	4,690	0.45	Representativeness
SVOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	2	4,690	0.04	Representativeness
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	42	4,690	0.90	Accuracy
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	11	4,690	0.23	Accuracy
SVOC	Sediment	Calibration	Independent calibration verification criteria not met	No	11	4,690	0.23	Accuracy
SVOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	47	4,690	1.00	N/A
SVOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	12	4,690	0.26	N/A
SVOC	Sediment	Documentation Issues	Transcription error	No	4	4,690	0.09	N/A
SVOC	Sediment	Documentation Issues	Transcription error	Yes	19	4,690	0.41	N/A
SVOC	Sediment	Holding Times	Holding times were exceeded	No	47	4,690	1.00	Representativeness
SVOC	Sediment	Holding Times	Holding times were exceeded	Yes	12	4,690	0.26	Representativeness
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	35	4,690	0.75	Accuracy
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	Yes	10	4,690	0.21	Accuracy
SVOC	Sediment	LCS	LCS recovery criteria were not met	No	1	4,690	0.02	Accuracy
SVOC	Sediment	Matrices	MS/MSD precision criteria were not met	No	10	4,690	0.21	Precision
SVOC	Sediment	Matrices	MS/MSD precision criteria were not met	Yes	1	4,690	0.02	Precision
SVOC	Sediment	Other	Sample results were not validated due to re-analysis	No	41	4,690	0.87	N/A
SVOC	Sediment	Other	Sample results were not validated due to re-analysis	Yes	25	4,690	0.53	N/A
SVOC	Sediment	Surrogates	Surrogate recovery criteria were not met	No	109	4,690	2.32	Accuracy
SVOC	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	11	4,690	0.23	Accuracy
SVOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	10	5,621	0.18	Representativeness
SVOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	2	5,621	0.04	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
SVOC	Surface W	Calculation Errors	Calculation error	No	17	5,621	0.30	N/A
SVOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	72	5,621	1.28	Accuracy
SVOC	Surface W	Calibration	Independent calibration verification criteria not met	No	24	5,621	0.43	Accuracy
SVOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	33	5,621	0.59	N/A
SVOC	Surface W	Documentation Issues	No mass spectra were provided	No	1	5,621	0.02	Representativeness
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	71	5,621	1.26	N/A
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1	5,621	0.02	N/A
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	8	5,621	0.14	Representativeness
SVOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	5,621	0.02	Representativeness
SVOC	Surface W	Documentation Issues	Original documentation not provided	No	12	5,621	0.21	N/A
SVOC	Surface W	Documentation Issues	Record added by the validator	No	327	5,621	5.82	N/A
SVOC	Surface W	Documentation Issues	Record added by the validator	Yes	2	5,621	0.04	N/A
SVOC	Surface W	Documentation Issues	Transcription error	No	448	5,621	7.97	N/A
SVOC	Surface W	Holding Times	Holding times were exceeded	No	395	5,621	7.03	Representativeness
SVOC	Surface W	Holding Times	Holding times were exceeded	Yes	1	5,621	0.02	Representativeness
SVOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	No	3	5,621	0.05	Accuracy
SVOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	139	5,621	2.47	Accuracy
SVOC	Surface W	Internal Standards	Internal standards did not meet criteria	Yes	1	5,621	0.02	Accuracy
SVOC	Surface W	LCS	LCS recovery criteria were not met	No	55	5,621	0.98	Accuracy
SVOC	Surface W	Other	Lab results not verified due to unsubmitted data	No	55	5,621	0.98	Representativeness
SVOC	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	1	5,621	0.02	Representativeness
SVOC	Surface W	Other	See hard copy for further explanation	No	348	5,621	6.19	N/A
SVOC	Surface W	Other	See hard copy for further explanation	Yes	1	5,621	0.02	N/A
SVOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	668	5,621	11.88	Representativeness
SVOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	4	5,621	0.07	Representativeness
SVOC	Surface W	Surrogates	Surrogate recovery criteria were not met	No	30	5,621	0.53	Accuracy

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	63	3,511	1.79	Representativeness
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	14	3,511	0.40	Representativeness
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	102	3,511	2.91	Accuracy
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	11	3,511	0.31	Accuracy
VOC	Sediment	Calibration	Independent calibration verification criteria not met	No	5	3,511	0.14	Accuracy
VOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	No	118	3,511	3.36	N/A
VOC	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	5	3,511	0.14	N/A
VOC	Sediment	Documentation Issues	Transcription error	No	3	3,511	0.09	N/A
VOC	Sediment	Documentation Issues	Transcription error	Yes	1	3,511	0.03	N/A
VOC	Sediment	Holding Times	Holding times were exceeded	No	4	3,511	0.11	Representativeness
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	293	3,511	8.35	Accuracy
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	Yes	6	3,511	0.17	Accuracy
VOC	Sediment	Matrices	MS/MSD precision criteria were not met	No	121	3,511	3.45	Precision
VOC	Sediment	Matrices	MS/MSD precision criteria were not met	Yes	1	3,511	0.03	Precision
VOC	Sediment	Other	Sample results were not validated due to re-analysis	No	35	3,511	1.00	N/A
VOC	Sediment	Other	Sample results were not validated due to re-analysis	Yes	5	3,511	0.14	N/A
VOC	Sediment	Surrogates	Surrogate recovery criteria were not met	No	98	3,511	2.79	Accuracy
VOC	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	16	3,511	0.46	Accuracy
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	175	26,424	0.66	Representativeness
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	49	26,424	0.19	Representativeness
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	141	26,424	0.53	Accuracy
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	54	26,424	0.20	Accuracy
VOC	Surface W	Calibration	Independent calibration verification criteria not met	No	71	26,424	0.27	Accuracy

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Surface W	Calibration	Independent calibration verification criteria not met	Yes	11	26,424	0.04	Accuracy
VOC	Surface W	Calibration	Original result exceeded linear range, serial dilution value reported	Yes	2	26,424	0.01	Accuracy
VOC	Surface W	Calibration	Result exceeded linear range of measurement system	Yes	14	26,424	0.05	Accuracy
VOC	Surface W	Confirmation	Results were not confirmed	No	3	26,424	0.01	Precision
VOC	Surface W	Confirmation	Results were not confirmed	Yes	1	26,424	0.00	Precision
VOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	No	572	26,424	2.16	N/A
VOC	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	59	26,424	0.22	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	1,442	26,424	5.46	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	110	26,424	0.42	N/A
VOC	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	1	26,424	0.00	Representativeness
VOC	Surface W	Documentation Issues	Original documentation not provided	No	234	26,424	0.89	N/A
VOC	Surface W	Documentation Issues	Original documentation not provided	Yes	10	26,424	0.04	N/A
VOC	Surface W	Documentation Issues	Record added by the validator	No	183	26,424	0.69	N/A
VOC	Surface W	Documentation Issues	Record added by the validator	Yes	8	26,424	0.03	N/A
VOC	Surface W	Documentation Issues	Transcription error	No	2,809	26,424	10.63	N/A
VOC	Surface W	Documentation Issues	Transcription error	Yes	462	26,424	1.75	N/A
VOC	Surface W	Holding Times	Holding times were exceeded	No	2,771	26,424	10.49	Representativeness
VOC	Surface W	Holding Times	Holding times were exceeded	Yes	10	26,424	0.04	Representativeness
VOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	No	72	26,424	0.27	Accuracy
VOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	Yes	8	26,424	0.03	Accuracy
VOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	139	26,424	0.53	Accuracy
VOC	Surface W	Internal Standards	Internal standards did not meet criteria	Yes	3	26,424	0.01	Accuracy
VOC	Surface W	LCS	LCS recovery criteria were not met	No	498	26,424	1.88	Accuracy
VOC	Surface W	LCS	LCS recovery criteria were not met	Yes	94	26,424	0.36	Accuracy
VOC	Surface W	Matrices	MS/MSD precision criteria were not met	No	4	26,424	0.02	Precision
VOC	Surface W	Other	Lab results not verified due to unsubmitted data	No	1	26,424	0.00	Representativeness
VOC	Surface W	Other	Sample results were not validated due to re-analysis	No	11	26,424	0.04	N/A

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Surface W	Other	Sample results were not validated due to re-analysis	Yes	43	26,424	0.16	N/A
VOC	Surface W	Other	See hard copy for further explanation	No	482	26,424	1.82	N/A
VOC	Surface W	Other	See hard copy for further explanation	Yes	104	26,424	0.39	N/A
VOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	805	26,424	3.05	Representativeness
VOC	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	41	26,424	0.16	Representativeness
VOC	Surface W	Surrogates	Surrogate recovery criteria were not met	No	46	26,424	0.17	Accuracy
VOC	Surface W	Surrogates	Surrogate recovery criteria were not met	Yes	15	26,424	0.06	Accuracy
Wet Chem	Sediment	Blanks	Calibration verification blank contamination	No	4	75	5.33	Representativeness
Wet Chem	Sediment	Blanks	Calibration verification blank contamination	Yes	2	75	2.67	Representativeness
Wet Chem	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	2	75	2.67	Representativeness
Wet Chem	Sediment	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	1	75	1.33	N/A
Wet Chem	Sediment	Documentation Issues	Transcription error	No	5	75	6.67	N/A
Wet Chem	Sediment	Holding Times	Holding times were exceeded	Yes	5	75	6.67	Representativeness
Wet Chem	Sediment	Holding Times	Holding times were grossly exceeded	No	4	75	5.33	Representativeness
Wet Chem	Sediment	LCS	LCS recovery criteria were not met	Yes	1	75	1.33	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	2	75	2.67	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	11	75	14.67	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	29	75	38.67	Accuracy
Wet Chem	Sediment	Other	Lab results not verified due to unsubmitted data	Yes	1	75	1.33	Representativeness
Wet Chem	Surface W	Blanks	Calibration verification blank contamination	No	2	2,974	0.07	Representativeness
Wet Chem	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	1	2,974	0.03	Representativeness
Wet Chem	Surface W	Calculation Errors	Control limits not assigned correctly	Yes	2	2,974	0.07	N/A
Wet Chem	Surface W	Calibration	Calibration correlation coefficient did not meet requirements	Yes	7	2,974	0.24	Accuracy

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Wet Chem	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	14	2,974	0.47	Accuracy
Wet Chem	Surface W	Calibration	Result exceeded linear range of measurement system	Yes	8	2,974	0.27	Accuracy
Wet Chem	Surface W	Documentation Issues	Key data fields incorrect	No	1	2,974	0.03	N/A
Wet Chem	Surface W	Documentation Issues	Key data fields incorrect	Yes	1	2,974	0.03	N/A
Wet Chem	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	2	2,974	0.07	N/A
Wet Chem	Surface W	Documentation Issues	Missing deliverables (required for validation)	Yes	2	2,974	0.07	Representativeness
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	No	8	2,974	0.27	N/A
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	64	2,974	2.15	N/A
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	No	4	2,974	0.13	Representativeness
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	1	2,974	0.03	Representativeness
Wet Chem	Surface W	Documentation Issues	Record added by the validator	No	26	2,974	0.87	N/A
Wet Chem	Surface W	Documentation Issues	Record added by the validator	Yes	57	2,974	1.92	N/A
Wet Chem	Surface W	Documentation Issues	Transcription error	Yes	107	2,974	3.60	N/A
Wet Chem	Surface W	Holding Times	Holding times were exceeded	No	14	2,974	0.47	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were exceeded	Yes	56	2,974	1.88	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	No	7	2,974	0.24	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	Yes	2	2,974	0.07	Representativeness
Wet Chem	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	2	2,974	0.07	Precision
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	No	5	2,974	0.17	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	Yes	48	2,974	1.61	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery was < 30 percent	Yes	2	2,974	0.07	Accuracy
Wet Chem	Surface W	Matrices	Site samples were not used for sample matrix QC	Yes	8	2,974	0.27	Representativeness
Wet Chem	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	12	2,974	0.40	Representativeness

**Table A2.2.1**  
**SW AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Wet Chem	Surface W	Other	Result obtained through dilution	Yes	15	2,974	0.50	N/A
Wet Chem	Surface W	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	14	2,974	0.47	Representativeness
Wet Chem	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	4	2,974	0.13	Representativeness
Wet Chem	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	109	2,974	3.67	Representativeness

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Dioxins and Furans	Surface Water	Documentation Issues	Record added by the validator	No	2	14	14.29	N/A
Dioxins and Furans	Surface Water	Documentation Issues	Transcription error	No	3	14	21.43	N/A
Herbicide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	2	60	3.33	Accuracy
Herbicide	Sediment	Holding Times	Holding times were exceeded	No	3	60	5.00	Representativeness
Herbicide	Sediment	Internal Standards	Internal standards did not meet criteria	No	2	60	3.33	Accuracy
Herbicide	Sediment	Other	Sample results were not validated due to re-analysis	No	1	60	1.67	N/A
Herbicide	Sediment	Other	See hard copy for further explanation	No	6	60	10.00	N/A
Herbicide	Surface Water	Documentation Issues	Record added by the validator	No	1	141	0.71	N/A
Herbicide	Surface Water	Documentation Issues	Transcription error	No	21	141	14.89	N/A
Herbicide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	1	141	0.71	Accuracy
Herbicide	Surface Water	Other	See hard copy for further explanation	No	34	141	24.11	N/A
Metal	Sediment	Blanks	Calibration verification blank contamination	No	17	2,472	0.69	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	81	2,472	3.28	Representativeness
Metal	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	19	2,472	0.77	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	No	18	2,472	0.73	Representativeness
Metal	Sediment	Blanks	Negative bias indicated in the blanks	Yes	42	2,472	1.70	Representativeness
Metal	Sediment	Calibration	Calibration correlation coefficient did not meet requirements	Yes	9	2,472	0.36	Accuracy
Metal	Sediment	Calibration	Continuing calibration verification criteria were not met	No	2	2,472	0.08	Accuracy
Metal	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	8	2,472	0.32	Accuracy
Metal	Sediment	Documentation Issues	Missing deliverables (not required for validation)	No	3	2,472	0.12	N/A
Metal	Sediment	Documentation Issues	Missing deliverables (not required for validation)	Yes	20	2,472	0.81	N/A
Metal	Sediment	Documentation Issues	Transcription error	No	4	2,472	0.16	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	Documentation Issues	Transcription error	Yes	57	2,472	2.31	N/A
Metal	Sediment	Holding Times	Holding times were exceeded	No	3	2,472	0.12	Representativeness
Metal	Sediment	Instrument Set-up	Interference was indicated in the interference check sample	No	1	2,472	0.04	Accuracy
Metal	Sediment	Instrument Set-up	Interference was indicated in the interference check sample	Yes	5	2,472	0.20	Accuracy
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	No	19	2,472	0.77	Accuracy
Metal	Sediment	LCS	CRDL check sample recovery criteria were not met	Yes	19	2,472	0.77	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	No	105	2,472	4.25	Accuracy
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	374	2,472	15.13	Accuracy
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	No	24	2,472	0.97	Accuracy
Metal	Sediment	LCS	Low level check sample recovery criteria were not met	Yes	5	2,472	0.20	Accuracy
Metal	Sediment	Matrices	Duplicate sample precision criteria were not met	Yes	54	2,472	2.18	Precision
Metal	Sediment	Matrices	LCS/LCSD precision criteria were not met	Yes	1	2,472	0.04	Precision
Metal	Sediment	Matrices	MSA calibration correlation coefficient < 0.995	Yes	2	2,472	0.08	Accuracy
Metal	Sediment	Matrices	Percent solids < 30 percent	No	20	2,472	0.81	Representativeness
Metal	Sediment	Matrices	Percent solids < 30 percent	Yes	152	2,472	6.15	Representativeness
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	No	4	2,472	0.16	Accuracy
Metal	Sediment	Matrices	Post-digestion MS did not meet control criteria	Yes	21	2,472	0.85	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	55	2,472	2.22	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	168	2,472	6.80	Accuracy
Metal	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	2	2,472	0.08	Accuracy
Metal	Sediment	Matrices	Serial dilution criteria were not met	Yes	34	2,472	1.38	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	No	6	2,472	0.24	Accuracy
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	38	2,472	1.54	Accuracy
Metal	Sediment	Other	Result obtained through dilution	Yes	2	2,472	0.08	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Sediment	Other	See hard copy for further explanation	No	30	2,472	1.21	N/A
Metal	Sediment	Other	See hard copy for further explanation	Yes	80	2,472	3.24	N/A
Metal	Surface Water	Blanks	Calibration verification blank contamination	No	527	19,194	2.75	Representativeness
Metal	Surface Water	Blanks	Calibration verification blank contamination	Yes	75	19,194	0.39	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	No	386	19,194	2.01	Representativeness
Metal	Surface Water	Blanks	Method, preparation, or reagent blank contamination	Yes	806	19,194	4.20	Representativeness
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	No	271	19,194	1.41	Representativeness
Metal	Surface Water	Blanks	Negative bias indicated in the blanks	Yes	164	19,194	0.85	Representativeness
Metal	Surface Water	Calculation Errors	Calculation error	No	5	19,194	0.03	N/A
Metal	Surface Water	Calculation Errors	Calculation error	Yes	1	19,194	0.01	N/A
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	No	4	19,194	0.02	N/A
Metal	Surface Water	Calculation Errors	Control limits not assigned correctly	Yes	3	19,194	0.02	N/A
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	No	127	19,194	0.66	Accuracy
Metal	Surface Water	Calibration	Calibration correlation coefficient did not meet requirements	Yes	4	19,194	0.02	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	2	19,194	0.01	Accuracy
Metal	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	7	19,194	0.04	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	No	1	19,194	0.01	Accuracy
Metal	Surface Water	Calibration	Frequency or sequencing verification criteria not met	Yes	9	19,194	0.05	Accuracy
Metal	Surface Water	Documentation Issues	Key data fields incorrect	No	127	19,194	0.66	N/A
Metal	Surface Water	Documentation Issues	Key data fields incorrect	Yes	632	19,194	3.29	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	84	19,194	0.44	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	Yes	93	19,194	0.48	N/A
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	18	19,194	0.09	Representativeness
Metal	Surface Water	Documentation Issues	Missing deliverables (required for validation)	Yes	20	19,194	0.10	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	146	19,194	0.76	N/A
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	252	19,194	1.31	N/A
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	No	2	19,194	0.01	Representativeness
Metal	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	3	19,194	0.02	Representativeness
Metal	Surface Water	Documentation Issues	Record added by the validator	No	101	19,194	0.53	N/A
Metal	Surface Water	Documentation Issues	Record added by the validator	Yes	120	19,194	0.63	N/A
Metal	Surface Water	Documentation Issues	Reported data does not agree with raw data	No	1	19,194	0.01	N/A
Metal	Surface Water	Documentation Issues	Transcription error	No	357	19,194	1.86	N/A
Metal	Surface Water	Documentation Issues	Transcription error	Yes	355	19,194	1.85	N/A
Metal	Surface Water	Holding Times	Holding times were exceeded	No	90	19,194	0.47	Representativeness
Metal	Surface Water	Holding Times	Holding times were exceeded	Yes	46	19,194	0.24	Representativeness
Metal	Surface Water	Holding Times	Holding times were grossly exceeded	Yes	4	19,194	0.02	Representativeness
Metal	Surface Water	Instrument Set-up	AA duplicate injection precision criteria were not met	Yes	3	19,194	0.02	Precision
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	No	3	19,194	0.02	Accuracy
Metal	Surface Water	Instrument Set-up	Interference was indicated in the interference check sample	Yes	44	19,194	0.23	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	No	167	19,194	0.87	Accuracy
Metal	Surface Water	LCS	CRDL check sample recovery criteria were not met	Yes	142	19,194	0.74	Accuracy

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	LCS	LCS recovery criteria were not met	No	93	19,194	0.48	Accuracy
Metal	Surface Water	LCS	LCS recovery criteria were not met	Yes	163	19,194	0.85	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	No	71	19,194	0.37	Accuracy
Metal	Surface Water	LCS	Low level check sample recovery criteria were not met	Yes	124	19,194	0.65	Accuracy
Metal	Surface Water	LCS	QC sample/analyte (e.g. spike, duplicate, LCS) was not analyzed	Yes	2	19,194	0.01	Representativeness
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	No	18	19,194	0.09	Precision
Metal	Surface Water	Matrices	Duplicate sample precision criteria were not met	Yes	72	19,194	0.38	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	No	13	19,194	0.07	Precision
Metal	Surface Water	Matrices	LCS/LCSD precision criteria were not met	Yes	35	19,194	0.18	Precision
Metal	Surface Water	Matrices	MS/MSD precision criteria were not met	No	8	19,194	0.04	Precision
Metal	Surface Water	Matrices	MSA calibration correlation coefficient < 0.995	Yes	1	19,194	0.01	Accuracy
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	No	237	19,194	1.23	Accuracy
Metal	Surface Water	Matrices	Post-digestion MS did not meet control criteria	Yes	23	19,194	0.12	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	No	252	19,194	1.31	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery criteria were not met	Yes	219	19,194	1.14	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	No	2	19,194	0.01	Accuracy
Metal	Surface Water	Matrices	Predigestion MS recovery was < 30 percent	Yes	15	19,194	0.08	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	No	10	19,194	0.05	Accuracy
Metal	Surface Water	Matrices	Serial dilution criteria were not met	Yes	294	19,194	1.53	Accuracy
Metal	Surface Water	Matrices	Site samples were not used for sample matrix QC	No	6	19,194	0.03	Representativeness

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Metal	Surface Water	Matrices	Site samples were not used for sample matrix QC	Yes	22	19,194	0.11	Representativeness
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	No	234	19,194	1.22	Accuracy
Metal	Surface Water	Other	IDL is older than 3 months from date of analysis	Yes	475	19,194	2.47	Accuracy
Metal	Surface Water	Other	See hard copy for further explanation	No	14	19,194	0.07	N/A
Metal	Surface Water	Other	See hard copy for further explanation	Yes	34	19,194	0.18	N/A
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	165	19,194	0.86	Representativeness
Metal	Surface Water	Sample Preparation	Samples were not properly preserved in the field	Yes	299	19,194	1.56	Representativeness
Metal	Surface Water	Sensitivity	IDL changed due to a significant figure discrepancy	No	5	19,194	0.03	Representativeness
Metal	Surface Water	Sensitivity	Instrument detection limit > the associated RDL	Yes	1	19,194	0.01	Representativeness
PCB	Sediment	Documentation Issues	Transcription error	No	6	398	1.51	N/A
PCB	Sediment	Documentation Issues	Transcription error	Yes	1	398	0.25	N/A
PCB	Sediment	Other	See hard copy for further explanation	Yes	3	398	0.75	N/A
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	No	47	398	11.81	Accuracy
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	3	398	0.75	Accuracy
PCB	Surface Water	Documentation Issues	Record added by the validator	No	7	546	1.28	N/A
PCB	Surface Water	Documentation Issues	Transcription error	No	35	546	6.41	N/A
PCB	Surface Water	Holding Times	Holding times were exceeded	No	28	546	5.13	Representativeness
PCB	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	14	546	2.56	Accuracy
Pesticide	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	1	1,088	0.09	Representativeness
Pesticide	Sediment	Calibration	Continuing calibration verification criteria were not met	No	4	1,088	0.37	Accuracy
Pesticide	Sediment	Documentation Issues	Record added by the validator	No	2	1,088	0.18	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Pesticide	Sediment	Documentation Issues	Transcription error	No	20	1,088	1.84	N/A
Pesticide	Sediment	Documentation Issues	Transcription error	Yes	1	1,088	0.09	N/A
Pesticide	Sediment	Holding Times	Holding times were exceeded	No	3	1,088	0.28	Representativeness
Pesticide	Sediment	Internal Standards	Internal standards did not meet criteria	No	2	1,088	0.18	Accuracy
Pesticide	Sediment	Other	Sample results were not validated due to re-analysis	No	1	1,088	0.09	N/A
Pesticide	Sediment	Other	See hard copy for further explanation	No	10	1,088	0.92	N/A
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	132	1,088	12.13	Accuracy
Pesticide	Surface Water	Blanks	Method, preparation, or reagent blank contamination	No	5	1,713	0.29	Representativeness
Pesticide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	12	1,713	0.70	Accuracy
Pesticide	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,713	0.06	Accuracy
Pesticide	Surface Water	Documentation Issues	Record added by the validator	No	21	1,713	1.23	N/A
Pesticide	Surface Water	Documentation Issues	Transcription error	No	22	1,713	1.28	N/A
Pesticide	Surface Water	Documentation Issues	Transcription error	Yes	1	1,713	0.06	N/A
Pesticide	Surface Water	Holding Times	Holding times were exceeded	No	84	1,713	4.90	Representativeness
Pesticide	Surface Water	Internal Standards	Internal standards did not meet criteria	No	1	1,713	0.06	Accuracy
Pesticide	Surface Water	Other	See hard copy for further explanation	No	3	1,713	0.18	N/A
Pesticide	Surface Water	Other	See hard copy for further explanation	Yes	2	1,713	0.12	N/A
Pesticide	Surface Water	Surrogates	Surrogate recovery criteria were not met	No	61	1,713	3.56	Accuracy
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	42	771	5.45	Representativeness
Radionuclide	Sediment	Calculation Errors	Calculation error	Yes	26	771	3.37	N/A
Radionuclide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	17	771	2.20	Accuracy
Radionuclide	Sediment	Documentation Issues	Record added by the validator	Yes	26	771	3.37	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Sediment	Documentation Issues	Results were not included on Data Summary Table	Yes	2	771	0.26	N/A
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	67	771	8.69	Representativeness
Radionuclide	Sediment	Documentation Issues	Transcription error	Yes	148	771	19.20	N/A
Radionuclide	Sediment	Holding Times	Holding times were grossly exceeded	Yes	15	771	1.95	Representativeness
Radionuclide	Sediment	Instrument Set-up	Detector efficiency did not meet requirements	Yes	64	771	8.30	Accuracy
Radionuclide	Sediment	Instrument Set-up	Resolution criteria were not met	Yes	7	771	0.91	Representativeness
Radionuclide	Sediment	LCS	LCS recovery > +/- 3 sigma	Yes	48	771	6.23	Accuracy
Radionuclide	Sediment	LCS	LCS recovery criteria were not met	Yes	55	771	7.13	Accuracy
Radionuclide	Sediment	LCS	LCS relative percent error criteria not met	Yes	38	771	4.93	Accuracy
Radionuclide	Sediment	Matrices	Recovery criteria were not met	Yes	4	771	0.52	Accuracy
Radionuclide	Sediment	Matrices	Replicate analysis was not performed	Yes	4	771	0.52	Precision
Radionuclide	Sediment	Matrices	Replicate precision criteria were not met	No	1	771	0.13	Precision
Radionuclide	Sediment	Matrices	Replicate precision criteria were not met	Yes	78	771	10.12	Precision
Radionuclide	Sediment	Matrices	Replicate recovery criteria were not met	Yes	13	771	1.69	Accuracy
Radionuclide	Sediment	Other	Lab results not verified due to unsubmitted data	Yes	1	771	0.13	Representativeness
Radionuclide	Sediment	Other	Sample exceeded efficiency curve weight limit	Yes	11	771	1.43	Accuracy
Radionuclide	Sediment	Other	See hard copy for further explanation	Yes	25	771	3.24	N/A
Radionuclide	Sediment	Other	Tracer requirements were not met	Yes	1	771	0.13	Accuracy
Radionuclide	Sediment	Sensitivity	Incorrect reported activity or MDA	No	2	771	0.26	N/A
Radionuclide	Sediment	Sensitivity	Incorrect reported activity or MDA	Yes	2	771	0.26	N/A
Radionuclide	Sediment	Sensitivity	MDA exceeded the RDL	Yes	6	771	0.78	Representativeness
Radionuclide	Sediment	Sensitivity	MDA was calculated by reviewer	Yes	173	771	22.44	N/A
Radionuclide	Sediment	Sensitivity	Results considered qualitative not quantitative	Yes	2	771	0.26	Accuracy
Radionuclide	Surface Water	Blanks	Blank data not submitted	Yes	7	4,708	0.15	Representativeness
Radionuclide	Surface Water	Blanks	Blank recovery criteria were not met	No	8	4,708	0.17	Representativeness
Radionuclide	Surface Water	Blanks	Blank recovery criteria were not met	Yes	47	4,708	1.00	Representativeness
Radionuclide	Surface Water	Blanks	Method, preparation, or reagent blank contamination	No	25	4,708	0.53	Representativeness
Radionuclide	Surface Water	Blanks	Method, preparation, or reagent blank contamination	Yes	159	4,708	3.38	Representativeness

**Table A2.2.2  
WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface Water	Calculation Errors	Calculation error	No	11	4,708	0.23	N/A
Radionuclide	Surface Water	Calculation Errors	Calculation error	Yes	7	4,708	0.15	N/A
Radionuclide	Surface Water	Calibration	Calibration counting statistics did not meet criteria	No	1	4,708	0.02	Accuracy
Radionuclide	Surface Water	Calibration	Calibration counting statistics did not meet criteria	Yes	2	4,708	0.04	Accuracy
Radionuclide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	64	4,708	1.36	Accuracy
Radionuclide	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	182	4,708	3.87	Accuracy
Radionuclide	Surface Water	Documentation Issues	Information missing from case narrative	No	1	4,708	0.02	N/A
Radionuclide	Surface Water	Documentation Issues	Key data fields incorrect	Yes	1	4,708	0.02	N/A
Radionuclide	Surface Water	Documentation Issues	Missing deliverables (not required for validation)	No	2	4,708	0.04	N/A
Radionuclide	Surface Water	Documentation Issues	Missing deliverables (required for validation)	No	6	4,708	0.13	Representativeness
Radionuclide	Surface Water	Documentation Issues	Missing deliverables (required for validation)	Yes	6	4,708	0.13	Representativeness
Radionuclide	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	No	54	4,708	1.15	N/A
Radionuclide	Surface Water	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	54	4,708	1.15	N/A
Radionuclide	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	No	8	4,708	0.17	Representativeness
Radionuclide	Surface Water	Documentation Issues	Omissions or errors in data package (required for validation)	Yes	11	4,708	0.23	Representativeness
Radionuclide	Surface Water	Documentation Issues	Record added by the validator	Yes	38	4,708	0.81	N/A
Radionuclide	Surface Water	Documentation Issues	Sample analysis was not requested	Yes	8	4,708	0.17	N/A
Radionuclide	Surface Water	Documentation Issues	Sufficient documentation not provided by the laboratory	No	5	4,708	0.11	Representativeness
Radionuclide	Surface Water	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	286	4,708	6.07	Representativeness
Radionuclide	Surface Water	Documentation Issues	Transcription error	No	170	4,708	3.61	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Documentation Issues	Transcription error	Yes	203	4,708	4.31	N/A
Radionuclide	Surface W	Holding Times	Holding times were exceeded	No	83	4,708	1.76	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were exceeded	Yes	167	4,708	3.55	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	No	13	4,708	0.28	Representativeness
Radionuclide	Surface W	Holding Times	Holding times were grossly exceeded	Yes	19	4,708	0.40	Representativeness
Radionuclide	Surface W	Instrument Set-up	Resolution criteria were not met	No	7	4,708	0.15	Representativeness
Radionuclide	Surface W	Instrument Set-up	Resolution criteria were not met	Yes	18	4,708	0.38	Representativeness
Radionuclide	Surface W	LCS	Expected LCS value not submitted/verifiable	No	14	4,708	0.30	Representativeness
Radionuclide	Surface W	LCS	Expected LCS value not submitted/verifiable	Yes	53	4,708	1.13	Representativeness
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	No	81	4,708	1.72	Accuracy
Radionuclide	Surface W	LCS	LCS recovery > +/- 3 sigma	Yes	109	4,708	2.32	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	No	12	4,708	0.25	Accuracy
Radionuclide	Surface W	LCS	LCS recovery criteria were not met	Yes	26	4,708	0.55	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	No	51	4,708	1.08	Accuracy
Radionuclide	Surface W	LCS	LCS relative percent error criteria not met	Yes	130	4,708	2.76	Accuracy
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	No	12	4,708	0.25	Precision
Radionuclide	Surface W	Matrices	Duplicate analysis was not performed	Yes	3	4,708	0.06	Precision
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	No	2	4,708	0.04	Precision
Radionuclide	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	6	4,708	0.13	Precision
Radionuclide	Surface W	Matrices	Recovery criteria were not met	No	5	4,708	0.11	Accuracy
Radionuclide	Surface W	Matrices	Recovery criteria were not met	Yes	8	4,708	0.17	Accuracy
Radionuclide	Surface W	Matrices	Replicate analysis was not performed	No	4	4,708	0.08	Precision
Radionuclide	Surface W	Matrices	Replicate analysis was not performed	Yes	26	4,708	0.55	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	No	62	4,708	1.32	Precision
Radionuclide	Surface W	Matrices	Replicate precision criteria were not met	Yes	145	4,708	3.08	Precision
Radionuclide	Surface W	Matrices	Replicate recovery criteria were not met	Yes	1	4,708	0.02	Accuracy
Radionuclide	Surface W	Other	Lab results not verified due to unsubmitted data	No	1	4,708	0.02	Representativeness
Radionuclide	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	13	4,708	0.28	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	No	11	4,708	0.23	Representativeness
Radionuclide	Surface W	Other	QC sample does not meet method requirements	Yes	8	4,708	0.17	Representativeness
Radionuclide	Surface W	Other	Sample exceeded efficiency curve weight limit	Yes	1	4,708	0.02	Accuracy

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Radionuclide	Surface W	Other	See hard copy for further explanation	No	136	4,708	2.89	N/A
Radionuclide	Surface W	Other	See hard copy for further explanation	Yes	212	4,708	4.50	N/A
Radionuclide	Surface W	Other	Tracer requirements were not met	No	8	4,708	0.17	Accuracy
Radionuclide	Surface W	Other	Tracer requirements were not met	Yes	4	4,708	0.08	Accuracy
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	No	12	4,708	0.25	Representativeness
Radionuclide	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	6	4,708	0.13	Representativeness
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	No	4	4,708	0.08	N/A
Radionuclide	Surface W	Sensitivity	Incorrect reported activity or MDA	Yes	19	4,708	0.40	N/A
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	No	22	4,708	0.47	Representativeness
Radionuclide	Surface W	Sensitivity	MDA exceeded the RDL	Yes	57	4,708	1.21	Representativeness
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	No	14	4,708	0.30	N/A
Radionuclide	Surface W	Sensitivity	MDA was calculated by reviewer	Yes	538	4,708	11.43	N/A
SVOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	12	3,520	0.34	Representativeness
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	10	3,520	0.28	Accuracy
SVOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	8	3,520	0.23	Accuracy
SVOC	Sediment	Documentation Issues	Transcription error	No	7	3,520	0.20	N/A
SVOC	Sediment	Holding Times	Holding times were exceeded	No	165	3,520	4.69	Representativeness
SVOC	Sediment	Holding Times	Holding times were exceeded	Yes	12	3,520	0.34	Representativeness
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	149	3,520	4.23	Accuracy
SVOC	Sediment	Internal Standards	Internal standards did not meet criteria	Yes	10	3,520	0.28	Accuracy
SVOC	Sediment	Matrices	Percent solids < 30 percent	Yes	10	3,520	0.28	Representativeness
SVOC	Sediment	Other	Sample results were not validated due to re-analysis	No	58	3,520	1.65	N/A
SVOC	Sediment	Other	Sample results were not validated due to re-analysis	Yes	1	3,520	0.03	N/A
SVOC	Sediment	Other	See hard copy for further explanation	No	329	3,520	9.35	N/A
SVOC	Sediment	Other	See hard copy for further explanation	Yes	23	3,520	0.65	N/A
SVOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	12	5,425	0.22	Representativeness
SVOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	45	5,425	0.83	Accuracy
SVOC	Surface W	Documentation Issues	Record added by the validator	No	41	5,425	0.76	N/A
SVOC	Surface W	Documentation Issues	Transcription error	No	9	5,425	0.17	N/A
SVOC	Surface W	Holding Times	Holding times were exceeded	No	13	5,425	0.24	Representativeness
SVOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	No	3	5,425	0.06	Accuracy

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
SVOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	46	5,425	0.85	Accuracy
SVOC	Surface W	Other	See hard copy for further explanation	No	160	5,425	2.95	N/A
SVOC	Surface W	Other	See hard copy for further explanation	Yes	2	5,425	0.04	N/A
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	54	1,854	2.91	Representativeness
VOC	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	1	1,854	0.05	Representativeness
VOC	Sediment	Calculation Errors	Calculation error	No	131	1,854	7.07	N/A
VOC	Sediment	Calculation Errors	Calculation error	Yes	4	1,854	0.22	N/A
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	No	5	1,854	0.27	Accuracy
VOC	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	20	1,854	1.08	Accuracy
VOC	Sediment	Confirmation	Results were not confirmed	No	1	1,854	0.05	Precision
VOC	Sediment	Documentation Issues	Transcription error	No	71	1,854	3.83	N/A
VOC	Sediment	Documentation Issues	Transcription error	Yes	1	1,854	0.05	N/A
VOC	Sediment	Holding Times	Holding times were exceeded	No	113	1,854	6.09	Representativeness
VOC	Sediment	Holding Times	Holding times were exceeded	Yes	5	1,854	0.27	Representativeness
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	118	1,854	6.36	Accuracy
VOC	Sediment	Matrices	MS/MSD precision criteria were not met	Yes	1	1,854	0.05	Precision
VOC	Sediment	Matrices	Percent solids < 30 percent	Yes	10	1,854	0.54	Representativeness
VOC	Sediment	Other	Sample results were not validated due to re-analysis	No	100	1,854	5.39	N/A
VOC	Sediment	Other	Sample results were not validated due to re-analysis	Yes	6	1,854	0.32	N/A
VOC	Sediment	Other	See hard copy for further explanation	No	24	1,854	1.29	N/A
VOC	Sediment	Other	See hard copy for further explanation	Yes	1	1,854	0.05	N/A
VOC	Sediment	Surrogates	Surrogate recovery criteria were not met	Yes	1	1,854	0.05	Accuracy
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	No	112	7,582	1.48	Representativeness
VOC	Surface W	Blanks	Method, preparation, or reagent blank contamination	Yes	12	7,582	0.16	Representativeness
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	No	41	7,582	0.54	Accuracy
VOC	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	11	7,582	0.15	Accuracy
VOC	Surface W	Calibration	Independent calibration verification criteria not met	Yes	1	7,582	0.01	Accuracy
VOC	Surface W	Documentation Issues	Record added by the validator	No	228	7,582	3.01	N/A
VOC	Surface W	Documentation Issues	Record added by the validator	Yes	3	7,582	0.04	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
VOC	Surface W	Documentation Issues	Transcription error	No	229	7,582	3.02	N/A
VOC	Surface W	Documentation Issues	Transcription error	Yes	3	7,582	0.04	N/A
VOC	Surface W	Holding Times	Holding times were exceeded	No	200	7,582	2.64	Representativeness
VOC	Surface W	Holding Times	Holding times were exceeded	Yes	5	7,582	0.07	Representativeness
VOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	No	48	7,582	0.63	Accuracy
VOC	Surface W	Instrument Set-up	Instrument tune criteria were not met	Yes	7	7,582	0.09	Accuracy
VOC	Surface W	Internal Standards	Internal standards did not meet criteria	No	213	7,582	2.81	Accuracy
VOC	Surface W	Internal Standards	Internal standards did not meet criteria	Yes	1	7,582	0.01	Accuracy
VOC	Surface W	LCS	LCS recovery criteria were not met	No	13	7,582	0.17	Accuracy
VOC	Surface W	Other	See hard copy for further explanation	No	10	7,582	0.13	N/A
VOC	Surface W	Other	See hard copy for further explanation	Yes	3	7,582	0.04	N/A
VOC	Surface W	Surrogates	Surrogate recovery criteria were not met	Yes	4	7,582	0.05	Accuracy
Wet Chem	Sediment	Blanks	Method, preparation, or reagent blank contamination	No	1	76	1.32	Representativeness
Wet Chem	Sediment	Documentation Issues	Record added by the validator	No	1	76	1.32	N/A
Wet Chem	Sediment	Documentation Issues	Record added by the validator	Yes	4	76	5.26	N/A
Wet Chem	Sediment	Holding Times	Holding times were exceeded	No	3	76	3.95	Representativeness
Wet Chem	Sediment	Holding Times	Holding times were exceeded	Yes	9	76	11.84	Representativeness
Wet Chem	Sediment	Holding Times	Holding times were grossly exceeded	No	1	76	1.32	Representativeness
Wet Chem	Sediment	Matrices	Duplicate sample precision criteria were not met	Yes	2	76	2.63	Precision
Wet Chem	Sediment	Matrices	Percent solids < 30 percent	Yes	7	76	9.21	Representativeness
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	3	76	3.95	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	4	76	5.26	Accuracy
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	15	76	19.74	Accuracy
Wet Chem	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	1	76	1.32	Accuracy
Wet Chem	Surface W	Blanks	Calibration verification blank contamination	No	1	1,741	0.06	Representativeness
Wet Chem	Surface W	Calibration	Calibration correlation coefficient did not meet requirements	Yes	2	1,741	0.11	Accuracy
Wet Chem	Surface W	Calibration	Continuing calibration verification criteria were not met	Yes	1	1,741	0.06	Accuracy
Wet Chem	Surface W	Documentation Issues	Missing deliverables (not required for validation)	Yes	3	1,741	0.17	N/A
Wet Chem	Surface W	Documentation Issues	Omissions or errors in data package (not required for validation)	Yes	19	1,741	1.09	N/A

**Table A2.2.2**  
**WC AEU - Summary of V&V Observations**

Analyte Group	Matrix	QC Category	V&V Observation	Detect	No. of Records w/ Noted Observation	Total No. of V&V Records	Percent Observed (%)	PARCC Parameter Affected
Wet Chem	Surface W	Documentation Issues	Record added by the validator	No	79	1,741	4.54	N/A
Wet Chem	Surface W	Documentation Issues	Record added by the validator	Yes	69	1,741	3.96	N/A
Wet Chem	Surface W	Documentation Issues	Transcription error	No	7	1,741	0.40	N/A
Wet Chem	Surface W	Documentation Issues	Transcription error	Yes	20	1,741	1.15	N/A
Wet Chem	Surface W	Holding Times	Holding times were exceeded	No	17	1,741	0.98	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were exceeded	Yes	25	1,741	1.44	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	No	6	1,741	0.34	Representativeness
Wet Chem	Surface W	Holding Times	Holding times were grossly exceeded	Yes	4	1,741	0.23	Representativeness
Wet Chem	Surface W	LCS	LCS recovery criteria were not met	No	2	1,741	0.11	Accuracy
Wet Chem	Surface W	Matrices	Duplicate sample precision criteria were not met	Yes	3	1,741	0.17	Precision
Wet Chem	Surface W	Matrices	LCS/LCSD precision criteria were not met	Yes	3	1,741	0.17	Precision
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	No	8	1,741	0.46	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery criteria were not met	Yes	29	1,741	1.67	Accuracy
Wet Chem	Surface W	Matrices	Predigestion MS recovery was < 30 percent	Yes	3	1,741	0.17	Accuracy
Wet Chem	Surface W	Matrices	Site samples were not used for sample matrix QC	Yes	3	1,741	0.17	Representativeness
Wet Chem	Surface W	Other	Lab results not verified due to unsubmitted data	Yes	17	1,741	0.98	Representativeness
Wet Chem	Surface W	Other	Result obtained through dilution	Yes	8	1,741	0.46	N/A
Wet Chem	Surface W	Other	See hard copy for further explanation	No	1	1,741	0.06	N/A
Wet Chem	Surface W	Sample Preparation	Preservation requirements were not met by the laboratory	Yes	10	1,741	0.57	Representativeness
Wet Chem	Surface W	Sample Preparation	Samples were not properly preserved in the field	Yes	21	1,741	1.21	Representativeness

**Table A2.3.0**  
**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	Sediment	1	68	Yes	1.47
Dioxins and Furans	Surface Water	3	24	No	12.50
Herbicide	Sediment	8	101	No	7.92
Herbicide	Surface Water	34	121	No	28.10
Metal	Sediment	415	3,147	No	13.19
Metal	Sediment	581	3,147	Yes	18.46
Metal	Surface Water	1,960	19,900	No	9.85
Metal	Surface Water	2,314	19,900	Yes	11.63
PCB	Sediment	14	703	No	1.99
PCB	Sediment	1	703	Yes	0.14
PCB	Surface Water	21	280	No	7.50
Pesticide	Sediment	58	1,267	No	4.58
Pesticide	Sediment	1	1,267	Yes	0.08
Pesticide	Surface Water	100	781	No	12.80
Radionuclide	Sediment	16	790	No	2.03
Radionuclide	Sediment	4	790	Yes	0.51
Radionuclide	Surface Water	50	6,267	No	0.80
Radionuclide	Surface Water	71	6,267	Yes	1.13
SVOC	Sediment	255	5,330	No	4.78
SVOC	Sediment	17	5,330	Yes	0.32
SVOC	Surface Water	654	4,719	No	13.86
SVOC	Surface Water	5	4,719	Yes	0.11
VOC	Sediment	263	2,873	No	9.15
VOC	Sediment	21	2,873	Yes	0.73
VOC	Surface Water	568	6,950	No	8.17
VOC	Surface Water	27	6,950	Yes	0.39
Wet Chem	Sediment	10	71	No	14.08
Wet Chem	Sediment	38	71	Yes	53.52
Wet Chem	Surface Water	27	1,244	No	2.17
Wet Chem	Surface Water	74	1,244	Yes	5.95
	<b>Total</b>	<b>7,611</b>	<b>54,636</b>		<b>13.93%</b>

**Table A2.3.1**  
**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	Surface Water	1	34	No	2.94
Herbicide	Sediment	5	79	No	6.33
Herbicide	Surface Water	20	110	No	18.18
Metal	Sediment	764	3,597	Yes	21.24
Metal	Sediment	492	3,597	No	13.68
Metal	Surface Water	4,209	40,618	No	10.36
Metal	Surface Water	4,337	40,618	Yes	10.68
PCB	Sediment	2	602	Yes	0.33
PCB	Sediment	13	602	No	2.16
PCB	Surface Water	14	189	No	7.41
Pesticide	Sediment	68	1,182	No	5.75
Pesticide	Sediment	2	1,182	Yes	0.17
Pesticide	Surface Water	62	665	No	9.32
Radionuclide	Sediment	3	922	No	0.33
Radionuclide	Sediment	5	922	Yes	0.54
Radionuclide	Surface Water	63	10,144	No	0.62
Radionuclide	Surface Water	97	10,144	Yes	0.96
SVOC	Sediment	5	4,690	Yes	0.11
SVOC	Sediment	142	4,690	No	3.03
SVOC	Surface Water	993	5,621	No	17.67
SVOC	Surface Water	2	5,621	Yes	0.04
VOC	Sediment	26	3,511	Yes	0.74
VOC	Sediment	529	3,511	No	15.07
VOC	Surface Water	227	26,424	Yes	0.86
VOC	Surface Water	3,716	26,424	No	14.06
Wet Chem	Sediment	40	75	Yes	53.33
Wet Chem	Sediment	8	75	No	10.67
Wet Chem	Surface Water	154	2,974	Yes	5.18
Wet Chem	Surface Water	28	2,974	No	0.94
	<b>Total</b>	<b>16,027</b>	<b>101,437</b>		<b>15.80%</b>

**Table A2.3.2**  
**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	Sediment	13	60	No	21.67
Herbicide	Surface Water	35	141	No	24.82
Metal	Sediment	334	2,472	No	13.51
Metal	Sediment	797	2,472	Yes	32.24
Metal	Surface Water	2,015	19,194	No	10.50
Metal	Surface Water	2,048	19,194	Yes	10.67
PCB	Sediment	47	398	No	11.81
PCB	Sediment	1	398	Yes	0.25
PCB	Surface Water	42	546	No	7.69
Pesticide	Sediment	147	1,088	No	13.51
Pesticide	Surface Water	162	1,713	No	9.46
Radionuclide	Sediment	2	771	Yes	0.26
Radionuclide	Surface Water	19	4,708	No	0.40
Radionuclide	Surface Water	41	4,708	Yes	0.87
SVOC	Sediment	638	3,520	No	18.13
SVOC	Sediment	15	3,520	Yes	0.43
SVOC	Surface Water	274	5,425	No	5.05
VOC	Sediment	272	1,854	No	14.67
VOC	Sediment	19	1,854	Yes	1.02
VOC	Surface Water	564	7,582	No	7.44
VOC	Surface Water	29	7,582	Yes	0.38
Wet Chem	Sediment	8	76	No	10.53
Wet Chem	Sediment	37	76	Yes	48.68
Wet Chem	Surface Water	34	1,741	No	1.95
Wet Chem	Surface Water	90	1,741	Yes	5.17
	<b>Total</b>	<b>7,683</b>	<b>51,337</b>		<b>14.97%</b>

**Table A2.4.0**  
**NW AEU - Summary of Data Qualified as Undetected Due to Blank Contamination**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of CRA Records Qualified as Undetected</b>	<b>Total No. of CRA Records with Detected Results<sup>a</sup></b>	<b>Percent Qualified as Undetected</b>
Metal	Sediment	39	2,314	1.69
Metal	Surface Water	398	12,686	3.14
Pesticide	Surface Water	1	13	7.69
Radionuclide	Surface Water	1	4,374	0.02
VOC	Sediment	6	66	9.09
VOC	Surface Water	1	135	0.74
	<b>Total</b>	<b>446</b>	<b>19,588</b>	<b>2.28%</b>

<sup>a</sup> As determined by the laboratory prior to V&V.

**Table A2.4.1**  
**SW AEU - Summary of Data Qualified as Undetected Due to Blank Contamination**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of CRA Records Qualified as Undetected</b>	<b>Total No. of CRA Records with Detected Results<sup>a</sup></b>	<b>Percent Qualified as Undetected</b>
Metal	Sediment	77	2,624	2.93
Metal	Surface Water	481	22,739	2.12
SVOC	Sediment	2	594	0.34
VOC	Sediment	4	92	4.35
VOC	Surface Water	10	2,349	0.43
Wet Chem	Sediment	4	53	7.55
	<b>Total</b>	<b>578</b>	<b>28,451</b>	<b>2.03%</b>

<sup>a</sup> As determined by the laboratory prior to V&V.

**Table A2.4.2**  
**SW AEU - Summary of Data Qualified as Undetected Due to Blank Contamination**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of CRA Records Qualified as Undetected</b>	<b>Total No. of CRA Records with Detected Results<sup>a</sup></b>	<b>Percent Qualified as Undetected</b>
Metal	Sediment	15	1,821	0.82
Metal	Surface Water	308	10,039	3.07
	<b>Total</b>	<b>323</b>	<b>11,860</b>	<b>2.72%</b>

<sup>a</sup> As determined by the laboratory prior to V&V.

**Table A2.5.0  
NW AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of Duplicates Failing RPD/DER Criteria</b>	<b>Total No. of Duplicate Pairs</b>	<b>Percent Failure (%)</b>	<b>Field Duplicate Frequency (%)</b>
Herbicide	Sediment	0	14	0.00	12.17
Herbicide	Surface Water	0	7	0.00	1.20
Metal	Sediment	42	373	11.26	11.69
Metal	Surface Water	45	825	5.45	3.28
PCB	Sediment	0	105	0.00	12.35
PCB	Surface Water	0	35	0.00	4.46
Pesticide	Sediment	0	238	0.00	13.92
Pesticide	Surface Water	0	109	0.00	3.37
Radionuclide	Sediment	4	132	3.03	12.88
Radionuclide	Surface Water	4	369	1.08	3.30
SVOC	Sediment	1	815	0.12	13.38
SVOC	Surface Water	0	413	0.00	3.66
VOC	Sediment	0	313	0.00	9.33
VOC	Surface Water	0	314	0.00	2.18
Wet Chem	Sediment	0	22	0.00	13.92
Wet Chem	Surface Water	2	64	3.13	2.24

**Table A2.5.1**  
**SW AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of Duplicates Failing RPD/DER Criteria</b>	<b>Total No. of Duplicate Pairs</b>	<b>Percent Failure (%)</b>	<b>Field Duplicate Frequency (%)</b>
Dioxins and Furans	Surface Water	0	1	0.00	2.94
Herbicide	Sediment	0	7	0.00	8.33
Herbicide	Surface Water	0	9	0.00	2.77
Metal	Sediment	59	345	17.10	9.58
Metal	Surface Water	53	1,102	4.81	2.48
PCB	Sediment	0	63	0.00	9.28
PCB	Surface Water	0	35	0.00	7.14
Pesticide	Sediment	0	168	0.00	11.79
Pesticide	Surface Water	0	125	0.00	6.23
Radionuclide	Sediment	1	104	0.96	9.11
Radionuclide	Surface Water	9	500	1.80	3.49
SVOC	Sediment	0	411	0.00	8.34
SVOC	Surface Water	0	297	0.00	3.39
VOC	Sediment	0	264	0.00	7.14
VOC	Surface Water	0	558	0.00	1.74
Wet Chem	Sediment	1	12	8.33	8.51
Wet Chem	Surface Water	1	86	1.16	1.91

**Table A2.5.2**  
**WC AEU - Summary of RPDs/DERs of Field Duplicate Analyte Pairs**

<b>Analyte Group</b>	<b>Matrix</b>	<b>No. of Duplicates Failing RPD/DER Criteria</b>	<b>Total No. of Duplicate Pairs</b>	<b>Percent Failure (%)</b>	<b>Field Duplicate Frequency (%)</b>
Herbicide	Sediment	0	3	0.00	4.76
Herbicide	Surface Water	0	3	0.00	1.00
Metal	Sediment	34	139	24.46	5.60
Metal	Surface Water	12	918	1.31	3.99
PCB	Sediment	0	14	0.00	2.95
PCB	Surface Water	0	35	0.00	4.72
Pesticide	Sediment	0	45	0.00	3.56
Pesticide	Surface Water	0	105	0.00	3.99
Radionuclide	Sediment	3	58	5.17	6.74
Radionuclide	Surface Water	4	313	1.28	3.26
SVOC	Sediment	0	173	0.00	4.82
SVOC	Surface Water	0	291	0.00	3.79
VOC	Sediment	1	108	0.93	5.15
VOC	Surface Water	0	419	0.00	3.71
Wet Chem	Sediment	0	9	0.00	10.23
Wet Chem	Surface Water	0	87	0.00	3.57

**Table A2.6.0**  
**NW AEU - Summary of Data Rejected During V&V**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of Rejected Records</b>	<b>Total No. of V&amp;V Records</b>	<b>Percent Rejected (%)</b>
Dioxins and Furans	Sediment	0	103	0.00
Dioxins and Furans	Surface Water	0	40	0.00
Herbicide	Sediment	2	152	1.32
Herbicide	Surface Water	11	208	5.29
Metal	Sediment	73	5,207	1.40
Metal	Surface Water	694	32,967	2.11
PCB	Sediment	33	1,181	2.79
PCB	Surface Water	7	756	0.93
Pesticide	Sediment	32	2,312	1.38
Pesticide	Surface Water	30	2,235	1.34
Radionuclide	Sediment	202	2,565	7.88
Radionuclide	Surface Water	1,231	10,914	11.28
SVOC	Sediment	114	8,282	1.38
SVOC	Surface Water	380	8,435	4.51
VOC	Sediment	54	4,888	1.10
VOC	Surface Water	639	13,620	4.69
Wet Chem	Sediment	33	130	25.38
Wet Chem	Surface Water	50	2,889	1.73
	<b>Total</b>	<b>3,585</b>	<b>96,884</b>	<b>3.70%</b>

**Table A2.6.1**  
**SW AEU - Summary of Data Rejected During V&V**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of Rejected Records</b>	<b>Total No. of V&amp;V Records</b>	<b>Percent Rejected (%)</b>
Dioxins and Furans	Surface Water	2	63	3.17
Herbicide	Sediment	1	134	0.75
Herbicide	Surface Water	9	160	5.63
Metal	Sediment	56	6,005	0.93
Metal	Surface Water	807	68,277	1.18
PCB	Sediment	24	1,072	2.24
PCB	Surface Water	14	469	2.99
Pesticide	Sediment	18	2,294	0.78
Pesticide	Surface Water	45	1,560	2.88
Radionuclide	Sediment	146	2,492	5.86
Radionuclide	Surface Water	1,157	17,274	6.70
SVOC	Sediment	20	7,955	0.25
SVOC	Surface Water	300	9,746	3.08
VOC	Sediment	43	6,608	0.65
VOC	Surface Water	1,302	54,094	2.41
Wet Chem	Sediment	35	178	19.66
Wet Chem	Surface Water	59	7,306	0.81
	<b>Total</b>	<b>4,038</b>	<b>185,687</b>	<b>2.17%</b>

**Table A2.6.2**  
**WC AEU - Summary of Data Rejected During V&V**

<b>Analyte Group</b>	<b>Matrix</b>	<b>Total No. of Rejected Records</b>	<b>Total No. of V&amp;V Records</b>	<b>Percent Rejected (%)</b>
Dioxins and Furans	Sediment	0	34	0.00
Dioxins and Furans	Surface Water	2	27	7.41
Herbicide	Sediment	9	112	8.04
Herbicide	Surface Water	9	272	3.31
Metal	Sediment	190	4,935	3.85
Metal	Surface Water	2,009	43,534	4.61
PCB	Sediment	66	791	8.34
PCB	Surface Water	14	1,449	0.97
Pesticide	Sediment	205	2,275	9.01
Pesticide	Surface Water	46	4,408	1.04
Radionuclide	Sediment	321	2,093	15.34
Radionuclide	Surface Water	1,785	10,801	16.53
SVOC	Sediment	568	6,622	8.58
SVOC	Surface Water	180	13,014	1.38
VOC	Sediment	415	4,542	9.14
VOC	Surface Water	880	23,041	3.82
Wet Chem	Sediment	12	158	7.59
Wet Chem	Surface Water	25	3,741	0.67
	<b>Total</b>	<b>6,736</b>	<b>121,849</b>	<b>5.53%</b>

**Table A2.7.0**  
**NW AEU - Summary of Data Quality Issues Identified by V&V**

Analyte Group	Matrix	Categories Description	V&V Observation	Detect	Percent Observed	Percent Qualified U <sup>a</sup>	Percent Qualified J <sup>b</sup>	PARCC Parameter Affected	Impacts Risk Assessment Decisions
Dioxins and Furans	Surface Water	Internal Standards	Internal standards did not meet criteria	No	12.50	0.00	12.50	Accuracy	No
Herbicide	Surface Water	Calibration	Continuing calibration verification criteria were not met	No	9.92	0.83	9.09	Accuracy	No
Herbicide	Surface Water	Holding Times	Holding times were exceeded	No	5.79	4.13	1.65	Representativeness	No
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	6.48	0.00	6.48	Accuracy	No
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	7.15	0.00	7.15	Accuracy	No
Metal	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	7.79	0.00	0.92	Accuracy	No
Pesticide	Sediment	Matrices	MS/MSD precision criteria were not met	No	6.31	0.55	0.00	Precision	No
Pesticide	Surface Water	Holding Times	Holding times were exceeded	No	5.51	3.20	2.30	Representativeness	No
Radionuclide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	14.94	0.00	0.00	Accuracy	No
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	20.13	0.00	0.00	Representativeness	No
Radionuclide	Sediment	LCS	LCS relative percent error criteria not met	Yes	5.82	0.00	0.00	Accuracy	No
SVOC	Surface Water	Holding Times	Holding times were exceeded	No	6.61	6.46	0.13	Representativeness	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	No	8.45	0.00	8.45	Accuracy	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	18.31	0.00	18.31	Accuracy	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	28.17	0.00	28.17	Accuracy	No
Wet Chem	Sediment	Other	IDL is older than 3 months from date of analysis	Yes	5.63	0.00	5.63	Accuracy	No

<sup>a</sup>Defined as validation qualifier codes containing "U"

<sup>b</sup>Defined as validation qualifier codes containing "J", except "UJ"

**Table A2.7.1  
SW AEU - Summary of Data Quality Issues Identified by V&V**

Analyte Group	Matrix	Categories Description	V&V Observation	Detect	Percent Observed	Percent Qualified U <sup>a</sup>	Percent Qualified J <sup>b</sup>	PARCC Parameter Affected	Impacts Risk Assessment Decisions
Herbicide	Surface Water	Holding Times	Holding times were exceeded	No	8.18	0.00	8.18	Representativeness	No
Herbicide	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	9.09	0.91	0.00	Representativeness	No
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	5.64	0.00	5.64	Accuracy	No
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	6.59	0.00	6.59	Accuracy	No
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	6.68	0.08	3.47	Accuracy	No
Radionuclide	Sediment	Blanks	Method, preparation, or reagent blank contamination	Yes	6.18	0.00	0.00	Representativeness	No
Radionuclide	Sediment	Calibration	Continuing calibration verification criteria were not met	Yes	11.17	0.00	0.00	Accuracy	No
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	16.27	0.00	0.00	Representativeness	No
Radionuclide	Surface Water	Calibration	Continuing calibration verification criteria were not met	Yes	5.67	0.00	0.29	Accuracy	No
SVOC	Surface Water	Holding Times	Holding times were exceeded	No	7.03	0.20	6.83	Representativeness	No
SVOC	Surface Water	Sample Preparation	Samples were not properly preserved in the field	No	11.88	0.57	0.00	Representativeness	No
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	8.35	7.38	0.97	Accuracy	No
VOC	Surface Water	Holding Times	Holding times were exceeded	No	10.49	0.45	10.03	Representativeness	No
Wet Chem	Sediment	Holding Times	Holding times were exceeded	Yes	6.67	0.00	6.67	Representativeness	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	14.67	0.00	14.67	Accuracy	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	38.67	0.00	38.67	Accuracy	No

<sup>a</sup>Defined as validation qualifier codes containing "U"

<sup>b</sup>Defined as validation qualifier codes containing "J", except "UJ"

**Table A2.7.2**  
**WC AEU - Summary of Data Quality Issues Identified by V&V**

Analyte Group	Matrix	Categories Description	V&V Observation	Detect	Percent Observed	Percent Qualified U <sup>a</sup>	Percent Qualified J <sup>b</sup>	PARCC Parameter Affected	Impacts Risk Assessment Decisions
Metal	Sediment	LCS	LCS recovery criteria were not met	Yes	15.13	0.00	15.13	Accuracy	No
Metal	Sediment	Matrices	Percent solids < 30 percent	Yes	6.15	0.00	6.15	Representativeness	No
Metal	Sediment	Matrices	Predigestion MS recovery criteria were not met	Yes	6.80	0.00	6.80	Accuracy	No
PCB	Sediment	Surrogates	Surrogate recovery criteria were not met	No	11.81	0.00	11.81	Accuracy	No
Pesticide	Sediment	Surrogates	Surrogate recovery criteria were not met	No	12.13	0.00	12.13	Accuracy	No
Radionuclide	Sediment	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	8.69	0.00	0.00	Representativeness	No
Radionuclide	Sediment	Instrument Set-up	Detector efficiency did not meet requirements	Yes	8.30	0.00	0.00	Accuracy	No
Radionuclide	Sediment	LCS	LCS recovery > +/- 3 sigma	Yes	6.23	0.00	0.00	Accuracy	No
Radionuclide	Sediment	LCS	LCS recovery criteria were not met	Yes	7.13	0.00	0.00	Accuracy	No
Radionuclide	Sediment	Matrices	Replicate precision criteria were not met	Yes	10.12	0.00	0.00	Precision	No
Radionuclide	Surface Water	Documentation Issues	Sufficient documentation not provided by the laboratory	Yes	6.07	0.00	0.00	Representativeness	No
VOC	Sediment	Holding Times	Holding times were exceeded	No	6.09	0.00	6.09	Representativeness	No
VOC	Sediment	Internal Standards	Internal standards did not meet criteria	No	6.36	0.00	6.36	Accuracy	No
Wet Chem	Sediment	Holding Times	Holding times were exceeded	Yes	11.84	0.00	11.84	Representativeness	No
Wet Chem	Sediment	Matrices	Percent solids < 30 percent	Yes	9.21	0.00	9.21	Representativeness	No
Wet Chem	Sediment	Matrices	Predigestion MS recovery was < 30 percent	Yes	19.74	0.00	19.74	Accuracy	No

<sup>a</sup>Defined as validation qualifier codes containing "U"

<sup>b</sup>Defined as validation qualifier codes containing "J", except "UJ"

**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

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 for the field sample and the background sample comparisons are presented in Figures A3.2.NW AEU.1 to A3.2.NW AEU.62 for the NW AEU, in Figures A3.2.SW AEU.1 to A3.2.SW AEU.50 for the SW AEU, and in Figures A3.2.WC AEU.1 to A3.2.WC AEU.52 for the WC AEU.<sup>1</sup> 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 concentration (EPC) –ecological screening level (ESL) comparison step of the ECOPC selection processes.

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<sup>1</sup> 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.

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, chromium, cobalt, cyanide, fluoride, iron, lithium, 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. Benzyl alcohol, 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
- Iron
- Lithium
- Strontium
- Vanadium
- Americium-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<sup>1</sup>***

- Ammonia
- Beryllium
- Cobalt
- Cyanide
- 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, copper, lead, manganese, nickel, selenium, 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
- Lead
- Zinc

### ***Background Comparison not Performed<sup>1</sup>***

- Cadmium
- Nickel
- Selenium
- 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<sup>1</sup>***

- 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, barium, beryllium, chromium, cyanide, fluoride, iron, lithium, 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. 4,4'-DDT, has MDC (total concentrations) greater than its ESLs and detection frequency 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***

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

#### ***Not Statistically Greater than Background at the 0.1 Significance Level***

- Chromium
- Iron
- Vanadium
- Radium-226

### ***Background Comparison not Performed<sup>1</sup>***

- Ammonia
- Beryllium
- Cyanide
- 4,4'-DDT

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

In surface water, cadmium, copper, lead, selenium, 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***

- Zinc

#### ***Not Statistically Greater than Background at the 0.1 Significance Level***

- Copper
- Lead

### ***Background Comparison not Performed<sup>1</sup>***

- Cadmium
- Selenium
- Silver
- Thallium

### **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<sup>1</sup>***

- 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, iron, lead, lithium, 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***

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

***Not Statistically Greater than Background at the 0.1 Significance Level***

- Chromium
- Iron
- Vanadium

***Background Comparison not Performed<sup>1</sup>***

- Ammonia
- Beryllium
- Cobalt
- Cyanide

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

In surface water, cadmium, copper, lead, manganese, mercury, selenium, silver, thallium, 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
- Lead
- Manganese
- Zinc

***Background Comparison not Performed<sup>1</sup>***

- Cadmium
- Mercury
- Selenium
- Silver
- Thallium

**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 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<sup>1</sup>***

- 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 (see the ECOPC Summary tables for the respective AEU in Section 2).

#### **3.1 NW AEU**

##### **3.1.1 Surface Water Data (Total Concentrations)**

The UTLs for aluminum, ammonia, cyanide, lithium, 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 cadmium, selenium, and silver 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 aluminum, 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, silver and zinc 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 AEU 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**

**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 (%)			
4,4'-DDT	N/A	N/A	N/A	116	NONPARAMETRIC	0.9	N/A	N/A	N/A
Anthracene	N/A	N/A	N/A	189	NONPARAMETRIC	0.5	N/A	N/A	N/A
Aquatic TEQ	N/A	N/A	N/A	0	0	0.0	N/A	N/A	N/A
Benzo(a)anthracene	N/A	N/A	N/A	189	NONPARAMETRIC	0.5	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	N/A	189	NONPARAMETRIC	0.5	N/A	N/A	N/A
Benzyl Alcohol	N/A	N/A	N/A	164	NONPARAMETRIC	2.4	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	3	0	17	188	NONPARAMETRIC	30.3	N/A	N/A	N/A
Carbon Disulfide	N/A	N/A	N/A	207	NONPARAMETRIC	1.0	N/A	N/A	N/A
Di-n-butylphthalate	1	0	6	189	NONPARAMETRIC	22.2	N/A	N/A	N/A
Heptachlor epoxide	N/A	N/A	N/A	116	NONPARAMETRIC	0.9	N/A	N/A	N/A
PCB-1254	N/A	N/A	N/A	112	NONPARAMETRIC	5.4	N/A	N/A	N/A
Phenanthrene	N/A	N/A	N/A	189	NONPARAMETRIC	1.1	N/A	N/A	N/A
Pyrene	N/A	N/A	N/A	186	NONPARAMETRIC	2.2	N/A	N/A	N/A
Total Dioxins	N/A	N/A	N/A	24	GAMMA	0.0	N/A	N/A	N/A
Total PCBs	N/A	N/A	N/A	112	NONPARAMETRIC	5.4	N/A	N/A	N/A
Aluminum	166	NONPARAMETRIC	82	632	NONPARAMETRIC	96.4	WRS	1.43E-14	Yes
Ammonia	1	0	0	204	NONPARAMETRIC	68.1	N/A	N/A	N/A
Barium	172	NONPARAMETRIC	78	634	NONPARAMETRIC	98.6	WRS	0	Yes
Beryllium	167	NONPARAMETRIC	13	915	NONPARAMETRIC	47.4	N/A	N/A	N/A
Cadmium	165	NONPARAMETRIC	5	642	NONPARAMETRIC	49.8	N/A	N/A	N/A
Chromium	167	NONPARAMETRIC	29	1083	NONPARAMETRIC	58.2	WRS	0.720	No
Cobalt	171	NONPARAMETRIC	17	634	NONPARAMETRIC	59.1	N/A	N/A	N/A
Copper	164	NONPARAMETRIC	46	628	LOGNORMAL	80.3	WRS	5.97E-10	Yes
Cyanide	128	NONPARAMETRIC	5	128	NONPARAMETRIC	17.2	N/A	N/A	N/A
Fluoride	118	NONPARAMETRIC	95	170	NONPARAMETRIC	80.0	WRS	7.46E-06	Yes
Iron	172	NONPARAMETRIC	97	635	NONPARAMETRIC	98.7	WRS	3.85E-11	Yes
Lead	166	NONPARAMETRIC	45	636	NONPARAMETRIC	74.5	WRS	5.12E-12	Yes
Lithium	166	NONPARAMETRIC	49	561	NONPARAMETRIC	92.7	WRS	0	Yes
Manganese	171	LOGNORMAL	91	635	NONPARAMETRIC	99.1	WRS	0	Yes

**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 (%)			
Mercury	162	NONPARAMETRIC	11	581	NONPARAMETRIC	16.4	N/A	N/A	N/A
Nickel	167	NONPARAMETRIC	26	631	NONPARAMETRIC	67.5	WRS	0.014	Yes
Selenium	162	NONPARAMETRIC	14	631	NONPARAMETRIC	39.0	N/A	N/A	N/A
Silver	170	NONPARAMETRIC	6	636	NONPARAMETRIC	11.0	N/A	N/A	N/A
Strontium	168	NONPARAMETRIC	80	607	NONPARAMETRIC	99.8	WRS	0	Yes
Tin	161	NONPARAMETRIC	12	543	NONPARAMETRIC	12.2	N/A	N/A	N/A
Vanadium	171	NONPARAMETRIC	34	633	NONPARAMETRIC	73.0	WRS	1.42E-06	Yes
Zinc	N/A	N/A	74	635	NONPARAMETRIC	90.7	WRS	0	Yes
Americium-241	101	NONPARAMETRIC	100	1286	NONPARAMETRIC	100.0	WRS	4.01E-14	Yes
Plutonium-239/240	107	NONPARAMETRIC	100	1320	NONPARAMETRIC	100.0	WRS	4.77E-15	Yes
Radium-226	5	NORMAL	100	11	LOGNORMAL	100.0	WRS	0.523	No
Radium-228	N/A	N/A	N/A	3	0	100.0	N/A	N/A	N/A
Uranium-233/234	77	NONPARAMETRIC	100	1270	NONPARAMETRIC	100.0	WRS	0	Yes
Uranium-235	74	NONPARAMETRIC	100	1252	NONPARAMETRIC	100.0	WRS	6.38E-06	Yes
Uranium-238	77	NONPARAMETRIC	100	1270	NONPARAMETRIC	100.0	WRS	0	Yes

Test: 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.2**  
**Summary Statistics For Surface Water, Total Analyses (excluding background samples)**  
**North Walnut Creek Aquatic Exposure Unit (NW AEU)<sup>a</sup>**

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
4,4'-DDT	ug/L	19	N/A	N/A	0.049	0.011	116	0.280	0.280	0.065	0.067
Anthracene	ug/L	18	N/A	N/A	5.17	0.420	189	2.00	2.00	3.77	1.75
Aquatic TEQ	ug/L	N/A	N/A	N/A	N/A	N/A	24	N/A	N/A	0	0
Benzo(a)anthracene	ug/L	18	N/A	N/A	5.17	0.420	189	8.00	8.00	3.81	1.74
Benzo(a)pyrene	ug/L	18	N/A	N/A	5.17	0.420	189	9.00	9.00	3.80	1.78
Benzyl Alcohol	ug/L	18	N/A	N/A	5.44	1.21	164	23.0	860	12.2	71.9
bis(2-ethylhexyl)phthalate	ug/L	18	1.00	5.00	4.58	1.31	188	0.500	200	8.40	22.3
Carbon Disulfide	ug/L	103	N/A	N/A	2.50	0	207	0.100	5.00	2.43	1.06
Di-n-butylphthalate	ug/L	18	1.00	1.00	4.94	1.07	189	0.300	11.0	3.89	1.75
Heptachlor epoxide	ug/L	19	N/A	N/A	0.027	0.004	116	0.050	0.050	0.032	0.033
PCB-1254	ug/L	19	N/A	N/A	0.486	0.115	112	0.260	3.30	0.577	0.411
Phenanthrene	ug/L	18	N/A	N/A	5.17	0.420	189	10.0	11.0	3.88	1.80
Pyrene	ug/L	18	N/A	N/A	5.17	0.420	186	0.200	12.0	3.83	1.73
Total Dioxins	ug/L	N/A	N/A	N/A	N/A	N/A	24	N/A	N/A	6.33E-04	5.50E-04
Total PCBs	ug/L	N/A	N/A	N/A	N/A	N/A	112	0.260	3.30	0.577	0.411
Aluminum	mg/L	166	0.026	129	3.39	12.5	632	0.007	442	10.7	26.8
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	204	0	16.5	1.68	2.59
Barium	mg/L	172	0.009	0.630	0.079	0.079	634	1.50E-04	4.52	0.172	0.243
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	915	1.00E-05	0.027	5.73E-04	0.001
Cadmium	mg/L	165	7.00E-05	0.004	0.001	8.84E-04	642	7.00E-05	0.030	9.99E-04	0.002
Chromium	mg/L	167	5.10E-04	0.247	0.008	0.024	1083	5.20E-06	0.434	0.009	0.023
Cobalt	mg/L	171	2.90E-04	0.019	0.005	0.008	634	1.70E-04	0.253	0.004	0.012
Copper	mg/L	164	0.002	0.048	0.007	0.008	628	3.00E-04	0.623	0.021	0.040
Cyanide	mg/L	128	0.002	0.040	0.048	0.443	128	0	0.146	0.008	0.016
Fluoride	mg/L	118	0.100	1.00	0.335	0.125	170	0.100	2.90	0.572	0.582
Iron	mg/L	172	0.032	88.6	3.04	10.2	635	0.005	481	10.1	27.0
Lead	mg/L	166	1.20E-04	0.051	0.003	0.007	636	2.40E-04	0.596	0.013	0.034
Lithium	mg/L	166	0.001	0.154	0.015	0.022	561	8.00E-05	2.97	0.050	0.201
Manganese	mg/L	171	0.002	4.06	0.090	0.334	635	7.00E-05	7.31	0.304	0.612
Mercury	mg/L	162	3.50E-05	6.30E-04	1.13E-04	7.89E-05	581	1.00E-04	0.013	1.37E-04	6.29E-04
Nickel	mg/L	167	0.002	0.120	0.009	0.013	631	3.70E-04	0.479	0.013	0.027
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	631	4.20E-04	0.023	0.002	0.004
Silver	mg/L	170	6.00E-05	0.007	0.002	0.002	636	4.00E-05	0.913	0.002	0.036
Strontium	mg/L	168	0.028	0.955	0.199	0.159	607	2.00E-04	8.59	0.411	0.683
Tin	mg/L	161	9.90E-04	0.180	0.027	0.058	543	5.50E-04	0.315	0.005	0.017
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	633	1.30E-04	0.892	0.023	0.053
Zinc	mg/L	170	0.002	3.11	0.055	0.245	635	0.003	16.4	0.386	1.18
Americium-241	pCi/L	101	-0.010	0.060	0.005	0.009	1286	-0.043	84.0	0.298	2.73
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	1320	-0.110	259	0.624	8.00
Radium-226	pCi/L	5	-0.100	4.90	1.76	2.06	11	0.110	21.0	2.69	6.14
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	1270	-0.019	1,161	3.81	40.0
Uranium-235	pCi/L	74	-0.021	0.290	0.047	0.066	1252	-0.120	31.0	0.136	1.15
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	1270	-0.017	1,214	3.13	35.5

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.

N/A = Not Available

**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)			Test	1 - p	Statistically Greater Than Background?
	Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
Aluminum	138	NONPARAMETRIC	46	215	NONPARAMETRIC	50	WRS	1.000	No
<b>Barium</b>	<b>140</b>	<b>NONPARAMETRIC</b>	<b>68</b>	<b>224</b>	<b>NONPARAMETRIC</b>	<b>98</b>	<b>WRS</b>	<b>4.20E-10</b>	<b>Yes</b>
Cadmium	136	NONPARAMETRIC	7	513	NONPARAMETRIC	22	N/A	N/A	N/A
<b>Chromium</b>	<b>136</b>	<b>NONPARAMETRIC</b>	<b>5</b>	<b>226</b>	<b>NONPARAMETRIC</b>	<b>19</b>	N/A	N/A	N/A
Copper	138	NONPARAMETRIC	33	214	NONPARAMETRIC	44	WRS	1.000	No
Iron	137	LOGNORMAL	80	219	NONPARAMETRIC	70	WRS	1.00	No
Lead	133	NONPARAMETRIC	24	225	NONPARAMETRIC	34	WRS	0.967	No
<b>Lithium</b>	<b>134</b>	<b>NONPARAMETRIC</b>	<b>34</b>	<b>199</b>	<b>NONPARAMETRIC</b>	<b>84</b>	<b>WRS</b>	<b>9.22E-09</b>	<b>Yes</b>
Manganese	139	LOGNORMAL	81	230	LOGNORMAL	84	t-Test_LN	0.023	Yes
Nickel	134	NONPARAMETRIC	7	223	NONPARAMETRIC	26	N/A	N/A	N/A
Selenium	133	NONPARAMETRIC	8	225	NONPARAMETRIC	30	N/A	N/A	N/A
Silver	141	NONPARAMETRIC	6	511	NONPARAMETRIC	8	N/A	N/A	N/A
<b>Strontium</b>	<b>139</b>	<b>NONPARAMETRIC</b>	<b>76</b>	<b>217</b>	<b>NONPARAMETRIC</b>	<b>98</b>	<b>WRS</b>	<b>0</b>	<b>Yes</b>
Tin	133	NONPARAMETRIC	8	181	NONPARAMETRIC	5	N/A	N/A	N/A
Vanadium	139	NONPARAMETRIC	9	222	NONPARAMETRIC	29	N/A	N/A	N/A
Zinc	138	NONPARAMETRIC	57	224	NONPARAMETRIC	65	WRS	0.907	No
<b>Radium-226</b>	<b>6</b>	<b>NORMAL</b>	<b>100</b>	<b>7</b>	<b>GAMMA</b>	<b>100</b>	<b>WRS</b>	<b>0.077</b>	<b>Yes</b>
<b>Uranium-233/234</b>	<b>27</b>	<b>NONPARAMETRIC</b>	<b>100</b>	<b>110</b>	<b>NONPARAMETRIC</b>	<b>100</b>	<b>WRS</b>	<b>7.90E-13</b>	<b>Yes</b>
<b>Uranium-238</b>	<b>36</b>	<b>NONPARAMETRIC</b>	<b>100</b>	<b>110</b>	<b>NONPARAMETRIC</b>	<b>100</b>	<b>WRS</b>	<b>1.69E-14</b>	<b>Yes</b>

WRS = Wilcoxon Rank Sum

t-Test-LN = Student's t-test using log-transformed data

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

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

**Table A3.2.NW AEU.4**  
**Summary Statistics For Surface Water, Dissolved Analyses (excluding background samples)**  
**North Walnut Creek Aquatic Exposure Unit (NW AEU)<sup>a</sup>**

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
Aluminum	mg/L	138	0.013	1.05	0.101	0.164	215	0.009	11.6	0.095	0.795
Barium	mg/L	140	8.50E-04	0.586	0.058	0.059	224	0.003	0.844	0.098	0.113
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	513	1.60E-05	0.020	5.90E-04	0.002
Chromium	mg/L	136	0.002	0.015	0.003	0.002	226	2.70E-04	0.087	0.003	0.009
Copper	mg/L	138	0.001	0.026	0.006	0.005	214	9.70E-04	0.205	0.006	0.019
Iron	mg/L	137	0.010	72.8	0.724	6.21	219	0.005	9.57	0.141	0.731
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	225	1.50E-04	0.111	0.003	0.012
Lithium	mg/L	134	0.001	0.035	0.015	0.021	199	0.001	2.33	0.065	0.288
Manganese	mg/L	139	1.00E-03	1.45	0.052	0.163	230	6.60E-04	2.13	0.094	0.212
Nickel	mg/L	134	0.001	0.082	0.009	0.010	223	3.00E-04	0.170	0.006	0.013
Selenium	mg/L	133	9.00E-04	0.009	0.002	0.002	225	7.00E-04	0.017	0.002	0.003
Silver	mg/L	141	0.002	0.022	0.003	0.003	511	2.00E-05	0.032	7.70E-04	0.002
Strontium	mg/L	139	0.040	0.944	0.202	0.173	217	0.052	8.50	0.485	1.05
Tin	mg/L	133	0.011	0.030	0.030	0.062	181	0.002	0.206	0.010	0.020
Vanadium	mg/L	139	4.08E-04	1.20	0.018	0.108	222	4.20E-04	0.072	0.003	0.007
Zinc	mg/L	138	0.002	2.30	0.033	0.197	224	0.002	0.831	0.020	0.068
Radium-226	pCi/L	6	-0.050	0.342	0.164	0.148	7	0.068	1.34	0.422	0.433
Uranium-233/234	pCi/L	27	-0.016	31.8	1.44	6.06	110	0.110	583	8.33	56.1
Uranium-238	pCi/L	36	-0.061	24.5	1.03	4.10	110	0.001	253	5.04	24.4

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.

**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
2-Methylnaphthalene	N/A	N/A	N/A	104	NONPARAMETRIC	7	N/A	N/A	N/A
4,4'-DDT	N/A	N/A	N/A	79	NONPARAMETRIC	5	N/A	N/A	N/A
Acenaphthene	N/A	N/A	5	104	NONPARAMETRIC	24	N/A	N/A	N/A
Aldrin	N/A	N/A	N/A	78	NONPARAMETRIC	1	N/A	N/A	N/A
Anthracene	N/A	N/A	9	104	NONPARAMETRIC	38	N/A	N/A	N/A
Aquatic TEQ	N/A	N/A	N/A	4	LOGNORMAL	100	N/A	N/A	N/A
Atrazine	N/A	N/A	N/A	1	0	100	N/A	N/A	N/A
Benzo(a)anthracene	N/A	N/A	12	104	NONPARAMETRIC	59	N/A	N/A	N/A
Benzo(a)pyrene	N/A	N/A	9	104	NONPARAMETRIC	49	N/A	N/A	N/A
Benzo(g,h,i)perylene	N/A	N/A	5	104	NONPARAMETRIC	32	N/A	N/A	N/A
Benzo(k)fluoranthene	N/A	N/A	7	104	NONPARAMETRIC	37	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	N/A	N/A	43	104	NONPARAMETRIC	49	WRS	N/A	N/A
Carbazole	N/A	N/A	N/A	30	NONPARAMETRIC	43	N/A	N/A	N/A
Chrysene	N/A	N/A	12	104	LOGNORMAL	67	N/A	N/A	N/A

**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 (%)			
delta-BHC	N/A	N/A	N/A	79	NONPARAMETRIC	1	N/A	N/A	N/A
Dibenz(a,h)anthracene	N/A	N/A	2	104	NONPARAMETRIC	6	N/A	N/A	N/A
Endosulfan I	N/A	N/A	N/A	79	NONPARAMETRIC	1	N/A	N/A	N/A
Fluoranthene	N/A	N/A	14	104	LOGNORMAL	72	N/A	N/A	N/A
Fluorene	N/A	N/A	5	104	NONPARAMETRIC	16	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	N/A	N/A	5	104	NONPARAMETRIC	35	N/A	N/A	N/A
Naphthalene	N/A	N/A	N/A	106	NONPARAMETRIC	9	N/A	N/A	N/A
PCB-1254	N/A	N/A	5	124	NONPARAMETRIC	27	N/A	N/A	N/A
PCB-1260	N/A	N/A	N/A	121	NONPARAMETRIC	2	N/A	N/A	N/A
Phenanthrene	N/A	N/A	9	104	NONPARAMETRIC	67	N/A	N/A	N/A
Pyrene	N/A	N/A	14	104	NONPARAMETRIC	64	N/A	N/A	N/A
Total Dioxins	N/A	N/A	N/A	4	NORMAL	100	N/A	N/A	N/A
Total PAHs	N/A	N/A	N/A	106	NONPARAMETRIC	75	N/A	N/A	N/A
Total PCBs	N/A	N/A	N/A	124	NONPARAMETRIC	27	N/A	N/A	N/A

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 Sediments (excluding background samples)**  
**North Walnut Creek Aquatic Exposure Unit (NW AEU)<sup>a</sup>**

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	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	43	N/A	N/A	402	252	104	46.0	2,000	367	324
4,4'-DDT	ug/kg	40	N/A	N/A	31.1	76.9	79	2.90	4.90	11.0	11.9
Acenaphthene	ug/kg	43	75.0	270	391	254	104	24.0	620	253	144
Aldrin	ug/kg	40	N/A	N/A	15.8	40.0	78	54.0	54.0	6.27	8.09
Anthracene	ug/kg	43	75.0	700	397	252	104	20.0	970	241	176
Aquatic TEQ	ug/kg	N/A	N/A	N/A	N/A	N/A	4	6.45E-05	0.007	0.002	0.004
Atrazine	ug/kg	N/A	N/A	N/A	N/A	N/A	1	120	120	120	N/A
Benzo(a)anthracene	ug/kg	43	37.0	1,700	434	335	104	26.0	1,400	306	322
Benzo(a)pyrene	ug/kg	43	120	900	407	260	104	23.0	1,300	330	314
Benzo(g,h,i)perylene	ug/kg	41	240	460	396	246	104	35.0	900	319	279
Benzo(k)fluoranthene	ug/kg	42	96.0	780	397	254	104	35.0	1,200	330	300
bis(2-ethylhexyl)phthalate	ug/kg	42	37.0	810	348	246	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	43	50.0	2,000	446	368	104	22.0	1,500	320	343
delta-BHC	ug/kg	40	N/A	N/A	15.8	40.0	79	13.0	13.0	5.74	5.97
Dibenz(a,h)anthracene	ug/kg	43	220	220	402	252	104	41.0	330	346	260
Endosulfan I	ug/kg	40	N/A	N/A	15.8	40.0	79	20.0	20.0	5.53	5.48
Fluoranthene	ug/kg	43	70.0	3,100	527	621	104	44.0	3,100	494	547
Fluorene	ug/kg	43	380	420	401	249	104	21.0	650	337	271
Indeno(1,2,3-cd)pyrene	ug/kg	42	220	470	388	243	104	23.0	890	309	281
Naphthalene	ug/kg	43	N/A	N/A	402	252	106	1.10	320	287	234

**Table A3.2.NW AEU.6**  
**Summary Statistics For Sediments (excluding background samples)**  
**North Walnut Creek Aquatic Exposure Unit (NW AEU)<sup>a</sup>**

Analyte	Units	Background					NW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
PCB-1254	ug/kg	40	19.0	58.0	306	770	124	7.30	5,200	166	479
PCB-1260	ug/kg	40	N/A	N/A	311	769	121	150	180	107	109
Phenanthrene	ug/kg	43	260	3,200	527	614	104	26.0	3,300	419	522
Pyrene	ug/kg	43	61.0	4,700	536	742	104	37.0	3,900	495	574
Total Dioxins	ug/kg	N/A	N/A	N/A	N/A	N/A	4	0.048	0.741	0.291	0.308
Total PAHs	ug/kg	N/A	N/A	N/A	N/A	N/A	106	1,068	20,600	4,698	3,995
Total PCBs	ug/kg	N/A	N/A	N/A	N/A	N/A	124	7.30	5,200	166	479

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.  
N/A = Not Available

**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 (%)			
4,4'-DDD	N/A	N/A	N/A	72	NONPARAMETRIC	1.4	N/A	N/A	N/A
4,4'-DDT	N/A	N/A	N/A	72	NONPARAMETRIC	6.9	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	117	NONPARAMETRIC	0.9	N/A	N/A	N/A
Aquatic TEQ	N/A	N/A	N/A	0	0	0.0	N/A	N/A	N/A
PCB-1254	N/A	N/A	N/A	70	NONPARAMETRIC	1.4	N/A	N/A	N/A
Total Dioxins	N/A	N/A	N/A	34	GAMMA	0.0	N/A	N/A	N/A
Aluminum	166	NONPARAMETRIC	81.9	1042	NONPARAMETRIC	92.1	WRS	0.044	Yes
Ammonia	1	0	0.0	503	NONPARAMETRIC	73.8	N/A	N/A	N/A
Barium	172	NONPARAMETRIC	77.9	1047	NONPARAMETRIC	98.2	WRS	0	Yes
Beryllium	167	NONPARAMETRIC	12.6	1282	NONPARAMETRIC	34.6	N/A	N/A	N/A
Cadmium	165	NONPARAMETRIC	4.8	1051	NONPARAMETRIC	36.3	N/A	N/A	N/A
Chromium	167	NONPARAMETRIC	29.3	1365	NONPARAMETRIC	51.1	WRS	1.000	No
Copper	164	NONPARAMETRIC	46.3	1034	NONPARAMETRIC	71.5	WRS	0.586	No
Cyanide	128	NONPARAMETRIC	5.5	95	NONPARAMETRIC	10.5	N/A	N/A	N/A
Fluoride	118	NONPARAMETRIC	94.9	576	NONPARAMETRIC	94.6	WRS	0	Yes
Iron	172	NONPARAMETRIC	96.5	1049	NONPARAMETRIC	97.5	WRS	0.201	No
Lead	166	NONPARAMETRIC	45.2	1036	NONPARAMETRIC	59.6	WRS	0.026	Yes
Lithium	166	NONPARAMETRIC	49.4	781	NONPARAMETRIC	91.5	WRS	2.66E-15	Yes
Manganese	171	LOGNORMAL	91.2	1048	NONPARAMETRIC	97.5	WRS	7.22E-14	Yes
Mercury	162	NONPARAMETRIC	11.1	997	NONPARAMETRIC	9.5	N/A	N/A	N/A
Nickel	167	NONPARAMETRIC	26.3	1041	NONPARAMETRIC	48.6	WRS	1.000	No
Selenium	162	NONPARAMETRIC	14.2	1044	NONPARAMETRIC	30.6	N/A	N/A	N/A
Silver	170	NONPARAMETRIC	6.5	1045	NONPARAMETRIC	15.5	N/A	N/A	N/A
Vanadium	171	NONPARAMETRIC	33.9	1046	NONPARAMETRIC	69.7	WRS	0.322	No
Zinc	170	LOGNORMAL	73.5	1048	NONPARAMETRIC	95.4	WRS	0	Yes
Plutonium-239/240	107	NONPARAMETRIC	100.0	2176	NONPARAMETRIC	100.0	WRS	0	Yes
Radium-226	5	NORMAL	100.0	28	NONPARAMETRIC	100.0	WRS	0.759	No
Uranium-233/234	77	NONPARAMETRIC	100.0	1586	NONPARAMETRIC	100.0	WRS	0	Yes
Uranium-238	77	NONPARAMETRIC	100.0	1586	NONPARAMETRIC	100.0	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.**

**Table A3.2.SW AEU.2**  
**Summary Statistics For Surface Water, Total Analyses (excluding background samples)**  
**South Walnut Creek Aquatic Exposure Unit (SW AEU)<sup>a</sup>**

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
4,4'-DDD	ug/L	19	N/A	N/A	0.049	0.011	72	0.099	0.099	0.057	0.028
4,4'-DDT	ug/L	19	N/A	N/A	0.049	0.011	72	0.011	0.580	0.067	0.072
4-Methylphenol	ug/L	18	N/A	N/A	5.17	0.420	117	28.0	28.0	4.87	2.33
Aquatic TEQ	ug/L	N/A	N/A	N/A	N/A	N/A	34	N/A	N/A	0	0
PCB-1254	ug/L	19	N/A	N/A	0.486	0.115	70	24.0	24.0	0.897	2.81
Total Dioxins	ug/L	N/A	N/A	N/A	N/A	N/A	34	N/A	N/A	7.74E-04	6.37E-04
Aluminum	mg/L	166	0.026	129	3.39	12.5	1042	0.011	325	5.10	15.8
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	503	0	24.4	1.24	2.86
Barium	mg/L	172	0.009	0.630	0.079	0.079	1047	0.008	2.30	0.162	0.158
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	1282	2.00E-05	0.016	4.67E-04	7.51E-04
Cadmium	mg/L	165	7.00E-05	0.004	0.001	8.84E-04	1051	5.00E-05	0.048	0.001	0.002
Chromium	mg/L	167	5.10E-04	0.247	0.008	0.024	1365	5.20E-06	0.248	0.006	0.013
Copper	mg/L	164	0.002	0.048	0.007	0.008	1034	4.80E-04	0.202	0.010	0.018
Cyanide	mg/L	128	0.002	0.040	0.048	0.443	95	0.005	0.061	0.008	0.009
Fluoride	mg/L	118	0.100	1.00	0.335	0.125	576	0.050	9.60	0.766	0.507
Iron	mg/L	172	0.032	88.6	3.04	10.2	1049	0.011	245	5.32	14.5
Lead	mg/L	166	1.20E-04	0.051	0.003	0.007	1036	1.20E-04	0.189	0.008	0.017
Lithium	mg/L	166	0.001	0.154	0.015	0.022	781	0.002	1.71	0.020	0.066
Manganese	mg/L	171	0.002	4.06	0.090	0.334	1048	7.20E-04	4.30	0.212	0.404
Mercury	mg/L	162	3.50E-05	6.30E-04	1.13E-04	7.89E-05	997	1.00E-04	0.001	9.88E-05	1.68E-04
Nickel	mg/L	167	0.002	0.120	0.009	0.013	1041	5.70E-04	0.224	0.007	0.012
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	1044	3.20E-04	0.012	0.002	0.003
Silver	mg/L	170	6.00E-05	0.007	0.002	0.002	1045	5.00E-05	0.074	0.001	0.003
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	1046	1.60E-04	0.527	0.013	0.031
Zinc	mg/L	170	0.002	3.11	0.055	0.245	1048	0.003	8.07	0.193	0.369
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	2176	-0.190	90.0	0.445	4.02
Radium-226	pCi/L	5	-0.100	4.90	1.76	2.06	28	-0.190	3.00	0.413	0.562
Uranium-233/234	pCi/L	77	-0.056	5.10	0.479	0.747	1586	-0.090	86.8	1.41	2.59
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	1586	-0.504	93.6	1.34	2.70

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.  
N/A = Not Available

**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	Units	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	mg/L	138	NONPARAMETRIC	46.4	565	NONPARAMETRIC	26.5	WRS	1.00	No
<b>Barium</b>	<b>mg/L</b>	<b>140</b>	<b>NONPARAMETRIC</b>	<b>67.9</b>	<b>575</b>	<b>NONPARAMETRIC</b>	<b>98.4</b>	<b>WRS</b>	<b>0</b>	<b>Yes</b>
<b>Cadmium</b>	<b>mg/L</b>	<b>136</b>	<b>NONPARAMETRIC</b>	<b>7.4</b>	<b>840</b>	<b>NONPARAMETRIC</b>	<b>20.0</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Copper	mg/L	138	NONPARAMETRIC	33.3	566	NONPARAMETRIC	48.4	WRS	1.00	No
Iron	mg/L	137	LOGNORMAL	79.6	577	NONPARAMETRIC	51.5	WRS	1.00	No
Lead	mg/L	133	NONPARAMETRIC	24.1	575	NONPARAMETRIC	24.2	WRS	1.000	No
<b>Lithium</b>	<b>mg/L</b>	<b>134</b>	<b>NONPARAMETRIC</b>	<b>34.3</b>	<b>342</b>	<b>NONPARAMETRIC</b>	<b>88.3</b>	<b>WRS</b>	<b>6.69E-11</b>	<b>Yes</b>
Selenium	mg/L	133	NONPARAMETRIC	7.5	576	NONPARAMETRIC	30.0	N/A	N/A	N/A
Silver	mg/L	141	NONPARAMETRIC	5.7	843	NONPARAMETRIC	5.6	N/A	N/A	N/A
<b>Thallium</b>	<b>mg/L</b>	<b>134</b>	<b>NONPARAMETRIC</b>	<b>3.0</b>	<b>568</b>	<b>NONPARAMETRIC</b>	<b>3.3</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>Vanadium</b>	<b>mg/L</b>	<b>139</b>	<b>NONPARAMETRIC</b>	<b>9.4</b>	<b>576</b>	<b>NONPARAMETRIC</b>	<b>41.3</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
<b>Zinc</b>	<b>mg/L</b>	<b>138</b>	<b>NONPARAMETRIC</b>	<b>56.5</b>	<b>571</b>	<b>NONPARAMETRIC</b>	<b>61.6</b>	<b>WRS</b>	<b>0.007</b>	<b>Yes</b>

Test: 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.SW AEU.4**  
**Summary Statistics For Surface Water, Dissolved Analyses (excluding background samples)**  
**South Walnut Creek Aquatic Exposure Unit (SW AEU)<sup>a</sup>**

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
Aluminum	mg/L	138	0.013	1.05	0.101	0.164	565	0.005	1.89	0.025	0.108
Barium	mg/L	140	8.50E-04	0.586	0.058	0.059	575	0.009	0.592	0.131	0.071
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	840	5.00E-05	0.031	0.001	0.002
Copper	mg/L	138	0.001	0.026	0.006	0.005	566	3.10E-04	0.038	0.003	0.003
Iron	mg/L	137	0.010	72.8	0.724	6.21	577	0.003	1.55	0.042	0.120
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	575	1.10E-04	0.041	0.001	0.006
Lithium	mg/L	134	0.001	0.035	0.015	0.021	342	0.001	1.59	0.017	0.086
Selenium	mg/L	133	9.00E-04	0.009	0.002	0.002	576	2.30E-04	0.015	0.002	0.002
Silver	mg/L	141	0.002	0.022	0.003	0.003	843	5.00E-05	0.033	9.97E-04	0.002
Thallium	mg/L	134	4.30E-04	0.006	0.003	0.014	568	5.30E-04	0.018	0.001	0.004
Vanadium	mg/L	139	4.08E-04	1.20	0.018	0.108	576	1.90E-04	0.079	0.003	0.004
Zinc	mg/L	138	0.002	2.30	0.033	0.197	571	0.002	0.489	0.044	0.066

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.

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

Analyte	Units	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	mg/kg	55	GAMMA	100.0	126	NONPARAMETRIC	100.0	WRS	0.005	Yes
Antimony	mg/kg	47	LOGNORMAL	10.6	118	NONPARAMETRIC	22.9	N/A	N/A	N/A
Arsenic	mg/kg	55	GAMMA	89.1	125	NONPARAMETRIC	95.2	WRS	2.13E-07	Yes
Barium	mg/kg	54	GAMMA	100.0	126	NONPARAMETRIC	100.0	WRS	0.006	Yes
Cadmium	mg/kg	48	LOGNORMAL	10.4	126	NONPARAMETRIC	49.2	N/A	N/A	N/A
Chromium	mg/kg	55	GAMMA	85.5	126	GAMMA	94.4	WRS	8.13E-06	Yes
Copper	mg/kg	55	GAMMA	80.0	126	NONPARAMETRIC	95.2	WRS	4.26E-07	Yes
Fluoride	mg/kg	N/A	N/A	N/A	16	NONPARAMETRIC	50.0	N/A	N/A	N/A
Iron	mg/kg	55	GAMMA	100.0	126	NORMAL	100.0	WRS	2.69E-04	Yes
Lead	mg/kg	55	LOGNORMAL	100.0	126	LOGNORMAL	100.0	t-Test_LN	1.54E-05	Yes
Manganese	mg/kg	55	GAMMA	100.0	126	NORMAL	100.0	WRS	0.474	No
Mercury	mg/kg	46	NONPARAMETRIC	4.3	107	NONPARAMETRIC	32.7	N/A	N/A	N/A
Nickel	mg/kg	53	GAMMA	71.7	126	NONPARAMETRIC	93.7	WRS	4.72E-08	Yes
Selenium	mg/kg	54	NONPARAMETRIC	27.8	125	LOGNORMAL	11.2	N/A	N/A	N/A
Silver	mg/kg	48	NONPARAMETRIC	6.3	124	NONPARAMETRIC	25.8	N/A	N/A	N/A
Zinc	mg/kg	55	NONPARAMETRIC	98.2	126	NONPARAMETRIC	100.0	WRS	7.18E-13	Yes
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	83	NONPARAMETRIC	1.2	N/A	N/A	N/A
4,4'-DDE	ug/kg	N/A	N/A	N/A	66	NONPARAMETRIC	1.5	N/A	N/A	N/A
4-Methylphenol	ug/kg	N/A	N/A	15.9	84	NONPARAMETRIC	1.2	N/A	N/A	N/A
Acenaphthene	ug/kg	N/A	N/A	4.7	83	NONPARAMETRIC	14.5	N/A	N/A	N/A
Anthracene	ug/kg	N/A	N/A	9.3	83	NONPARAMETRIC	33.7	N/A	N/A	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	11.6	83	NONPARAMETRIC	56.6	N/A	N/A	N/A
Benzo(a)pyrene	ug/kg	N/A	N/A	9.3	83	NONPARAMETRIC	53.0	N/A	N/A	N/A
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	4.9	83	NONPARAMETRIC	39.8	N/A	N/A	N/A
Benzo(k)fluoranthene	ug/kg	N/A	N/A	7.1	83	NONPARAMETRIC	49.4	N/A	N/A	N/A
Benzyl Alcohol	ug/kg	N/A	N/A	N/A	67	NONPARAMETRIC	1.5	N/A	N/A	N/A
bis(2-ethylhexyl)phthalate	ug/kg	N/A	N/A	42.9	83	NONPARAMETRIC	66.3	WRS	N/A	N/A
Bromomethane	ug/kg	N/A	N/A	N/A	80	NONPARAMETRIC	7.5	N/A	N/A	N/A
Carbazole	ug/kg	N/A	N/A	N/A	16	NORMAL	37.5	N/A	N/A	N/A
Chrysene	ug/kg	N/A	N/A	11.6	83	GAMMA	62.7	N/A	N/A	N/A
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	2.3	83	NONPARAMETRIC	16.9	N/A	N/A	N/A
Fluoranthene	ug/kg	N/A	N/A	14.0	83	NONPARAMETRIC	68.7	N/A	N/A	N/A
Fluorene	ug/kg	N/A	N/A	4.7	83	NONPARAMETRIC	12.0	N/A	N/A	N/A
gamma-BHC (Lindane)	ug/kg	N/A	N/A	N/A	65	NONPARAMETRIC	1.5	N/A	N/A	N/A
Heptachlor epoxide	ug/kg	N/A	N/A	N/A	66	NONPARAMETRIC	1.5	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	4.8	83	NONPARAMETRIC	44.6	N/A	N/A	N/A

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

Analyte	Units	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 (%)			
PCB-1254	ug/kg	N/A	N/A	5.0	97	NONPARAMETRIC	26.8	N/A	N/A	N/A
PCB-1260	ug/kg	N/A	N/A	N/A	97	NONPARAMETRIC	5.2	N/A	N/A	N/A
Pentachlorophenol	ug/kg	N/A	N/A	N/A	84	NONPARAMETRIC	3.6	N/A	N/A	N/A
Phenanthrene	ug/kg	N/A	N/A	9.3	83	LOGNORMAL	61.4	N/A	N/A	N/A
Pyrene	ug/kg	N/A	N/A	14.0	83	NONPARAMETRIC	63.9	N/A	N/A	N/A
Total PAHs	ug/kg	N/A	N/A	N/A	83	NONPARAMETRIC	69.9	N/A	N/A	N/A
Total PCBs	ug/kg	N/A	N/A	N/A	97	NONPARAMETRIC	29.9	N/A	N/A	N/A

WRS = Wilcoxon Rank Sum

t-Test-LN = Student's t-test using log-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 Sediments (excluding background samples)**  
**South Walnut Creek Aquatic Exposure Unit (SW AEU)<sup>a</sup>**

Analyte	Units	Background					SW AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	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	59.9
Cadmium	mg/kg	48	0.410	1.30	0.525	0.345	126	0.036	44.0	1.03	3.93
Chromium	mg/kg	55	1.50	30.4	8.78	7.87	126	1.30	140	14.7	13.8
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	1,280	238	216	126	39.1	639	200	92.4
Mercury	mg/kg	46	0.034	0.050	0.077	0.061	107	0.013	1.70	0.064	0.163
Nickel	mg/kg	53	1.20	25.6	6.93	5.32	126	2.90	216	14.0	19.5
Selenium	mg/kg	54	0.100	3.20	0.458	0.634	125	0.330	3.60	0.456	0.403
Silver	mg/kg	48	1.40	3.40	0.737	0.654	124	0.160	3,100	27.6	278
Zinc	mg/kg	55	6.50	720	72.2	129	126	18.6	888	166	167
2-Methylnaphthalene	ug/kg	43	N/A	N/A	402	252	83	41.0	41.0	336	266
4,4'-DDE	ug/kg	40	N/A	N/A	31.1	76.9	66	4.10	4.10	9.19	4.63
4-Methylphenol	ug/kg	44	68.0	1,500	432	314	84	47.0	47.0	332	266
Acenaphthene	ug/kg	43	75.0	270	391	254	83	26.0	180	235	126
Anthracene	ug/kg	43	75.0	700	397	252	83	19.0	430	213	130
Benzo(a)anthracene	ug/kg	43	37.0	1,700	434	335	83	25.0	1,400	294	284
Benzo(a)pyrene	ug/kg	43	120	900	407	260	83	41.0	1,300	327	275
Benzo(g,h,i)perylene	ug/kg	41	240	460	396	246	83	43.0	1,100	300	279
Benzo(k)fluoranthene	ug/kg	42	96.0	780	397	254	83	31.0	920	311	285
Benzyl Alcohol	ug/kg	43	N/A	N/A	402	252	67	41.0	41.0	570	640
bis(2-ethylhexyl)phthalate	ug/kg	42	37.0	810	348	246	83	28.0	25,000	1,169	3,104
Bromomethane	ug/kg	39	N/A	N/A	8.44	4.63	80	2.00	5.00	21.7	101
Carbazole	ug/kg	N/A	N/A	N/A	N/A	N/A	16	25.0	290	186	85.4
Chrysene	ug/kg	43	50.0	2,000	446	368	83	23.0	1,400	332	296
Dibenz(a,h)anthracene	ug/kg	43	220	220	402	252	83	21.0	360	304	269
Fluoranthene	ug/kg	43	70.0	3,100	527	621	83	33.0	2,700	540	526
Fluorene	ug/kg	43	380	420	401	249	83	21.0	180	317	272
gamma-BHC (Lindane)	ug/kg	40	N/A	N/A	15.8	40.0	65	25.0	25.0	4.95	3.49
Heptachlor epoxide	ug/kg	40	N/A	N/A	15.8	40.0	66	33.0	33.0	5.84	6.59
Indeno(1,2,3-cd)pyrene	ug/kg	42	220	470	388	243	83	30.0	910	277	276
PCB-1254	ug/kg	40	19.0	58.0	306	770	97	27.0	3,100	181	380
PCB-1260	ug/kg	40	N/A	N/A	311	769	97	53.0	2,000	114	210
Pentachlorophenol	ug/kg	43	N/A	N/A	1,980	1,221	84	420	1,100	1,490	1,410
Phenanthrene	ug/kg	43	260	3,200	527	614	83	35.0	1,800	373	338
Pyrene	ug/kg	43	61.0	4,700	536	742	83	20.0	1,700	466	395
Total PAHs	ug/kg	N/A	N/A	N/A	N/A	N/A	83	1,027	15,520	4,375	3,306
Total PCBs	ug/kg	N/A	N/A	N/A	N/A	N/A	97	47.0	3,700	295	516

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.  
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	Units	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 (%)			
4,4'-DDT	ug/L	N/A	N/A	N/A	104	NONPARAMETRIC	4.8	N/A	N/A	N/A
Aquatic TEQ	ug/L	N/A	N/A	N/A	0	0	0.0	N/A	N/A	N/A
Carbon Disulfide	ug/L	N/A	N/A	N/A	227	NONPARAMETRIC	0.4	N/A	N/A	N/A
Pyrene	ug/L	N/A	N/A	N/A	124	NONPARAMETRIC	0.8	N/A	N/A	N/A
Total Dioxins	ug/L	N/A	N/A	N/A	14	GAMMA	0.0	N/A	N/A	N/A
Aluminum	mg/L	166	NONPARAMETRIC	81.9	542	NONPARAMETRIC	93.5	WRS	0.054	Yes
Ammonia	mg/L	1	0	0.0	83	NONPARAMETRIC	37.3	N/A	N/A	N/A
Barium	mg/L	172	NONPARAMETRIC	77.9	544	NONPARAMETRIC	97.1	WRS	0	Yes
Beryllium	mg/L	167	NONPARAMETRIC	12.6	612	NONPARAMETRIC	24.8	N/A	N/A	N/A
Cadmium	mg/L	165	NONPARAMETRIC	4.8	543	NONPARAMETRIC	25.6	N/A	N/A	N/A
Chromium	mg/L	167	NONPARAMETRIC	29.3	674	NONPARAMETRIC	41.5	WRS	1.000	No
Cobalt	mg/L	171	NONPARAMETRIC	17.0	541	NONPARAMETRIC	35.3	N/A	N/A	N/A
Copper	mg/L	164	NONPARAMETRIC	46.3	537	NONPARAMETRIC	67.6	WRS	0.982	No
Cyanide	mg/L	128	NONPARAMETRIC	5.5	163	NONPARAMETRIC	1.8	N/A	N/A	N/A
Iron	mg/L	172	NONPARAMETRIC	96.5	544	NONPARAMETRIC	97.6	WRS	0.229	No
Lead	mg/L	166	NONPARAMETRIC	45.2	540	NONPARAMETRIC	62.4	WRS	0.128	No
Lithium	mg/L	166	NONPARAMETRIC	49.4	497	NONPARAMETRIC	80.7	WRS	5.69E-06	Yes
Manganese	mg/L	171	LOGNORMAL	91.2	544	NONPARAMETRIC	96.5	WRS	7.71E-05	Yes
Mercury	mg/L	162	NONPARAMETRIC	11.1	524	NONPARAMETRIC	9.4	N/A	N/A	N/A
Nickel	mg/L	167	NONPARAMETRIC	26.3	530	NONPARAMETRIC	46.2	WRS	1.000	No
Selenium	mg/L	162	NONPARAMETRIC	14.2	529	NONPARAMETRIC	23.3	N/A	N/A	N/A
Silver	mg/L	170	NONPARAMETRIC	6.5	541	NONPARAMETRIC	8.1	N/A	N/A	N/A
Thallium	mg/L	166	NONPARAMETRIC	6.0	541	NONPARAMETRIC	5.7	N/A	N/A	N/A
Vanadium	mg/L	171	NONPARAMETRIC	33.9	541	NONPARAMETRIC	56.0	WRS	1.000	No
Zinc	mg/L	170	LOGNORMAL	73.5	540	NONPARAMETRIC	71.9	WRS	0.169	No
Americium-241	pCi/L	101	NONPARAMETRIC	100.0	1059	NONPARAMETRIC	100.0	WRS	3.43E-05	Yes
Plutonium-239/240	pCi/L	107	NONPARAMETRIC	100.0	1101	NONPARAMETRIC	100.0	WRS	2.11E-15	Yes
Uranium-233/234	pCi/L	77	NONPARAMETRIC	100.0	912	NONPARAMETRIC	100.0	WRS	0.000	Yes
Uranium-238	pCi/L	77	NONPARAMETRIC	100.0	912	NONPARAMETRIC	100.0	WRS	0.000	Yes

WRS = Wilcoxon Rank Sum

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

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

**Table A3.2.WC AEU.2**  
**Summary Statistics For Surface Water, Total Analyses (excluding background samples)**  
**Woman Creek Aquatic Exposure Unit (WC AEU)<sup>a</sup>**

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
4,4'-DDT	ug/L	19	N/A	N/A	0.049	0.011	104	0.010	0.073	0.056	0.030
Aquatic TEQ	ug/L	N/A	N/A	N/A	N/A	N/A	14	N/A	N/A	0	0
Carbon Disulfide	ug/L	103	N/A	N/A	2.50	0	227	8.00	8.00	2.68	0.699
Pyrene	ug/L	18	N/A	N/A	5.17	0.420	124	2.00	2.00	4.50	1.46
Total Dioxins	ug/L	N/A	N/A	N/A	N/A	N/A	14	N/A	N/A	6.23E-04	5.43E-04
Aluminum	mg/L	166	0.026	129	3.39	12.5	542	0.009	415	7.63	31.3
Ammonia	mg/L	1	N/A	N/A	0.050	N/A	83	0.070	15.0	0.575	1.78
Barium	mg/L	172	0.009	0.630	0.079	0.079	544	0.018	2.56	0.146	0.190
Beryllium	mg/L	167	4.00E-05	0.004	8.01E-04	8.44E-04	612	3.00E-05	0.026	6.82E-04	0.002
Cadmium	mg/L	165	7.00E-05	0.004	0.001	8.84E-04	543	5.60E-05	0.005	9.41E-04	8.30E-04
Chromium	mg/L	167	5.10E-04	0.247	0.008	0.024	674	5.10E-06	0.348	0.007	0.023
Cobalt	mg/L	171	2.90E-04	0.019	0.005	0.008	541	1.70E-04	0.112	0.003	0.009
Copper	mg/L	164	0.002	0.048	0.007	0.008	537	8.60E-04	0.259	0.011	0.023
Cyanide	mg/L	128	0.002	0.040	0.048	0.443	163	0.004	0.016	0.006	0.003
Iron	mg/L	172	0.032	88.6	3.04	10.2	544	0.008	398	7.25	29.2
Lead	mg/L	166	1.20E-04	0.051	0.003	0.007	540	8.10E-05	5.90	0.019	0.254
Lithium	mg/L	166	0.001	0.154	0.015	0.022	497	0.001	0.277	0.013	0.020
Manganese	mg/L	171	0.002	4.06	0.090	0.334	544	8.60E-04	7.77	0.188	0.530
Mercury	mg/L	162	3.50E-05	6.30E-04	1.13E-04	7.89E-05	524	0	0.002	1.05E-04	1.44E-04
Nickel	mg/L	167	0.002	0.120	0.009	0.013	530	4.30E-04	0.272	0.008	0.021
Selenium	mg/L	162	6.50E-04	0.019	0.002	0.003	529	4.60E-04	0.049	0.006	0.098
Silver	mg/L	170	6.00E-05	0.007	0.002	0.002	541	5.00E-05	0.048	0.001	0.003
Thallium	mg/L	166	2.40E-04	0.007	0.003	0.012	541	2.30E-04	0.020	0.006	0.112
Vanadium	mg/L	171	0.002	0.132	0.011	0.019	541	2.20E-04	0.747	0.016	0.058
Zinc	mg/L	170	0.002	3.11	0.055	0.245	540	9.50E-04	1.39	0.086	0.171
Americium-241	pCi/L	101	-0.010	0.060	0.005	0.009	1059	-0.018	48.0	0.183	1.82
Plutonium-239/240	pCi/L	107	-0.020	0.047	0.003	0.008	1101	-0.023	250	1.19	10.6
Uranium-233/234	pCi/L	77	-0.056	5.10	0.479	0.747	912	0.011	194	1.70	7.84
Uranium-238	pCi/L	77	-0.013	4.90	0.397	0.721	912	-0.009	138	1.81	6.72

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.  
N/A - Not Available

**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	Units	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	mg/L	138	NONPARAMETRIC	46.4	233	NONPARAMETRIC	42.9	WRS	1.000	No
<b>Cadmium</b>	<b>mg/L</b>	<b>136</b>	<b>NONPARAMETRIC</b>	<b>7.4</b>	<b>309</b>	<b>NONPARAMETRIC</b>	<b>12.6</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
Copper	mg/L	138	NONPARAMETRIC	33.3	234	NONPARAMETRIC	38.9	WRS	1.000	No
Iron	mg/L	137	LOGNORMAL	79.6	243	NONPARAMETRIC	67.9	WRS	1.00	No
Lead	mg/L	133	NONPARAMETRIC	24.1	236	NONPARAMETRIC	39.8	WRS	0.906	No
<b>Lithium</b>	<b>mg/L</b>	<b>134</b>	<b>NONPARAMETRIC</b>	<b>34.3</b>	<b>221</b>	<b>NONPARAMETRIC</b>	<b>77.4</b>	<b>WRS</b>	<b>7.21E-04</b>	<b>Yes</b>
Manganese	mg/L	139	LOGNORMAL	80.6	252	LOGNORMAL	91.7	t-Test_LN	0.447	No
Mercury	mg/L	135	NONPARAMETRIC	7.4	230	NONPARAMETRIC	5.7	N/A	N/A	N/A
Selenium	mg/L	133	NONPARAMETRIC	7.5	241	NONPARAMETRIC	14.5	N/A	N/A	N/A
Silver	mg/L	141	NONPARAMETRIC	5.7	311	NONPARAMETRIC	7.4	N/A	N/A	N/A
Thallium	mg/L	134	NONPARAMETRIC	3.0	236	NONPARAMETRIC	1.3	N/A	N/A	N/A
Vanadium	mg/L	139	NONPARAMETRIC	9.4	239	NONPARAMETRIC	15.9	N/A	N/A	N/A
Zinc	mg/L	138	NONPARAMETRIC	56.5	239	NONPARAMETRIC	49.0	WRS	1.000	No

WRS = Wilcoxon Rank Sum

t-Test-LN = Student's t-test using log-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.WC AEU.4**  
**Summary Statistics For Surface Water, Dissolved Analyses (excluding background samples)**  
**Woman Creek Aquatic Exposure Unit (WC AEU)<sup>a</sup>**

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
Aluminum	mg/L	138	0.013	1.05	0.101	0.164	233	0.012	0.770	0.026	0.052
Cadmium	mg/L	136	1.00E-03	0.017	0.002	0.001	309	5.00E-05	0.005	9.19E-04	7.37E-04
Copper	mg/L	138	0.001	0.026	0.006	0.005	234	0.001	0.023	0.003	0.003
Iron	mg/L	137	0.010	72.8	0.724	6.21	243	0.003	9.02	0.101	0.616
Lead	mg/L	133	1.20E-04	0.013	0.002	0.003	236	1.00E-04	0.027	0.002	0.005
Lithium	mg/L	134	0.001	0.035	0.015	0.021	221	0.001	0.129	0.008	0.012
Manganese	mg/L	139	1.00E-03	1.45	0.052	0.163	252	9.30E-04	1.77	0.054	0.149
Mercury	mg/L	135	2.20E-04	0.005	1.48E-04	4.06E-04	230	1.50E-04	1.00E-03	1.12E-04	9.27E-05
Selenium	mg/L	133	9.00E-04	0.009	0.002	0.002	241	9.00E-04	0.049	0.002	0.005
Silver	mg/L	141	0.002	0.022	0.003	0.003	311	1.50E-04	0.006	0.001	0.001
Thallium	mg/L	134	4.30E-04	0.006	0.003	0.014	236	0.014	0.017	0.003	0.007
Vanadium	mg/L	139	4.08E-04	1.20	0.018	0.108	239	7.10E-04	0.014	0.002	0.002
Zinc	mg/L	138	0.002	2.30	0.033	0.197	239	0.002	0.516	0.011	0.042

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.

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

Analyte	Units	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	mg/kg	55	GAMMA	100.0	80	GAMMA	100.0	WRS	4.40E-06	Yes
Antimony	mg/kg	47	LOGNORMAL	10.6	74	NONPARAMETRIC	10.8	N/A	N/A	N/A
Arsenic	mg/kg	55	GAMMA	89.1	80	NONPARAMETRIC	98.8	WRS	2.61E-10	Yes
Barium	mg/kg	54	GAMMA	100.0	80	GAMMA	98.8	WRS	8.91E-07	Yes
Cadmium	mg/kg	48	LOGNORMAL	10.4	75	NONPARAMETRIC	32.0	N/A	N/A	N/A
Chromium	mg/kg	55	GAMMA	85.5	80	GAMMA	98.8	WRS	6.15E-05	Yes
Copper	mg/kg	55	GAMMA	80.0	80	NONPARAMETRIC	95.0	WRS	8.17E-07	Yes
Fluoride	mg/kg	N/A	N/A	N/A	4	NONPARAMETRIC	25.0	N/A	N/A	N/A
Iron	mg/kg	55	GAMMA	100.0	80	NORMAL	100.0	WRS	9.31E-08	Yes
Lead	mg/kg	55	LOGNORMAL	100.0	80	GAMMA	100.0	WRS	5.16E-09	Yes
Manganese	mg/kg	55	GAMMA	100.0	80	GAMMA	100.0	WRS	7.26E-04	Yes
Mercury	mg/kg	46	NONPARAMETRIC	4.3	78	NONPARAMETRIC	30.8	N/A	N/A	N/A
Nickel	mg/kg	53	GAMMA	71.7	80	NORMAL	90.0	WRS	6.45E-09	Yes
Selenium	mg/kg	54	NONPARAMETRIC	27.8	72	LOGNORMAL	41.7	WRS	7.41E-06	Yes
Silver	mg/kg	48	NONPARAMETRIC	6.3	76	NONPARAMETRIC	14.5	N/A	N/A	N/A
Zinc	mg/kg	55	NONPARAMETRIC	98.2	80	NONPARAMETRIC	100.0	WRS	6.76E-07	Yes
2-Butanone	ug/kg	N/A	N/A	17.1	46	NONPARAMETRIC	15.2	N/A	N/A	N/A
2-Methylnaphthalene	ug/kg	N/A	N/A	N/A	54	NONPARAMETRIC	1.9	N/A	N/A	N/A
4,4'-DDT	ug/kg	N/A	N/A	N/A	52	NONPARAMETRIC	1.9	N/A	N/A	N/A
4-Methylphenol	ug/kg	N/A	N/A	15.9	54	NONPARAMETRIC	5.6	N/A	N/A	N/A
Acenaphthene	ug/kg	N/A	N/A	4.7	54	NONPARAMETRIC	7.4	N/A	N/A	N/A
Anthracene	ug/kg	N/A	N/A	9.3	54	NONPARAMETRIC	11.1	N/A	N/A	N/A
Aquatic TEQ	ug/kg	N/A	N/A	N/A	2	0	100.0	N/A	N/A	N/A
Benzo(a)anthracene	ug/kg	N/A	N/A	11.6	54	NONPARAMETRIC	20.4	N/A	N/A	N/A
Benzo(a)pyrene	ug/kg	N/A	N/A	9.3	54	NONPARAMETRIC	14.8	N/A	N/A	N/A
Benzo(g,h,i)perylene	ug/kg	N/A	N/A	4.9	54	NONPARAMETRIC	7.4	N/A	N/A	N/A
Benzo(k)fluoranthene	ug/kg	N/A	N/A	7.1	54	NONPARAMETRIC	9.3	N/A	N/A	N/A
Chrysene	ug/kg	N/A	N/A	11.6	55	NONPARAMETRIC	25.5	N/A	N/A	N/A
Dibenz(a,h)anthracene	ug/kg	N/A	N/A	2.3	53	NONPARAMETRIC	3.8	N/A	N/A	N/A
Fluoranthene	ug/kg	N/A	N/A	14.0	55	LOGNORMAL	34.5	N/A	N/A	N/A
Fluorene	ug/kg	N/A	N/A	4.7	54	NONPARAMETRIC	1.9	N/A	N/A	N/A
gamma-BHC (Lindane)	ug/kg	N/A	N/A	N/A	52	NONPARAMETRIC	1.9	N/A	N/A	N/A
Heptachlor	ug/kg	N/A	N/A	2.5	52	NONPARAMETRIC	3.8	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	ug/kg	N/A	N/A	4.8	54	NONPARAMETRIC	9.3	N/A	N/A	N/A
Naphthalene	ug/kg	N/A	N/A	N/A	54	NONPARAMETRIC	3.7	N/A	N/A	N/A
PCB-1254	ug/kg	N/A	N/A	5.0	62	NONPARAMETRIC	17.7	N/A	N/A	N/A
Pentachlorophenol	ug/kg	N/A	N/A	N/A	54	NONPARAMETRIC	1.9	N/A	N/A	N/A
Phenanthrene	ug/kg	N/A	N/A	9.3	55	NONPARAMETRIC	29.1	N/A	N/A	N/A
Pyrene	ug/kg	N/A	N/A	14.0	55	NONPARAMETRIC	25.5	N/A	N/A	N/A
Total Dioxins	ug/kg	N/A	N/A	N/A	2	0	100.0	N/A	N/A	N/A
Total PAHs	ug/kg	N/A	N/A	N/A	55	NONPARAMETRIC	38.2	N/A	N/A	N/A
Total PCBs	ug/kg	N/A	N/A	N/A	62	NONPARAMETRIC	17.7	N/A	N/A	N/A

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.**

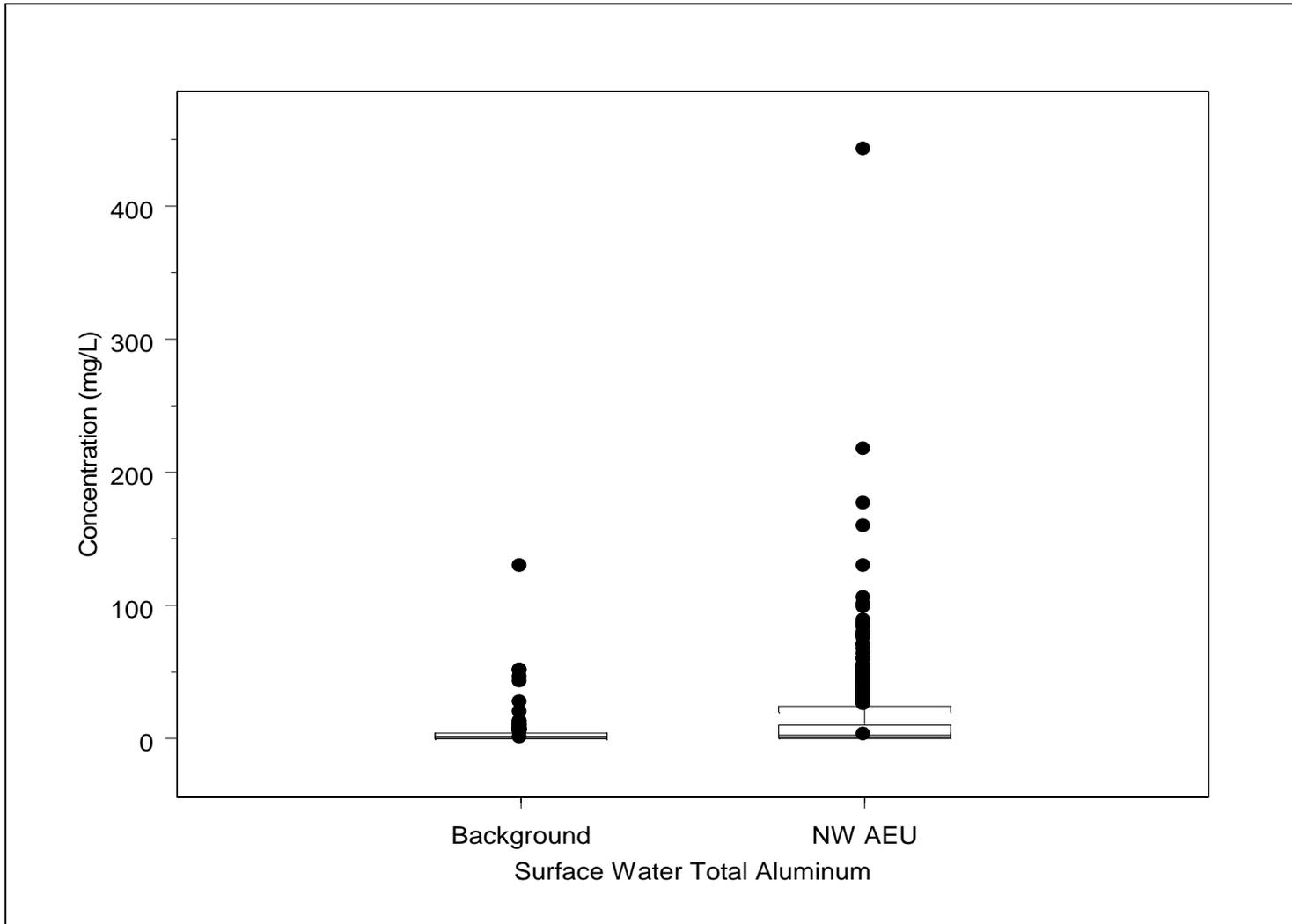
**Table A3.2.WC AEU.6**  
**Summary Statistics For Sediments (excluding background samples)**  
**Woman Creek Aquatic Exposure Unit (WC AEU)<sup>a</sup>**

Analyte	Units	Background					WC AEU (excluding background samples)				
		Total Samples	Minimum	Maximum	Mean	Standard Deviation	Total Samples	Minimum	Maximum	Mean	Standard Deviation
Aluminum	mg/kg	55	811	25,200	6,791	5,603	80	1,560	32,000	11,399	6,816
Antimony	mg/kg	47	1.00	12.4	3.64	3.21	74	0.210	51.3	5.86	9.41
Arsenic	mg/kg	55	0.270	8.70	2.43	1.92	80	0.480	27.9	5.11	3.62
Barium	mg/kg	54	10.6	260	78.9	58.8	80	14.6	404	140	78.8
Cadmium	mg/kg	48	0.410	1.30	0.525	0.345	75	0.130	3.60	0.632	0.594
Chromium	mg/kg	55	1.50	30.4	8.78	7.87	80	2.90	70.1	13.4	9.09
Copper	mg/kg	55	2.20	36.7	10.8	8.43	80	2.70	212	23.0	30.8
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	80	3,030	38,800	16,344	7,345
Lead	mg/kg	55	2.60	68.8	13.3	12.4	80	4.90	118	26.0	17.5
Manganese	mg/kg	55	9.00	1,280	238	216	80	53.0	1,580	316	217
Mercury	mg/kg	46	0.034	0.050	0.077	0.061	78	0.014	3.80	0.209	0.547
Nickel	mg/kg	53	1.20	25.6	6.93	5.32	80	2.20	33.0	13.9	7.11
Selenium	mg/kg	54	0.100	3.20	0.458	0.634	72	0.260	3.80	0.671	0.630
Silver	mg/kg	48	1.40	3.40	0.737	0.654	76	0.850	7.70	0.877	1.14
Zinc	mg/kg	55	6.50	720	72.2	129	80	10.6	2,080	150	273
2-Butanone	ug/kg	41	2.00	190	17.2	38.7	46	3.00	380	20.3	59.8
2-Methylnaphthalene	ug/kg	43	N/A	N/A	402	252	54	110	110	340	204
4,4'-DDT	ug/kg	40	N/A	N/A	31.1	76.9	52	18.0	18.0	18.4	17.8
4-Methylphenol	ug/kg	44	68.0	1,500	432	314	54	93.0	510	338	208
Acenaphthene	ug/kg	43	75.0	270	391	254	54	74.0	510	307	170
Anthracene	ug/kg	43	75.0	700	397	252	54	90.0	470	311	171
Aquatic TEQ	ug/kg	N/A	N/A	N/A	N/A	N/A	2	1.63E-05	0.001	6.92E-04	9.56E-04
Benzo(a)anthracene	ug/kg	43	37.0	1,700	434	335	54	22.0	1,200	299	236
Benzo(a)pyrene	ug/kg	43	120	900	407	260	54	37.0	970	316	221
Benzo(g,h,i)perylene	ug/kg	41	240	460	396	246	54	45.0	630	334	207
Benzo(k)fluoranthene	ug/kg	42	96.0	780	397	254	54	72.0	690	332	208
Chrysene	ug/kg	43	50.0	2,000	446	368	55	41.0	1,200	294	233
Dibenz(a,h)anthracene	ug/kg	43	220	220	402	252	53	220	530	336	198
Fluoranthene	ug/kg	43	70.0	3,100	527	621	55	31.0	2,900	315	403
Fluorene	ug/kg	43	380	420	401	249	54	400	400	346	201
gamma-BHC (Lindane)	ug/kg	40	N/A	N/A	15.8	40.0	52	4.40	4.40	9.62	10.1
Heptachlor	ug/kg	40	3.10	3.10	15.7	40.1	52	0	0	9.04	9.54
Indeno(1,2,3-cd)pyrene	ug/kg	42	220	470	388	243	54	24.0	500	329	191
Naphthalene	ug/kg	43	N/A	N/A	402	252	54	2.00	300	340	206
PCB-1254	ug/kg	40	19.0	58.0	306	770	62	26.0	250	171	194
Pentachlorophenol	ug/kg	43	N/A	N/A	1,980	1,221	54	950	950	1,614	979
Phenanthrene	ug/kg	43	260	3,200	527	614	55	24.0	2,900	329	397
Pyrene	ug/kg	43	61.0	4,700	536	742	55	45.0	3,100	361	433
Total Dioxins	ug/kg	N/A	N/A	N/A	N/A	N/A	2	0.032	0.054	0.043	0.016
Total PAHs	ug/kg	N/A	N/A	N/A	N/A	N/A	55	1,162	16,510	3,820	2,757
Total PCBs	ug/kg	N/A	N/A	N/A	N/A	N/A	62	26.0	250	171	194

<sup>a</sup> Statistics are computed using one-half the reported values for nondetects.  
N/A - Not Available

## **FIGURES**

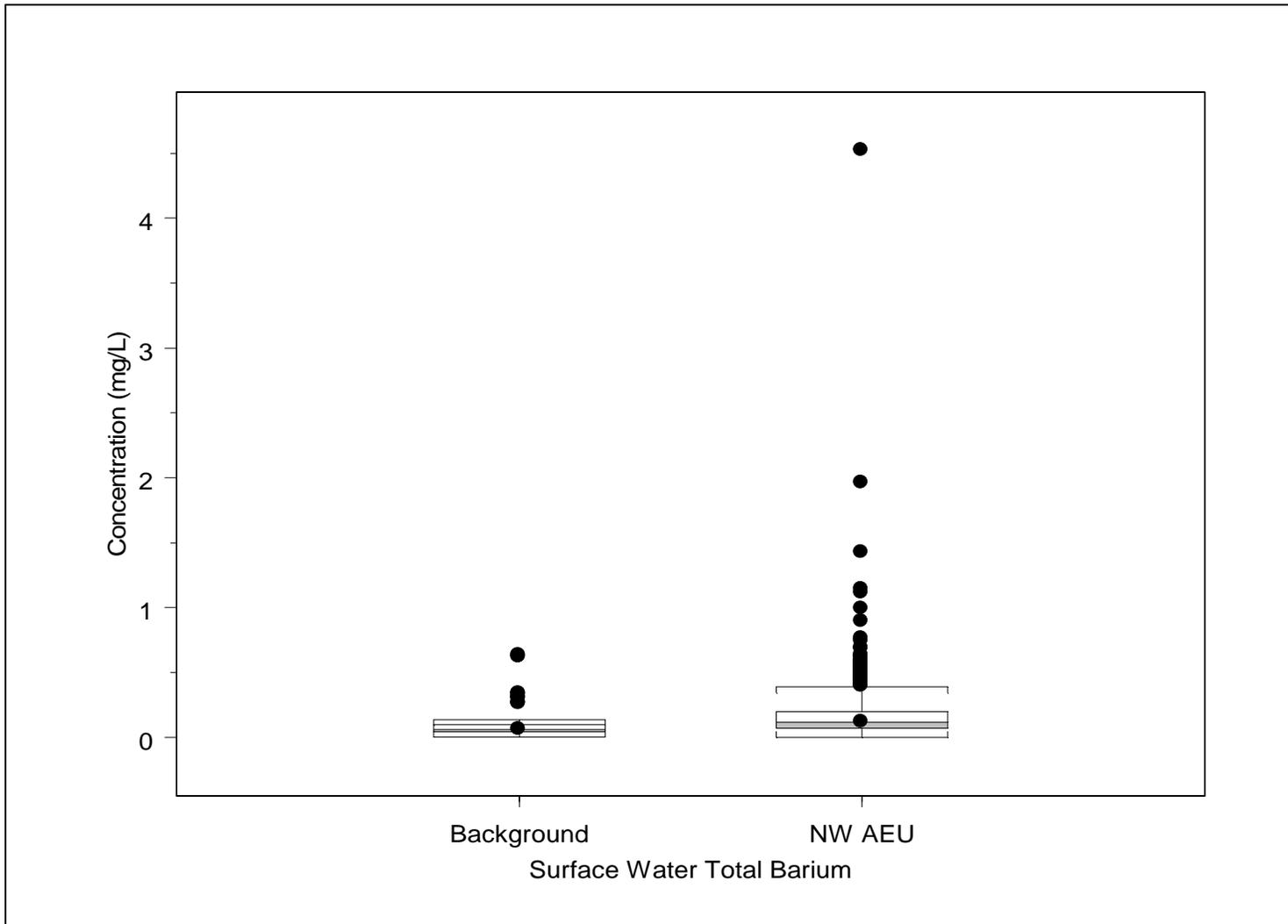
Figure A3.2.NW AEU.1  
NW AEU Surface Water Total Box Plots for Aluminum



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.

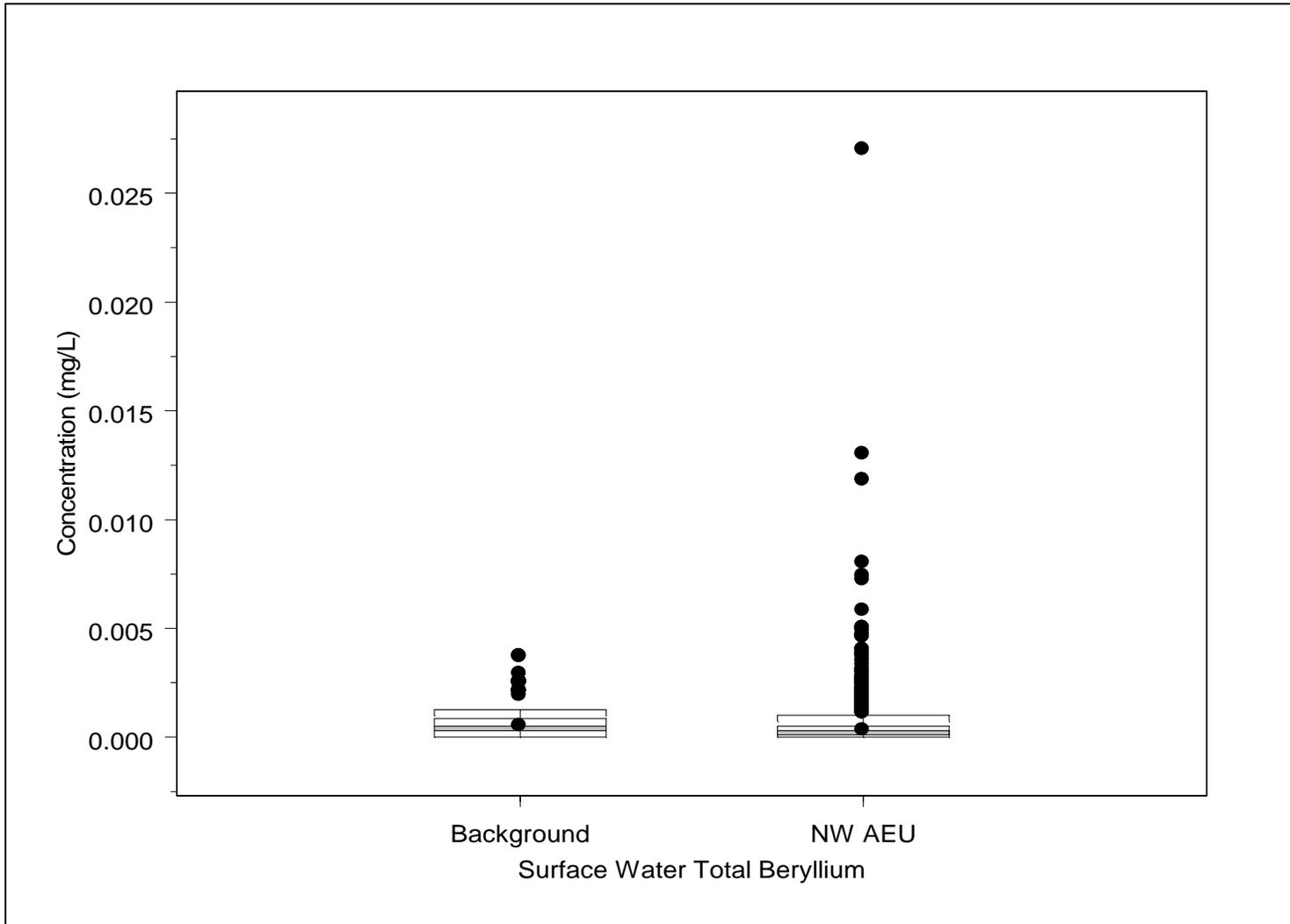


Figure A3.2.NW AEU.3  
NW AEU Surface Water Total Box Plots for Barium



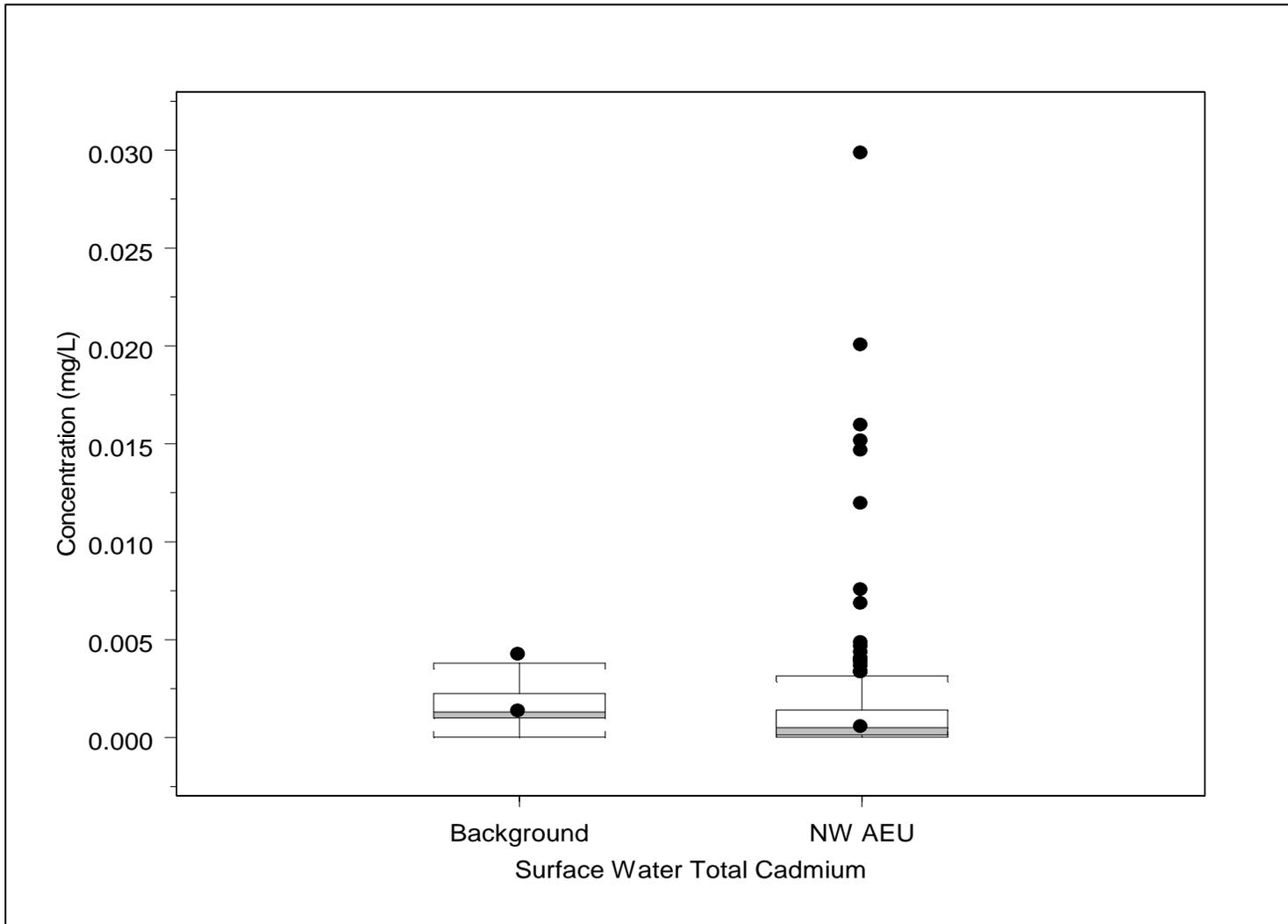
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



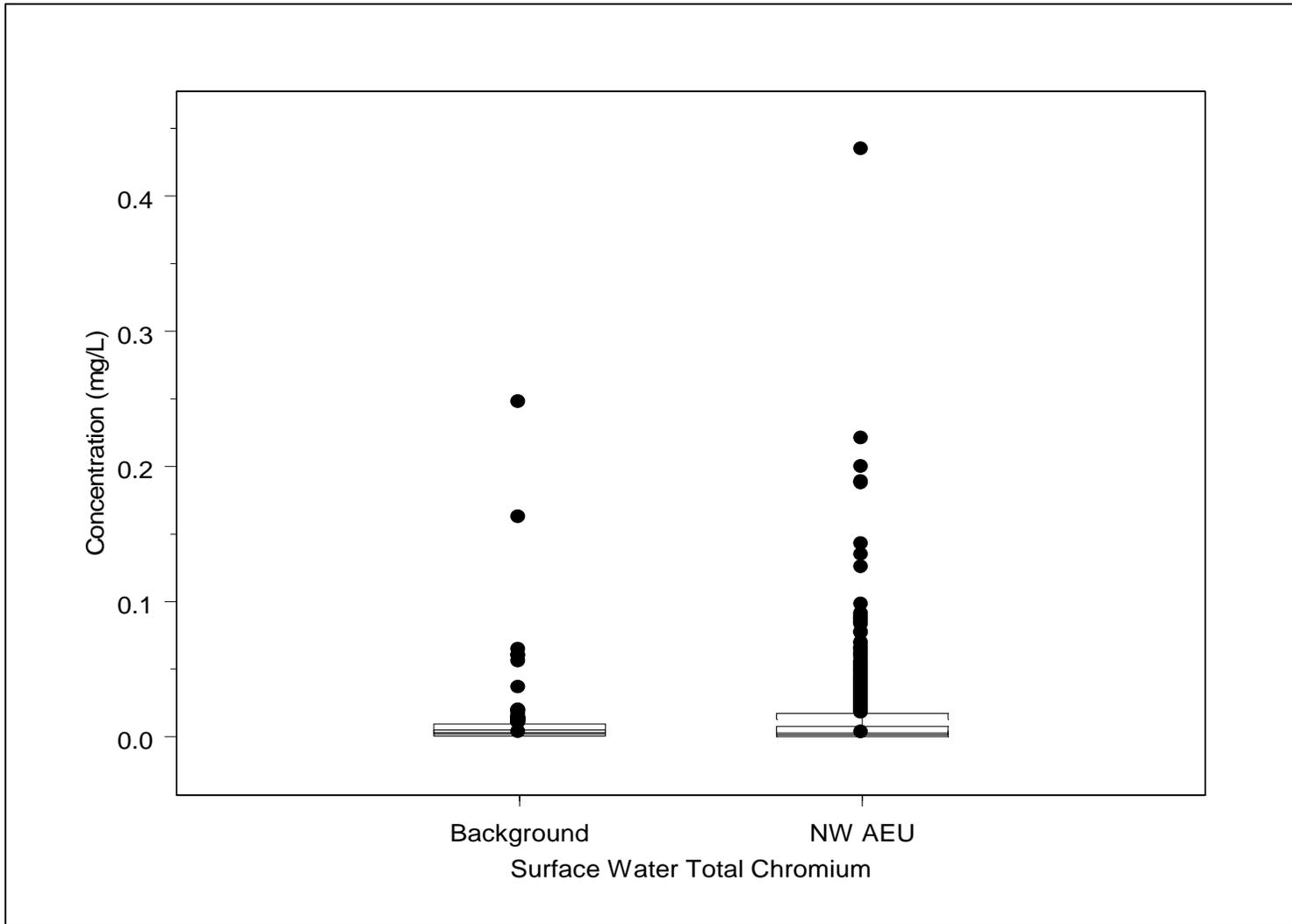
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



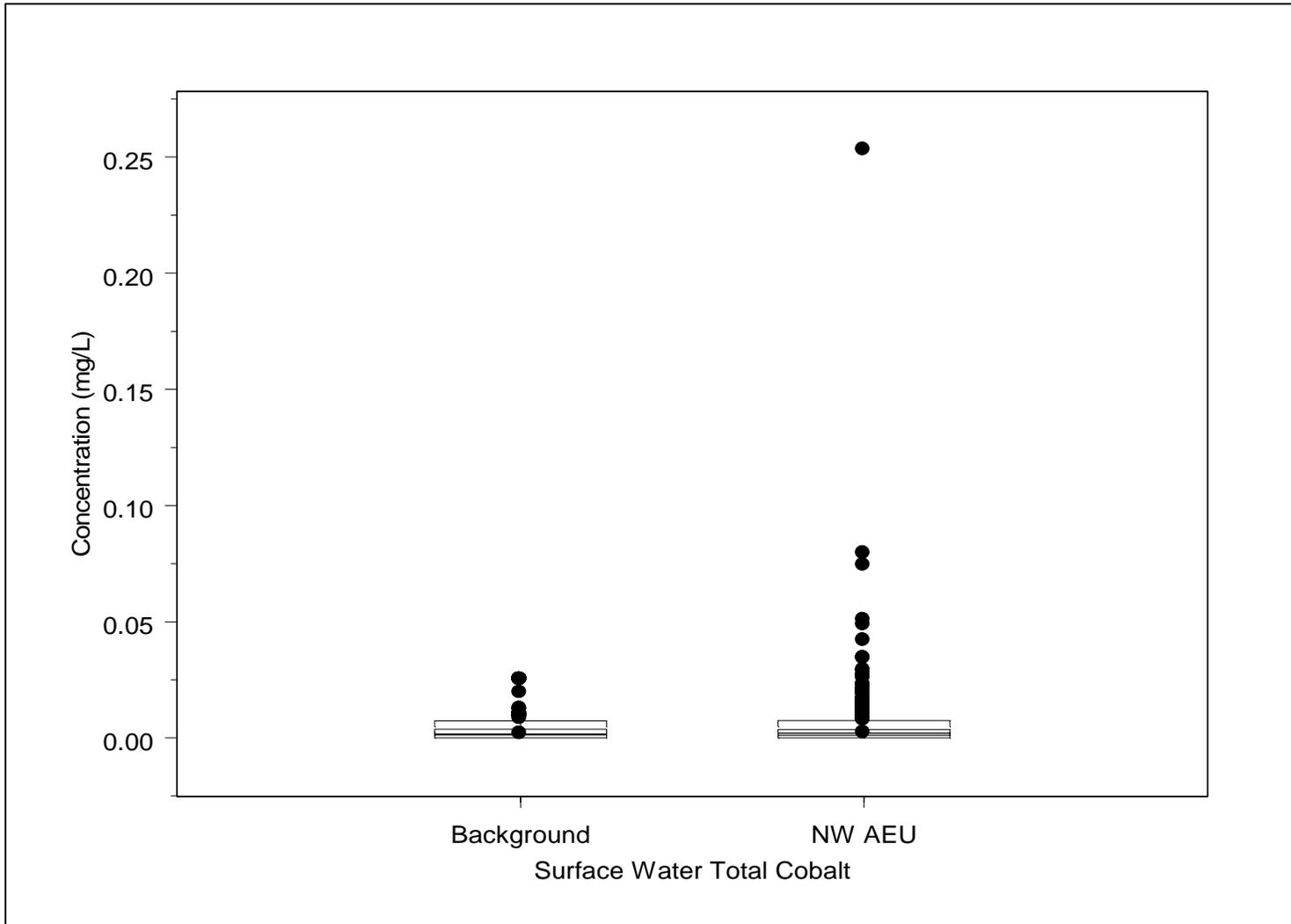
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.6  
NW AEU Surface Water Total Box Plots for Chromium



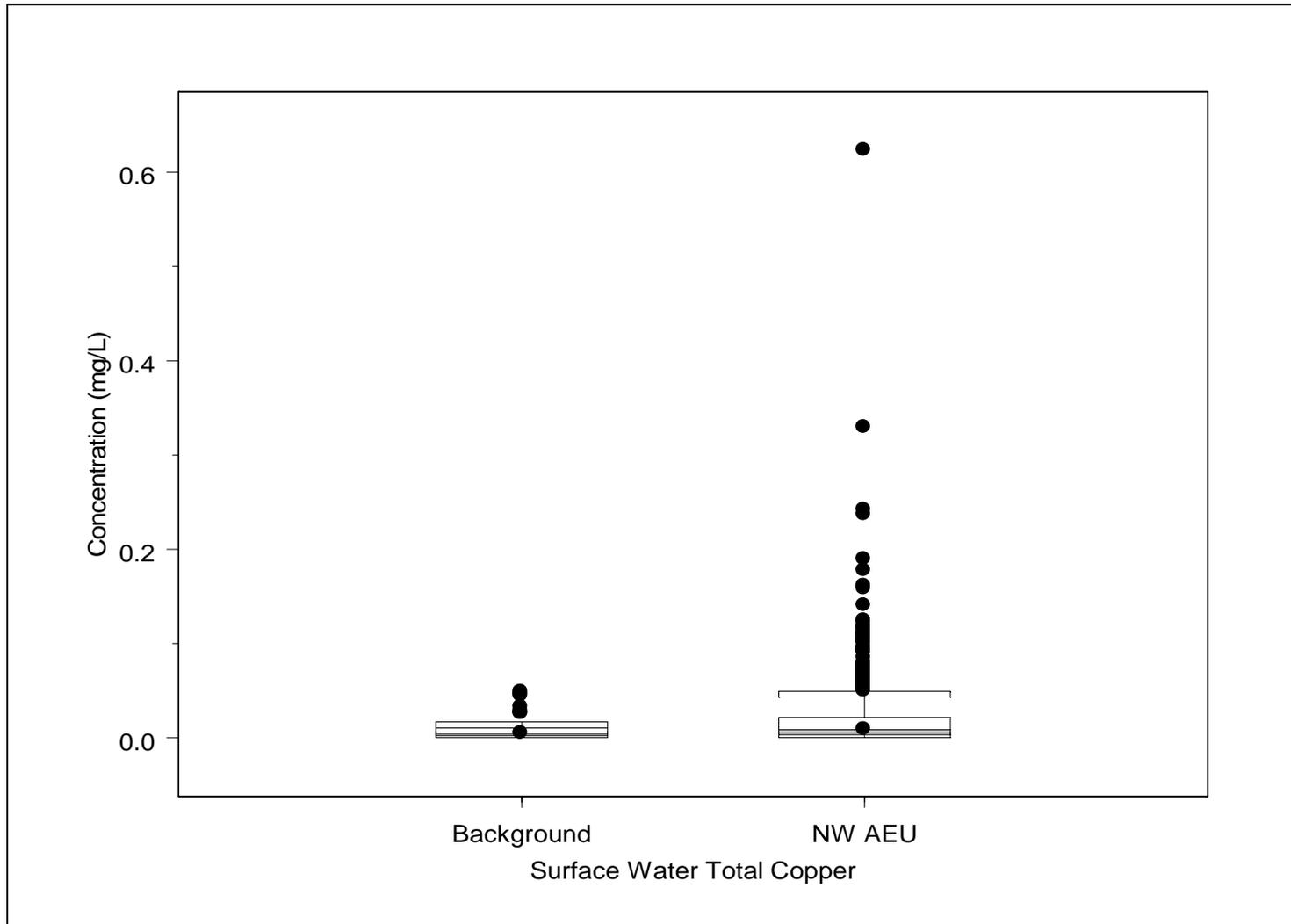
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



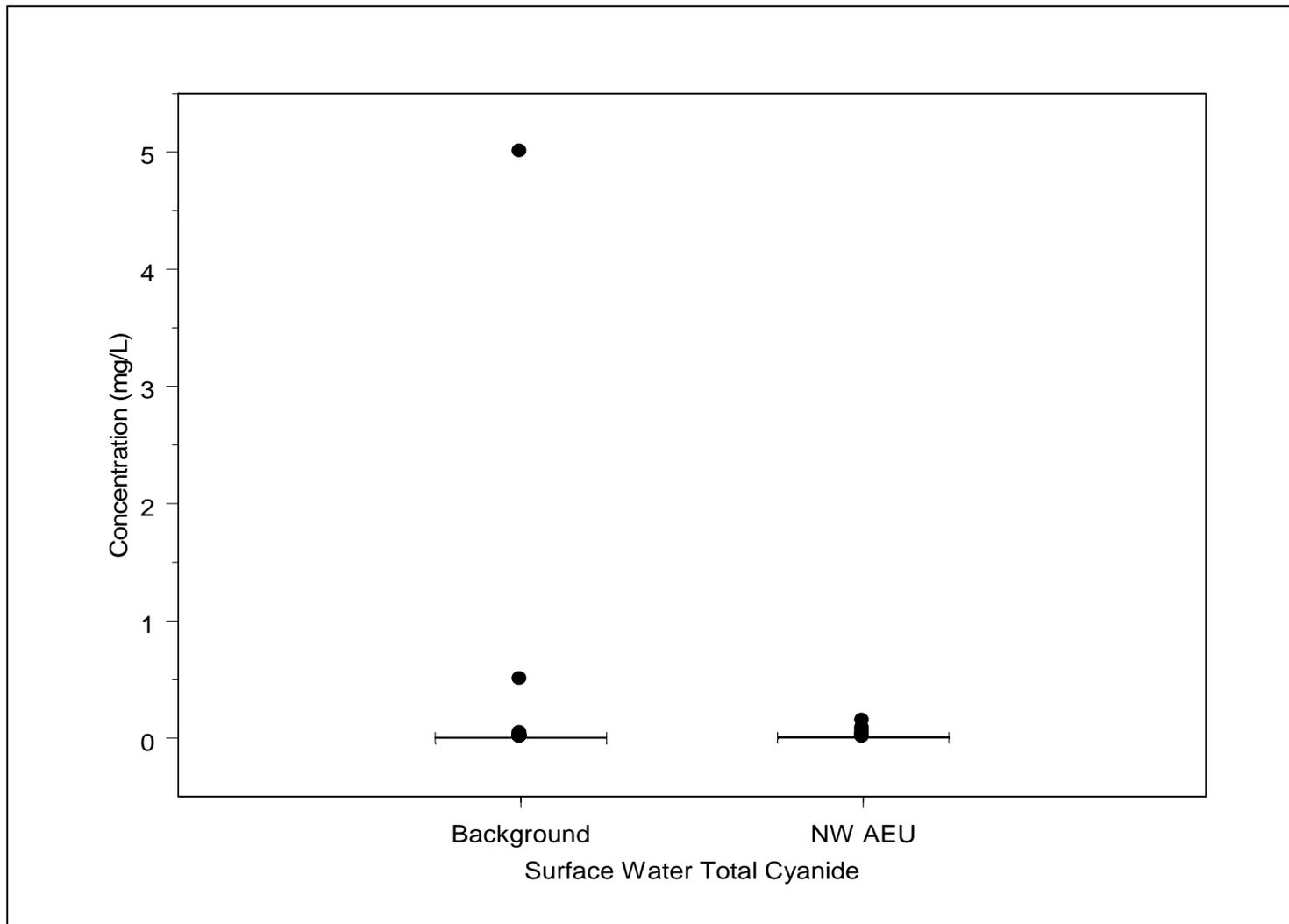
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.8  
NW AEU Surface Water Total Box Plots for Copper



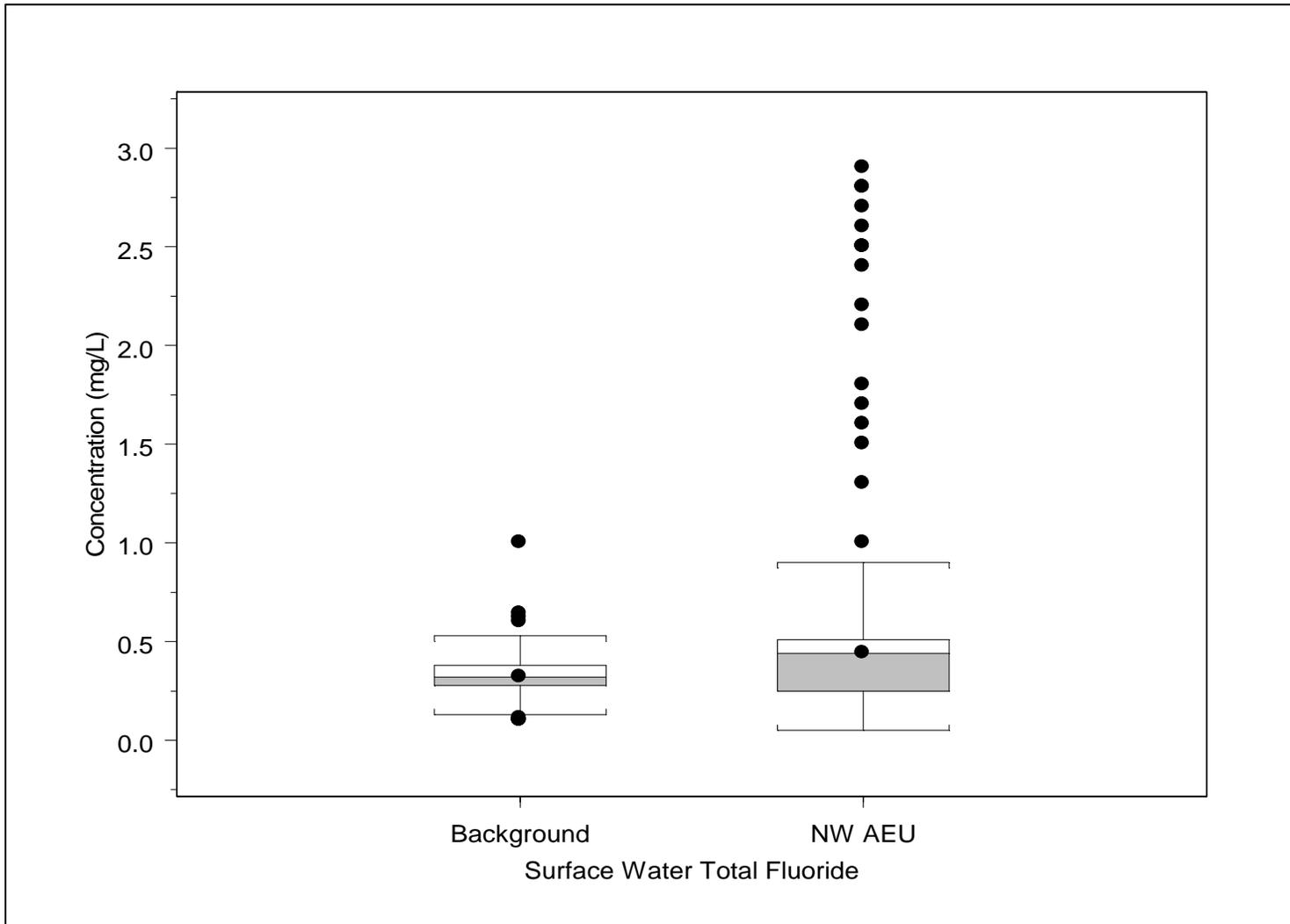
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.9  
NW AEU Surface Water Total Box Plots for Cyanide



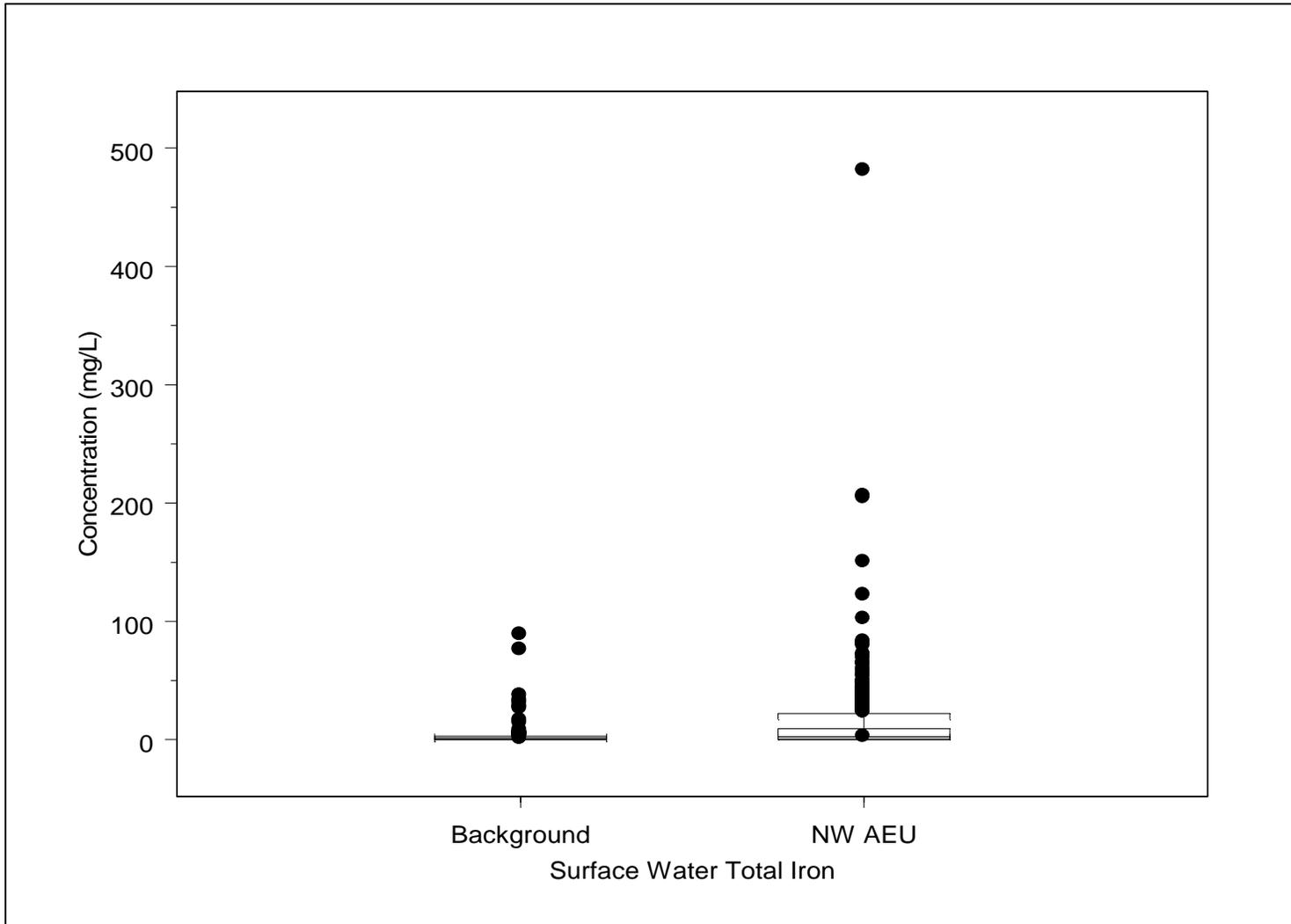
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.10  
NW AEU Surface Water Total Box Plots for Fluoride



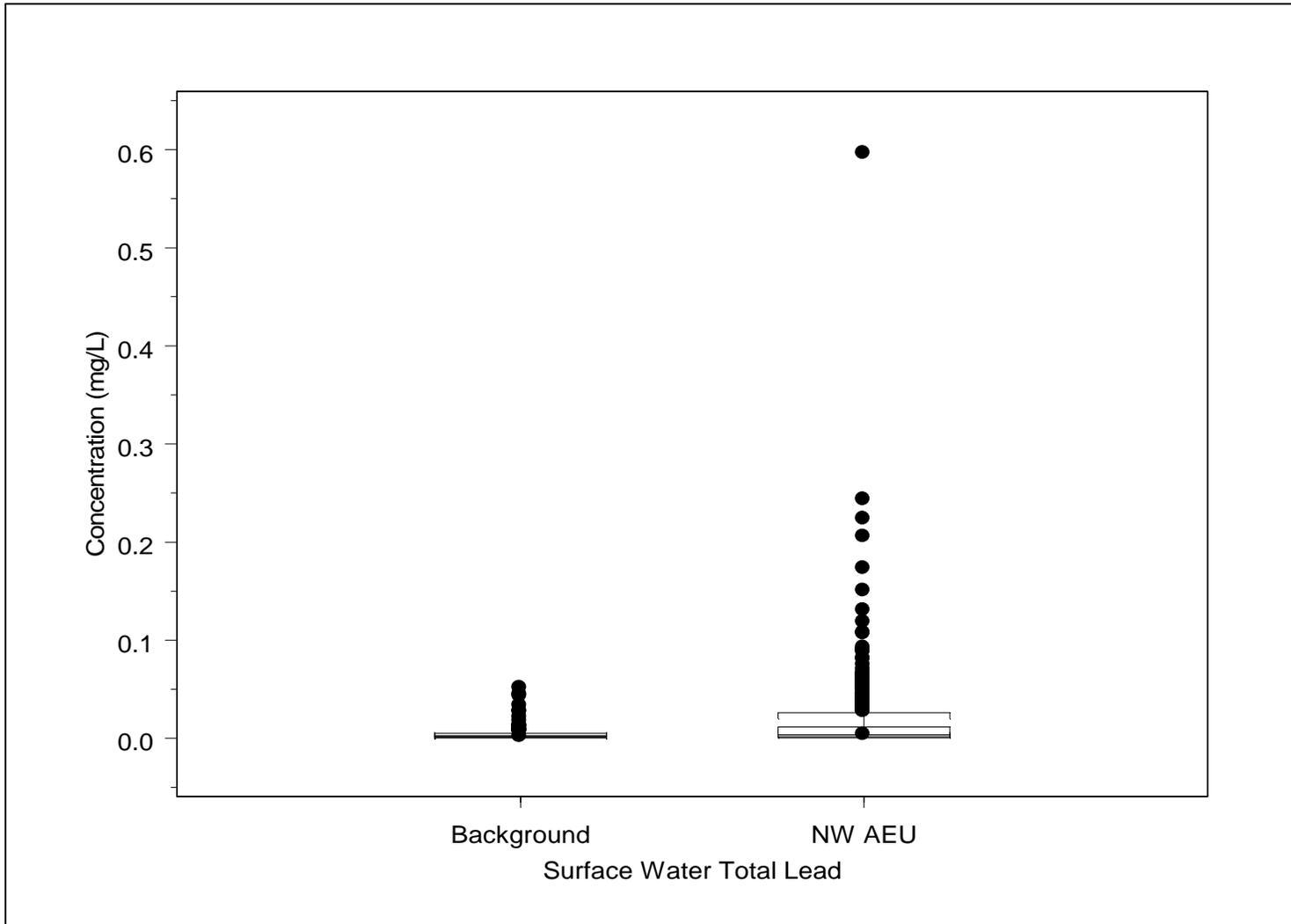
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



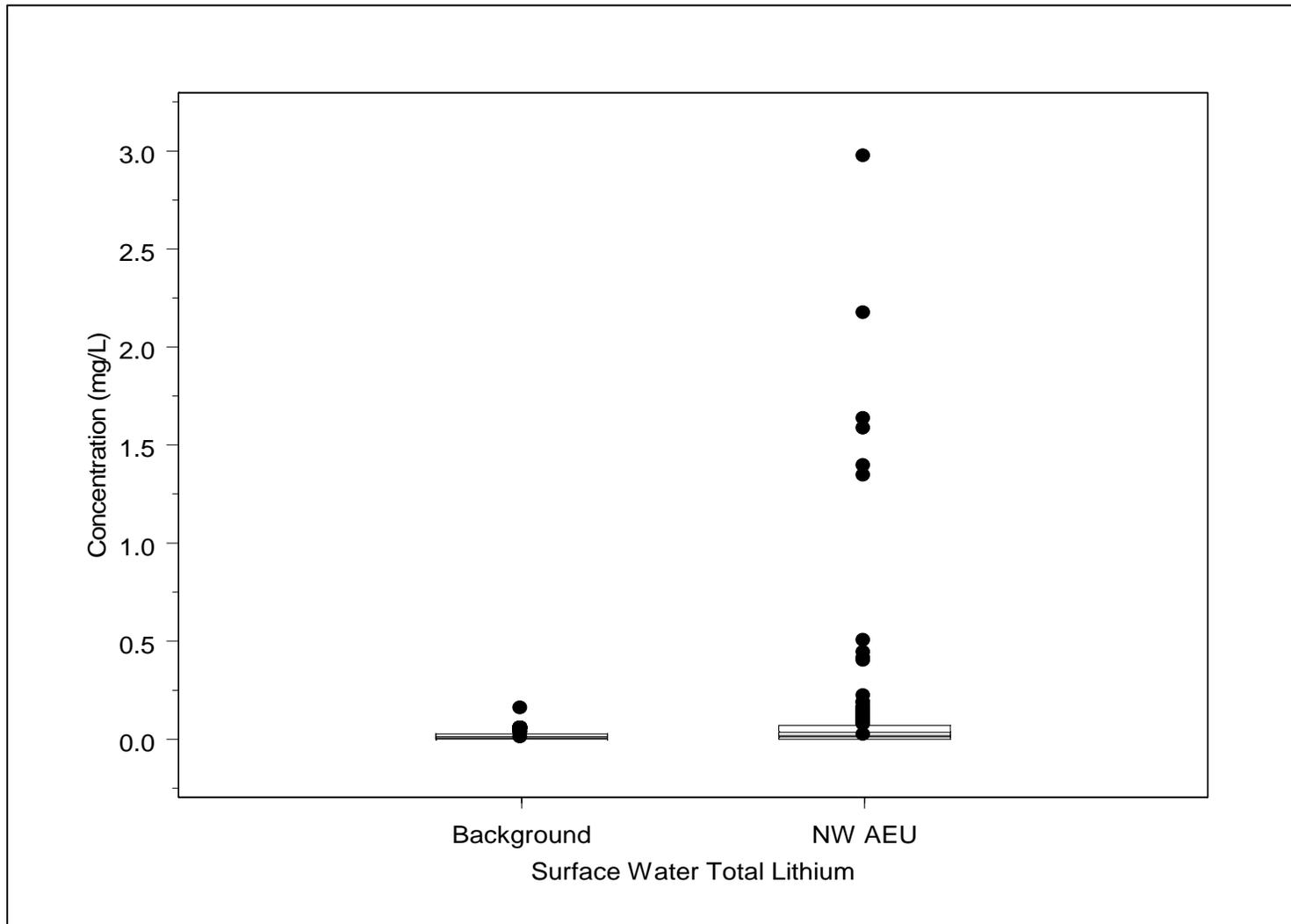
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.12  
NW AEU Surface Water Total Box Plots for Lead



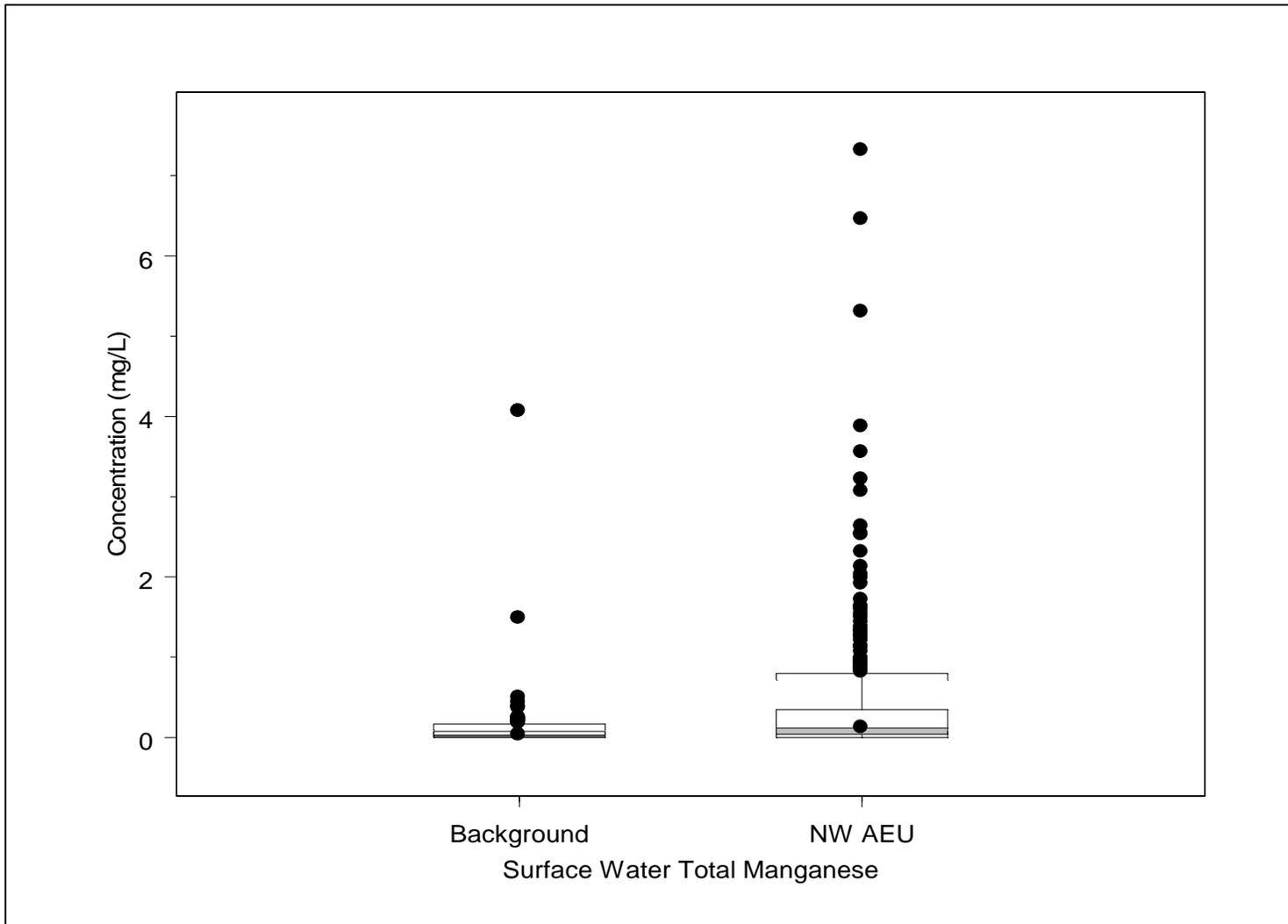
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.13  
NW AEU Surface Water Total Box Plots for Lithium



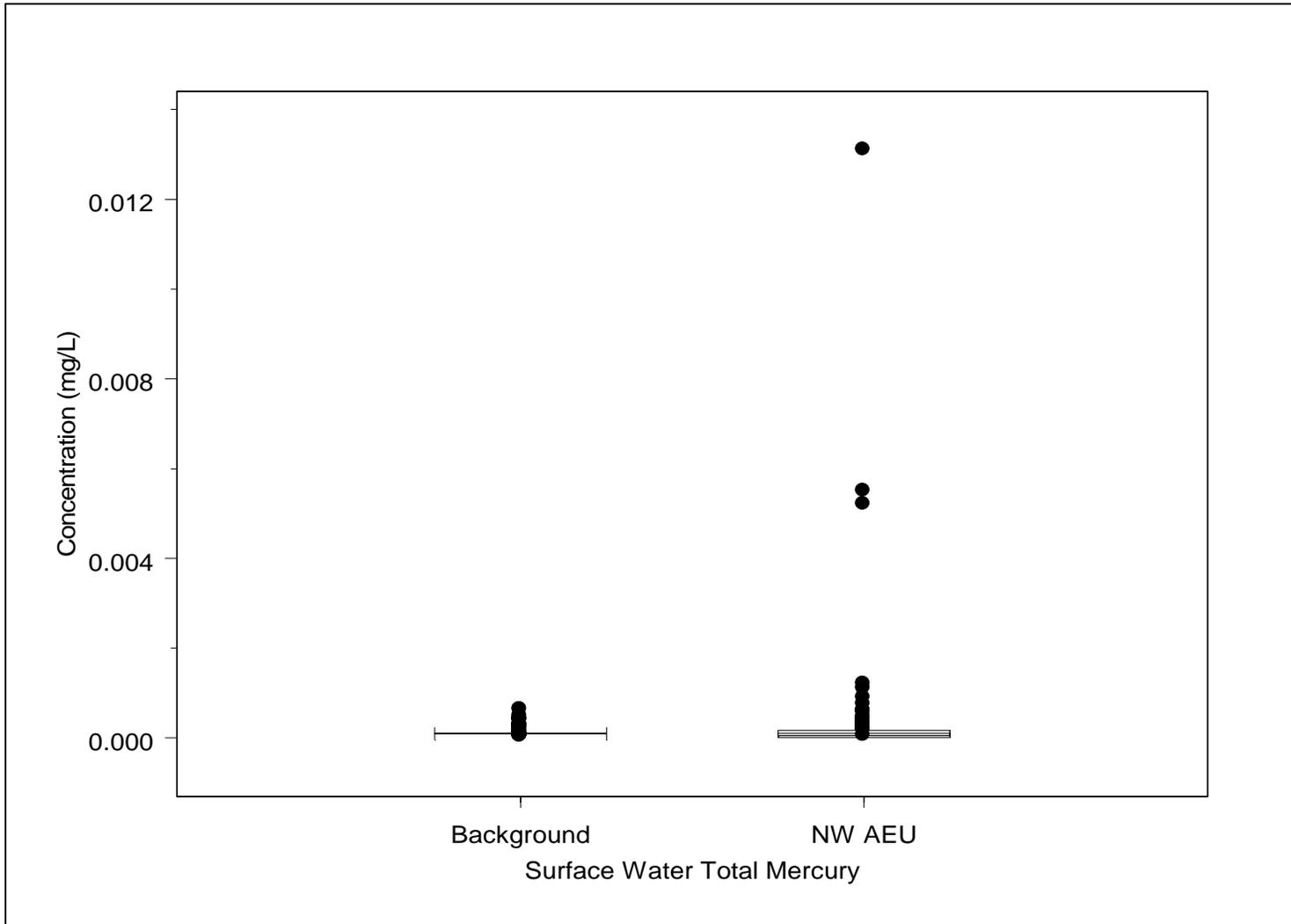
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.14  
NW AEU Surface Water Total Box Plots for Manganese



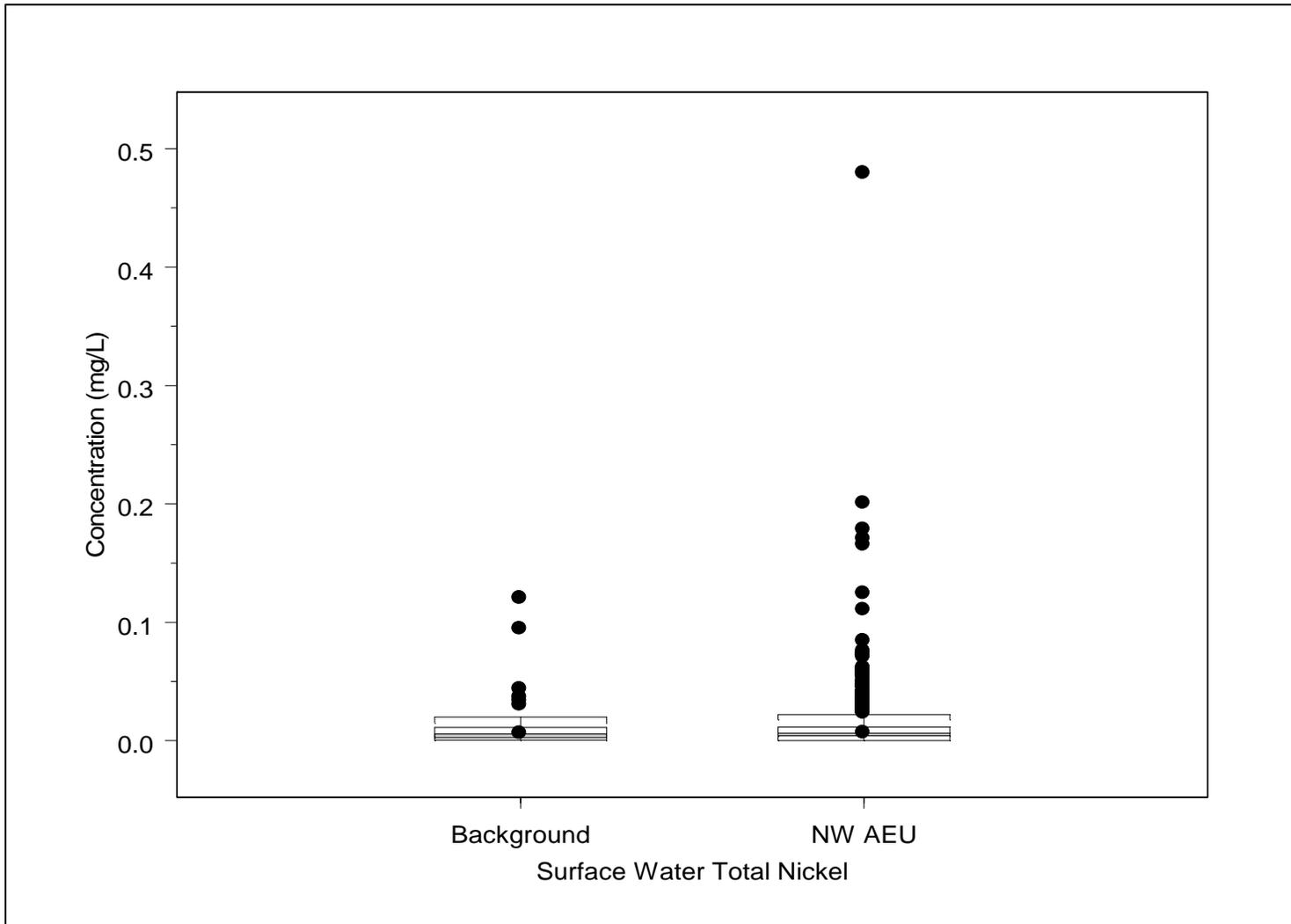
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.15  
NW AEU Surface Water Total Box Plots for Mercury



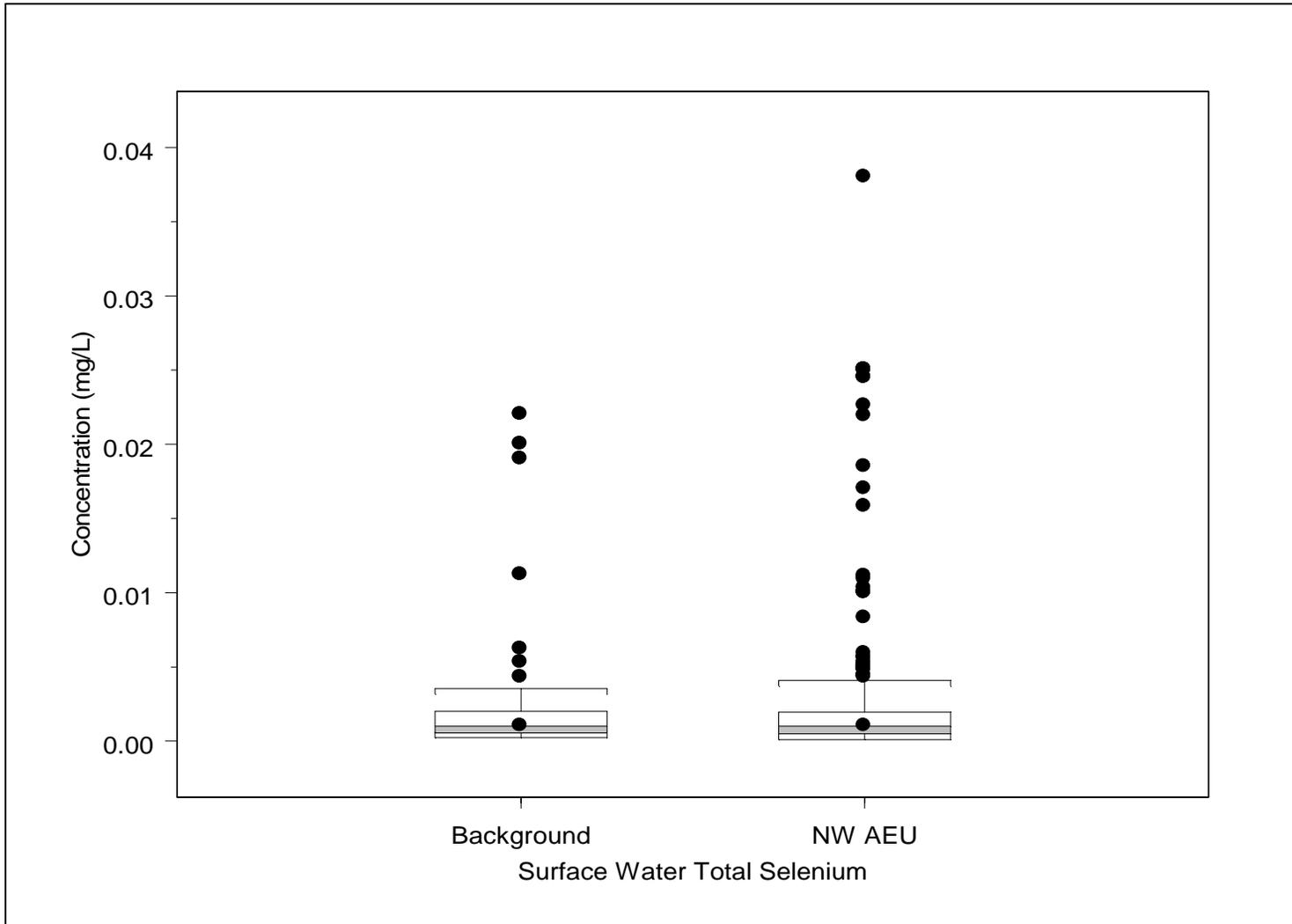
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.16  
NW AEU Surface Water Total Box Plots for Nickel



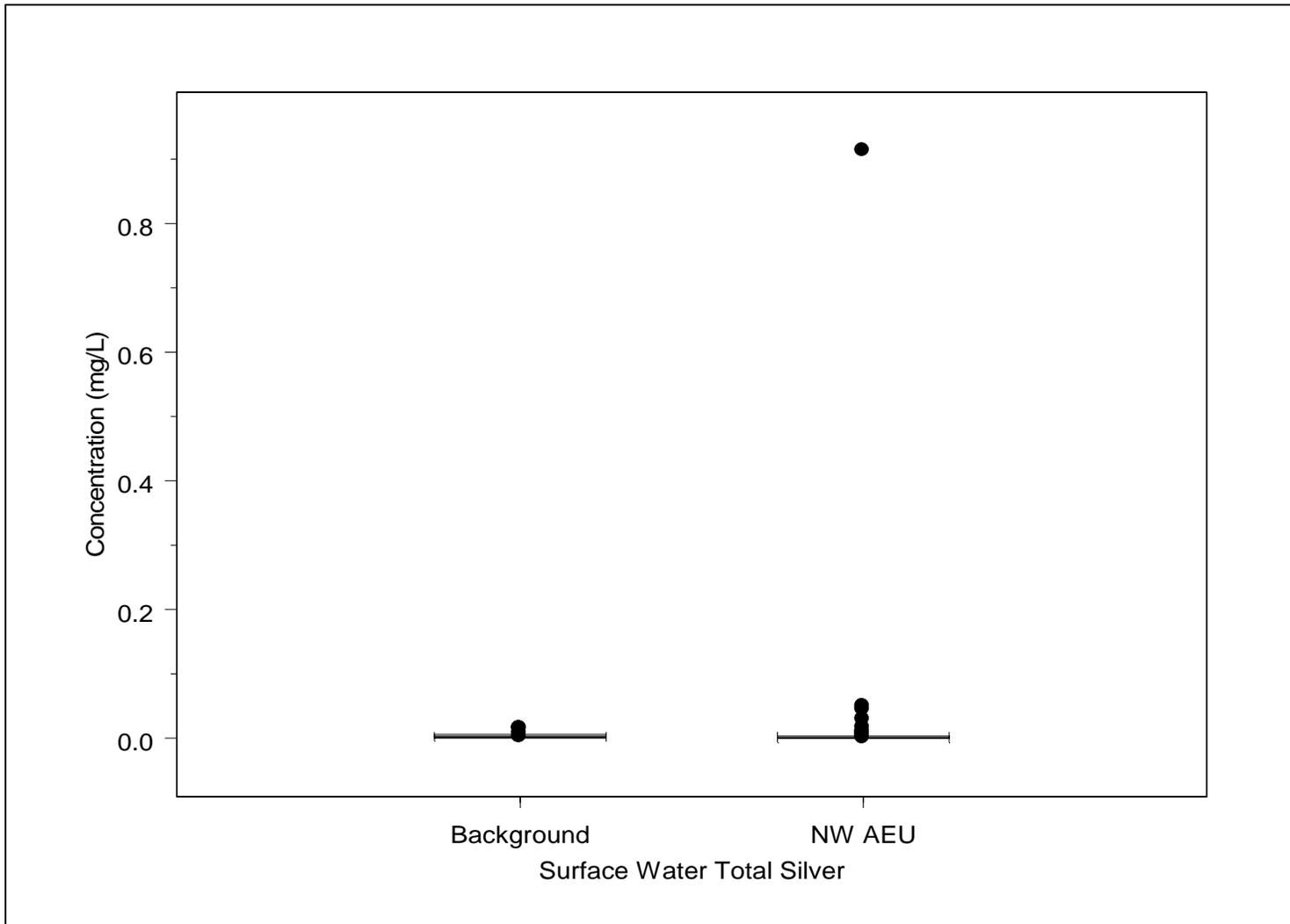
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.17  
NW AEU Surface Water Total Box Plots for Selenium



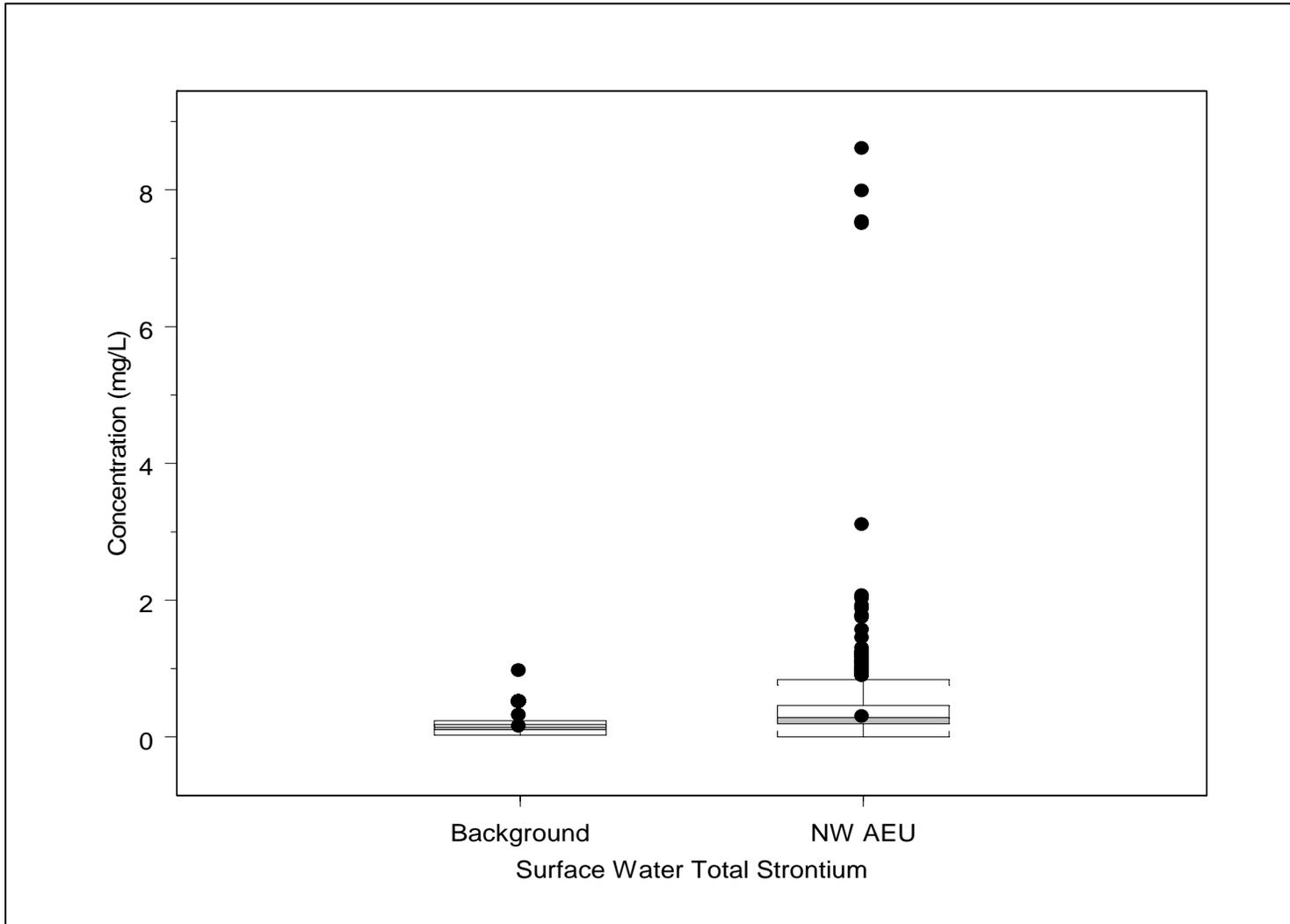
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.18  
NW AEU Surface Water Total Box Plots for Silver



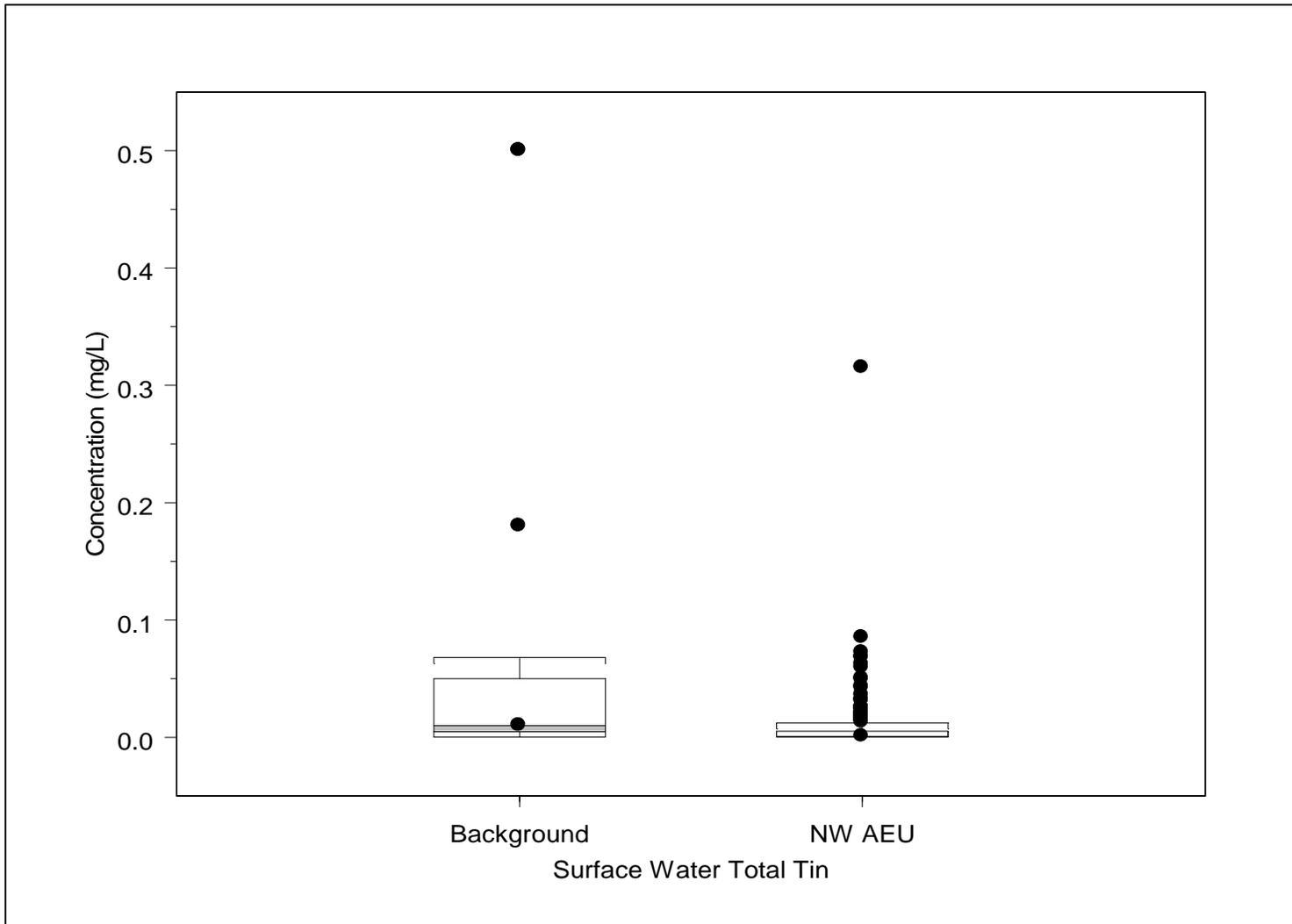
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.19  
NW AEU Surface Water Total Box Plots for Strontium



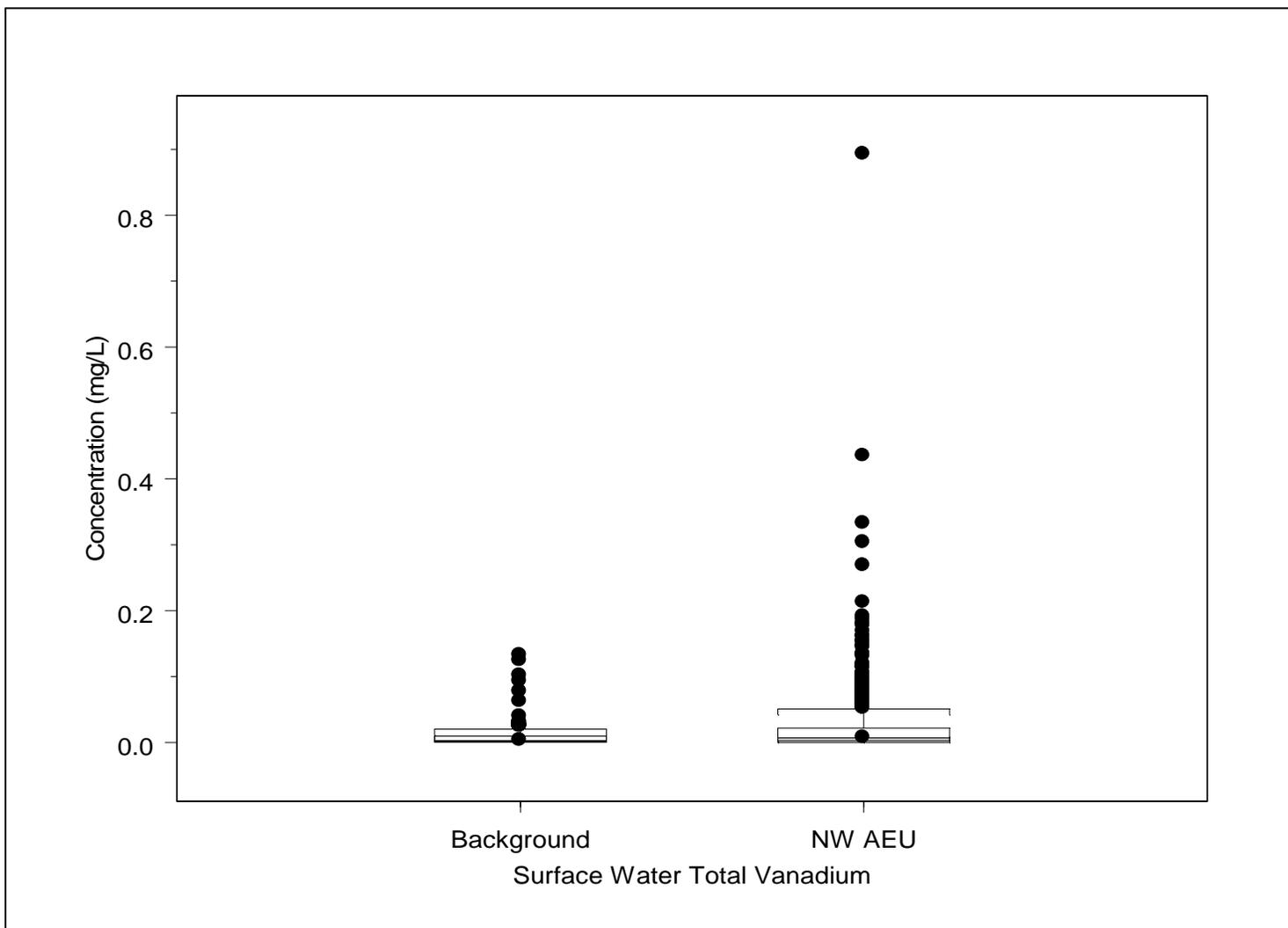
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.20  
NW AEU Surface Water Total Box Plots for Tin



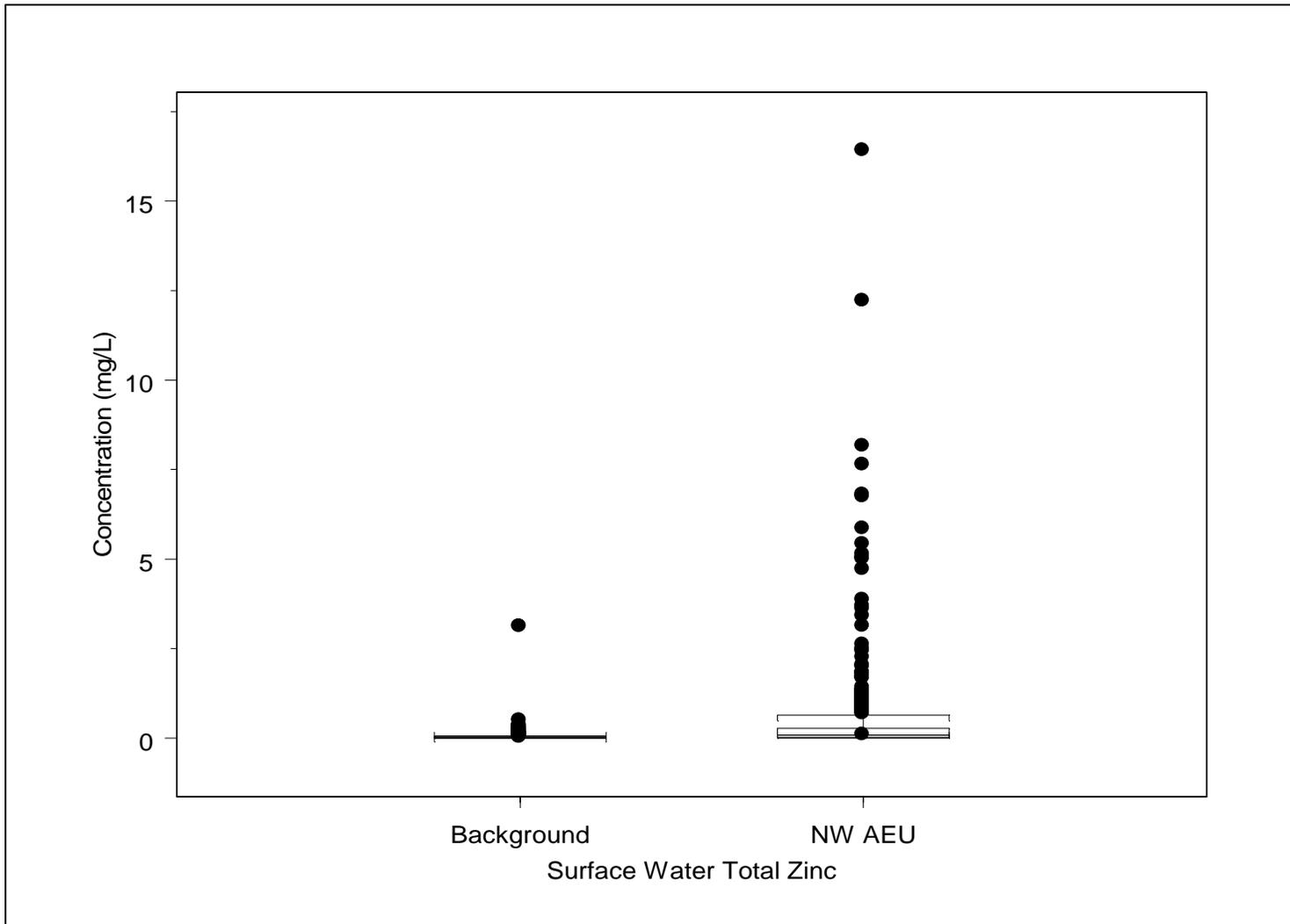
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.21  
NW AEU Surface Water Total Box Plots for Vanadium



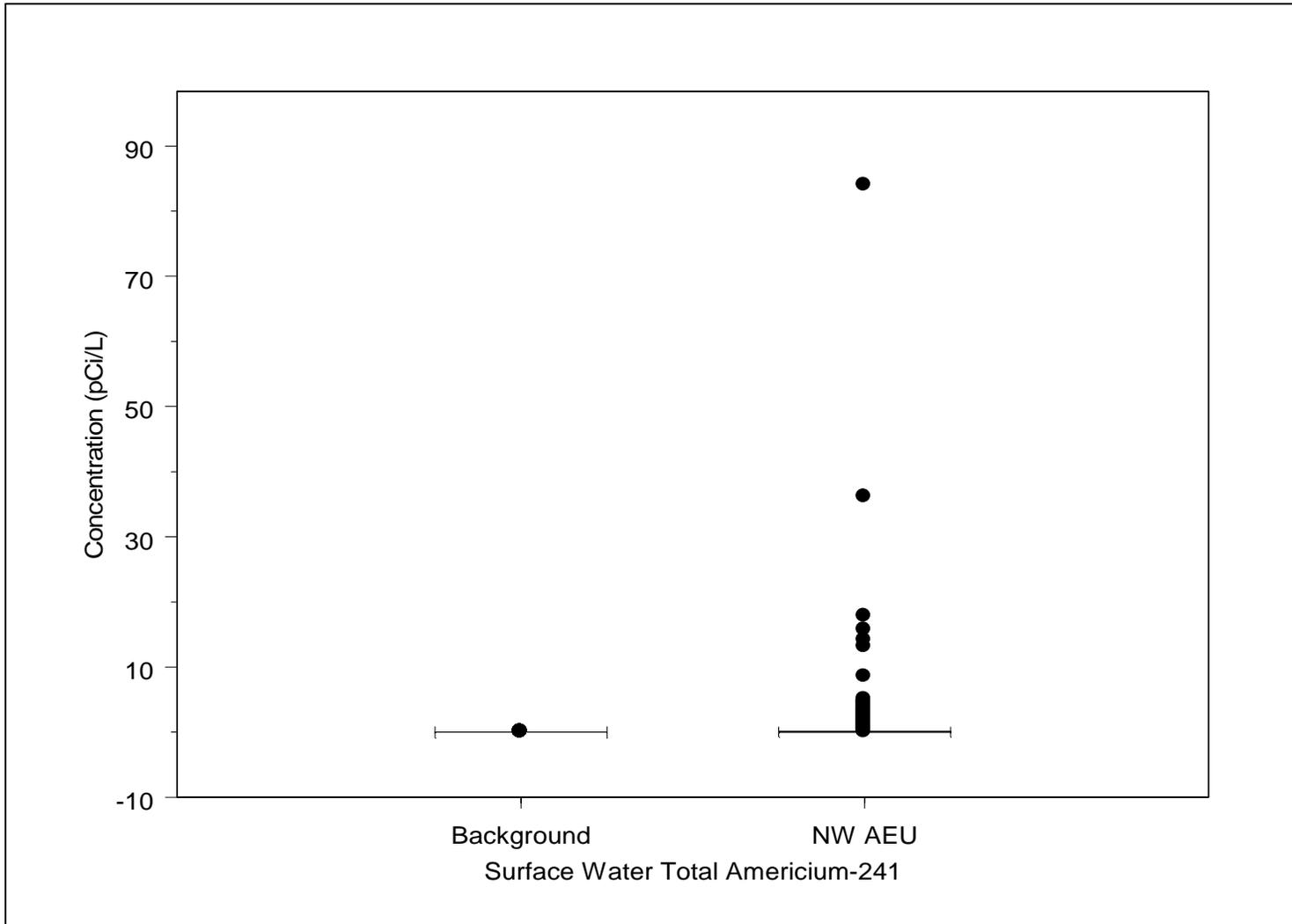
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.22  
NW AEU Surface Water Total Box Plots for Zinc



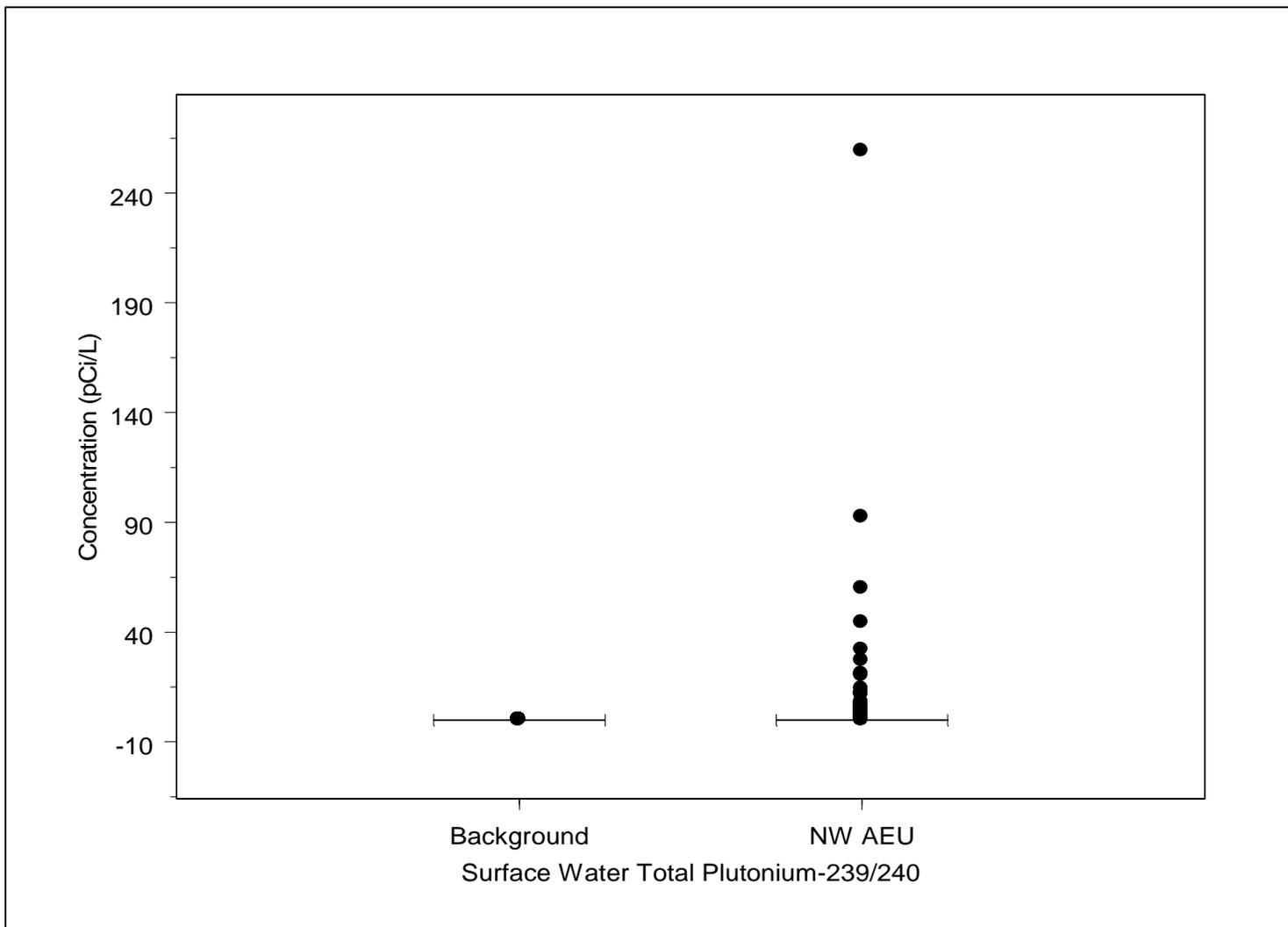
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.23  
NW AEU Surface Water Total Box Plots for Americium-241



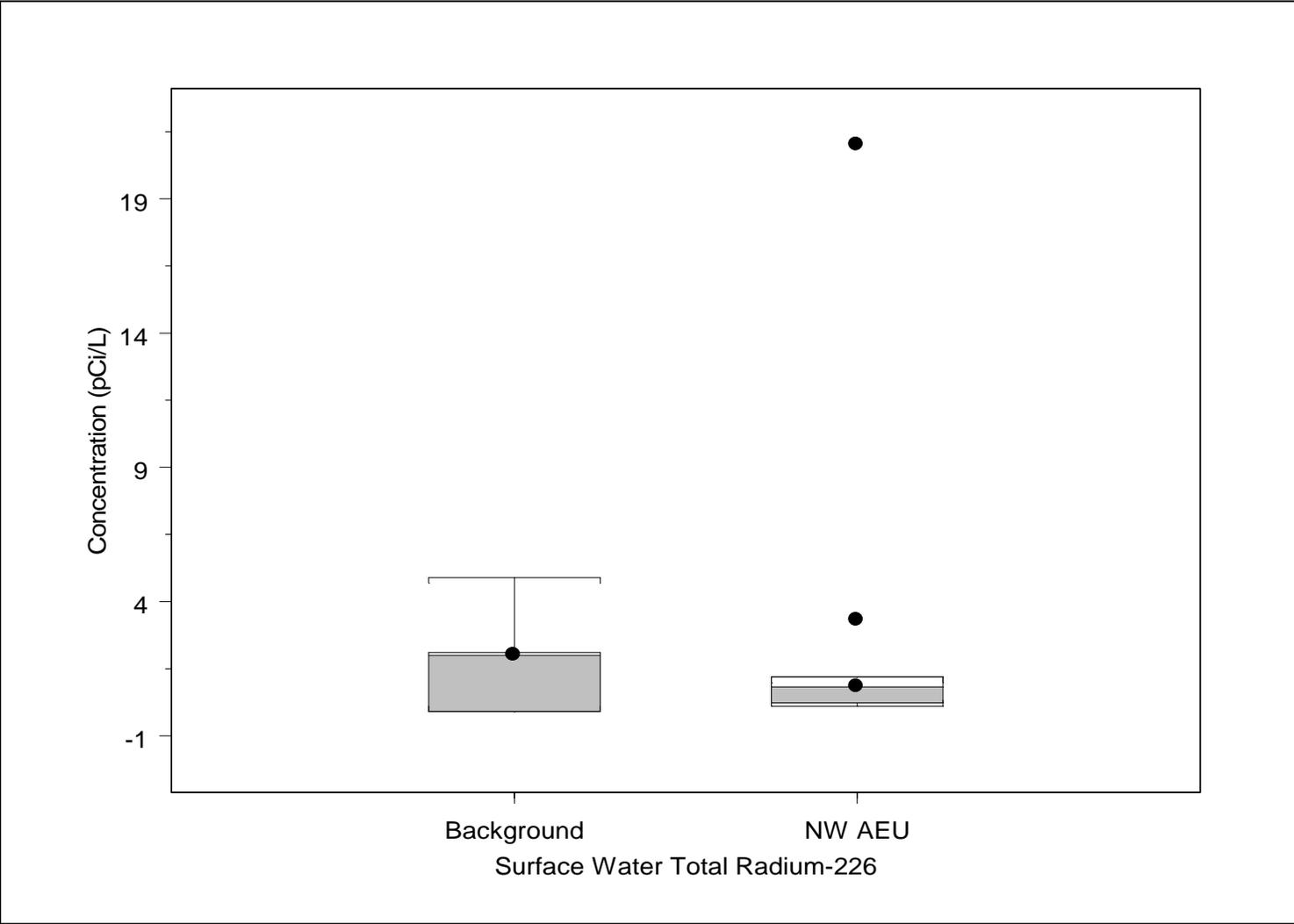
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.24  
NW AEU Surface Water Total Box Plots for Plutonium-239/240



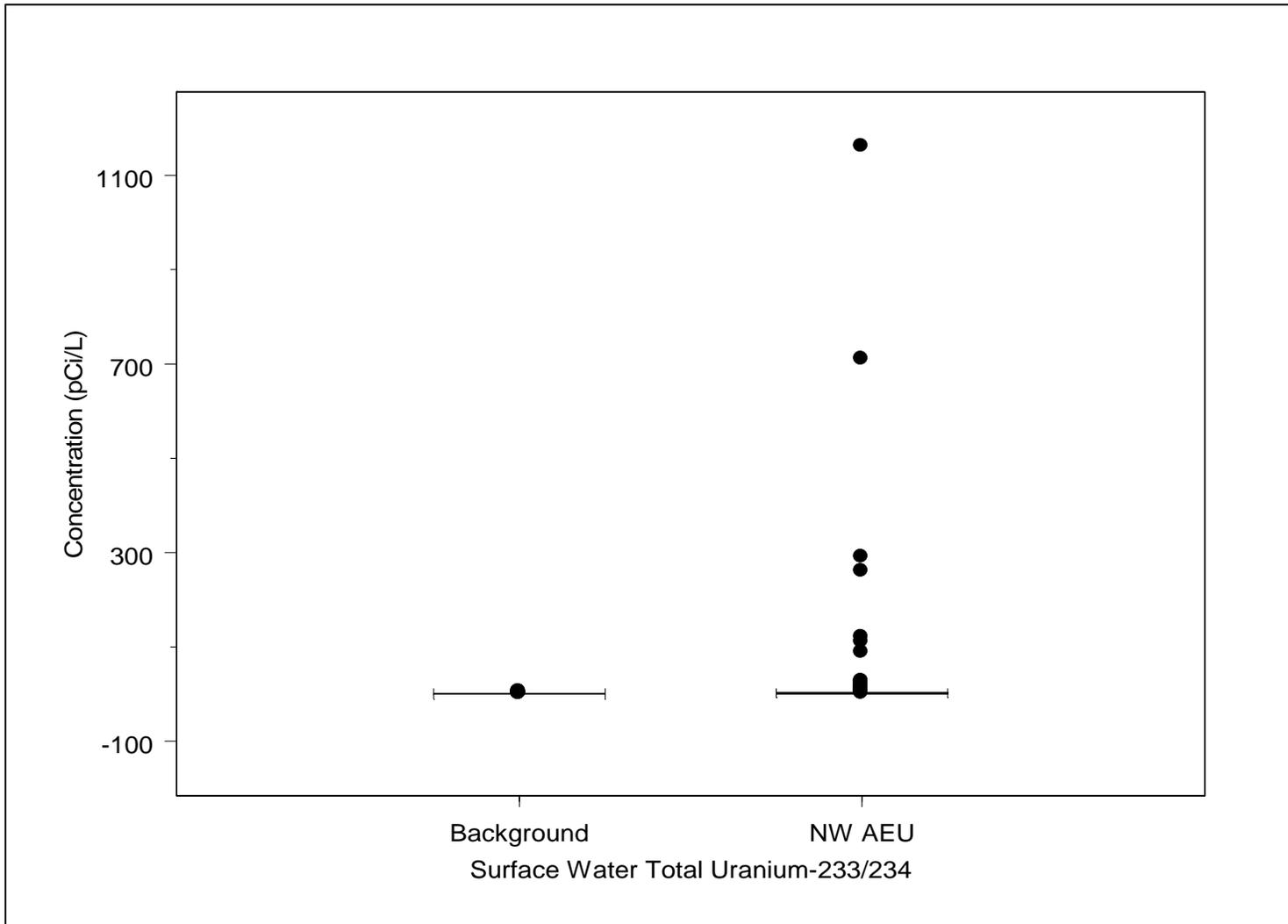
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.25  
NW AEU Surface Water Total Box Plots for Radium-226



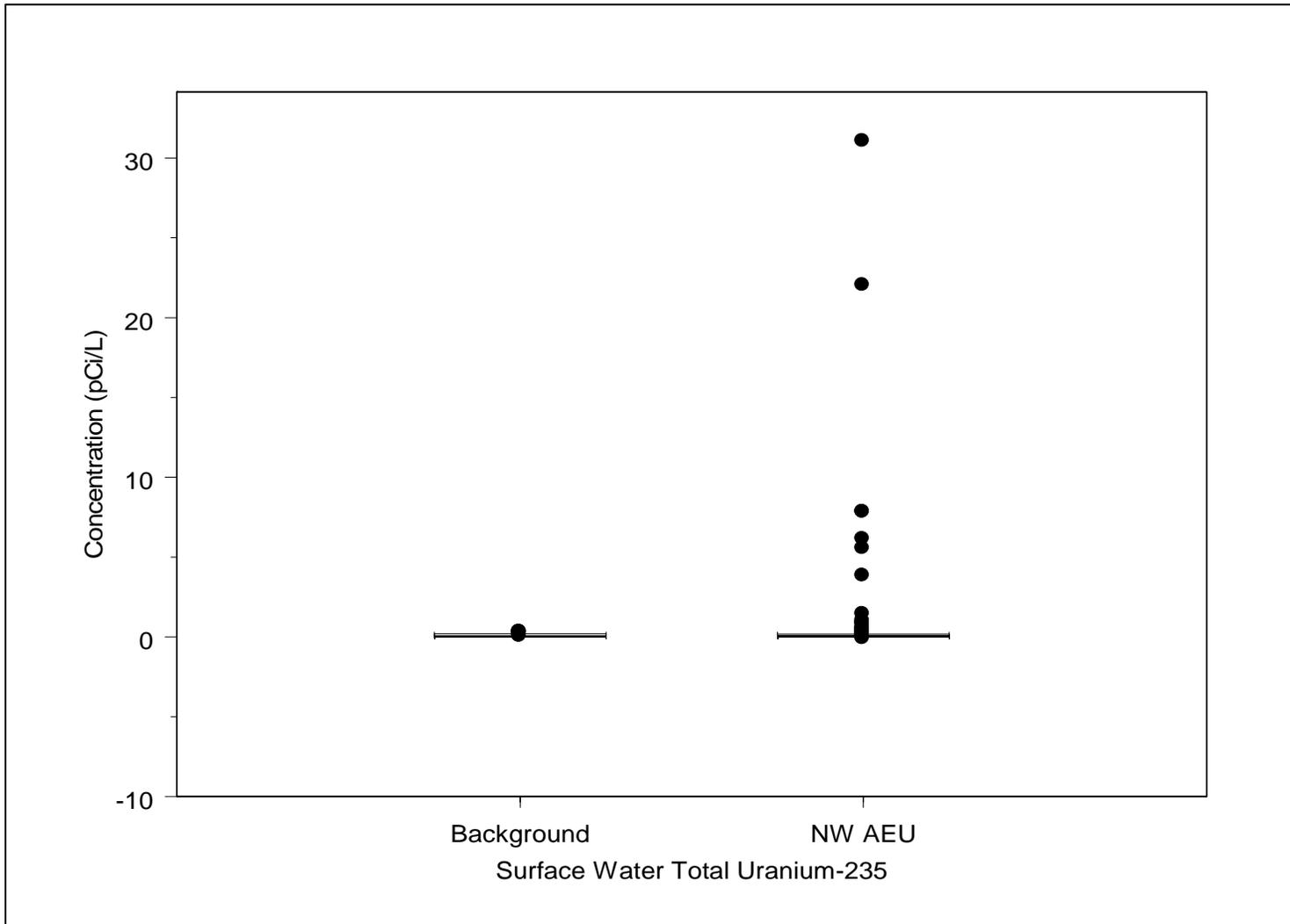
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.26  
NW AEU Surface Water Total Box Plots for Uranium-233/234



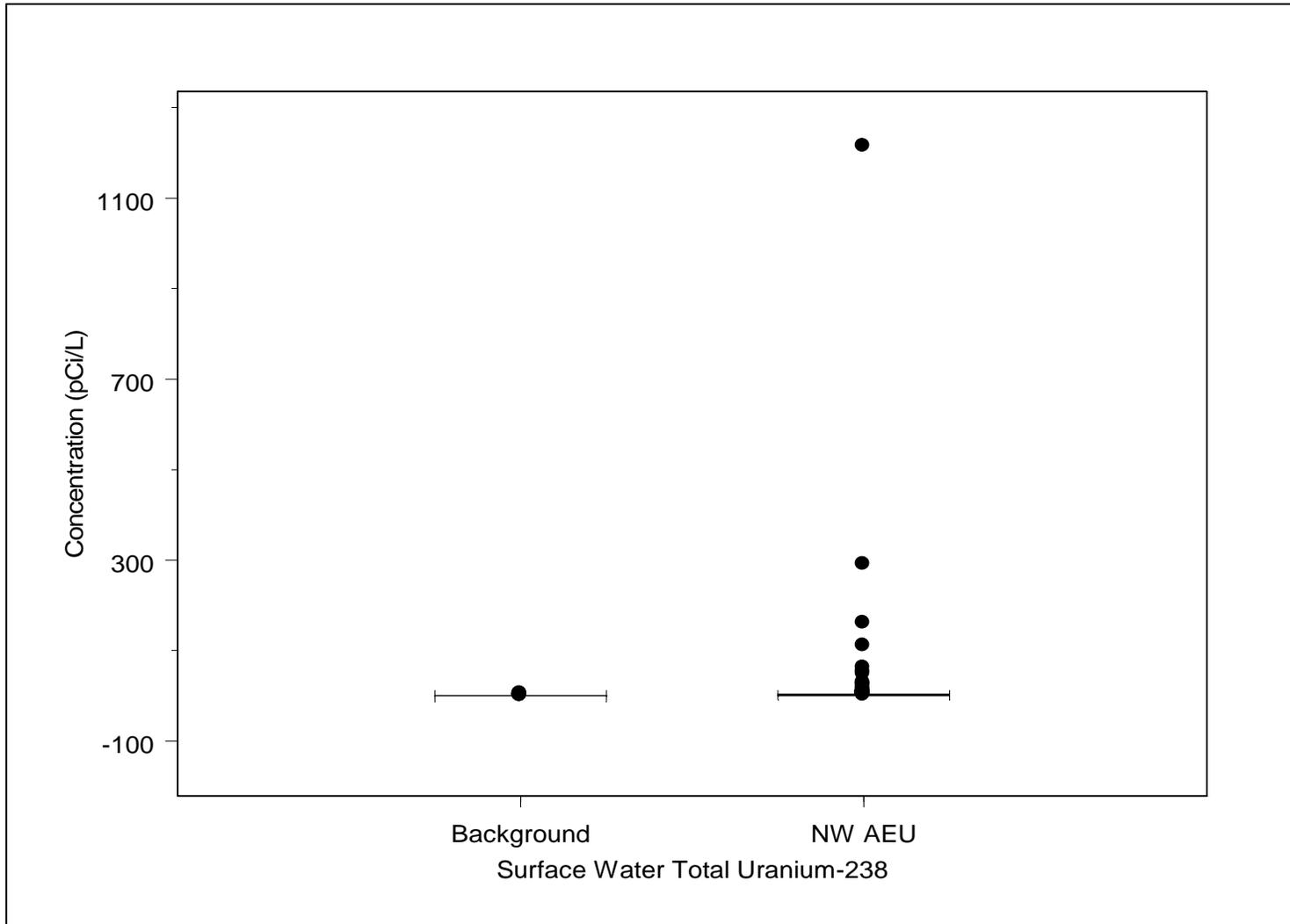
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.27  
NW AEU Surface Water Total Box Plots for Uranium-235



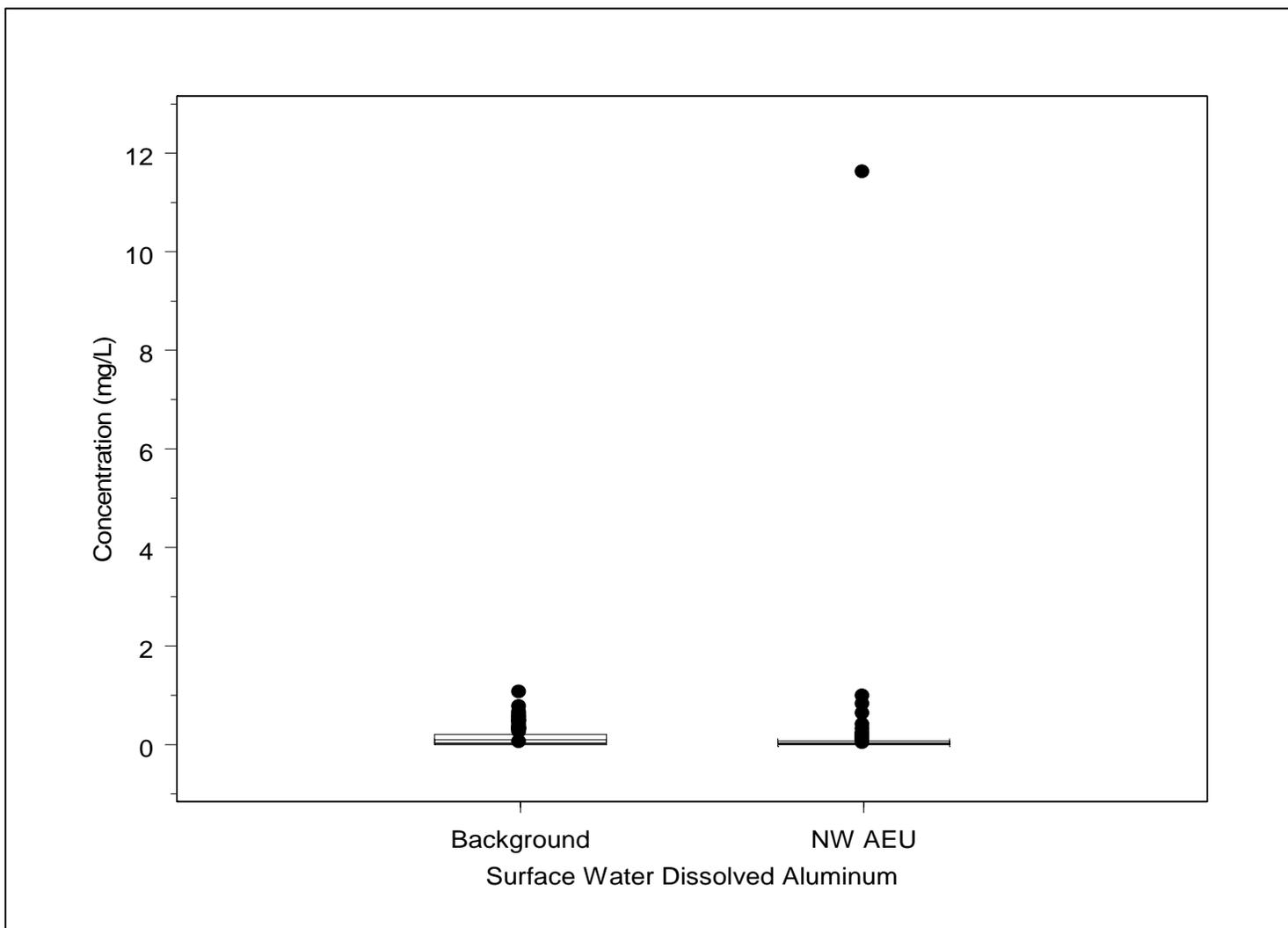
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.28  
NW AEU Surface Water Total Box Plots for Uranium-238



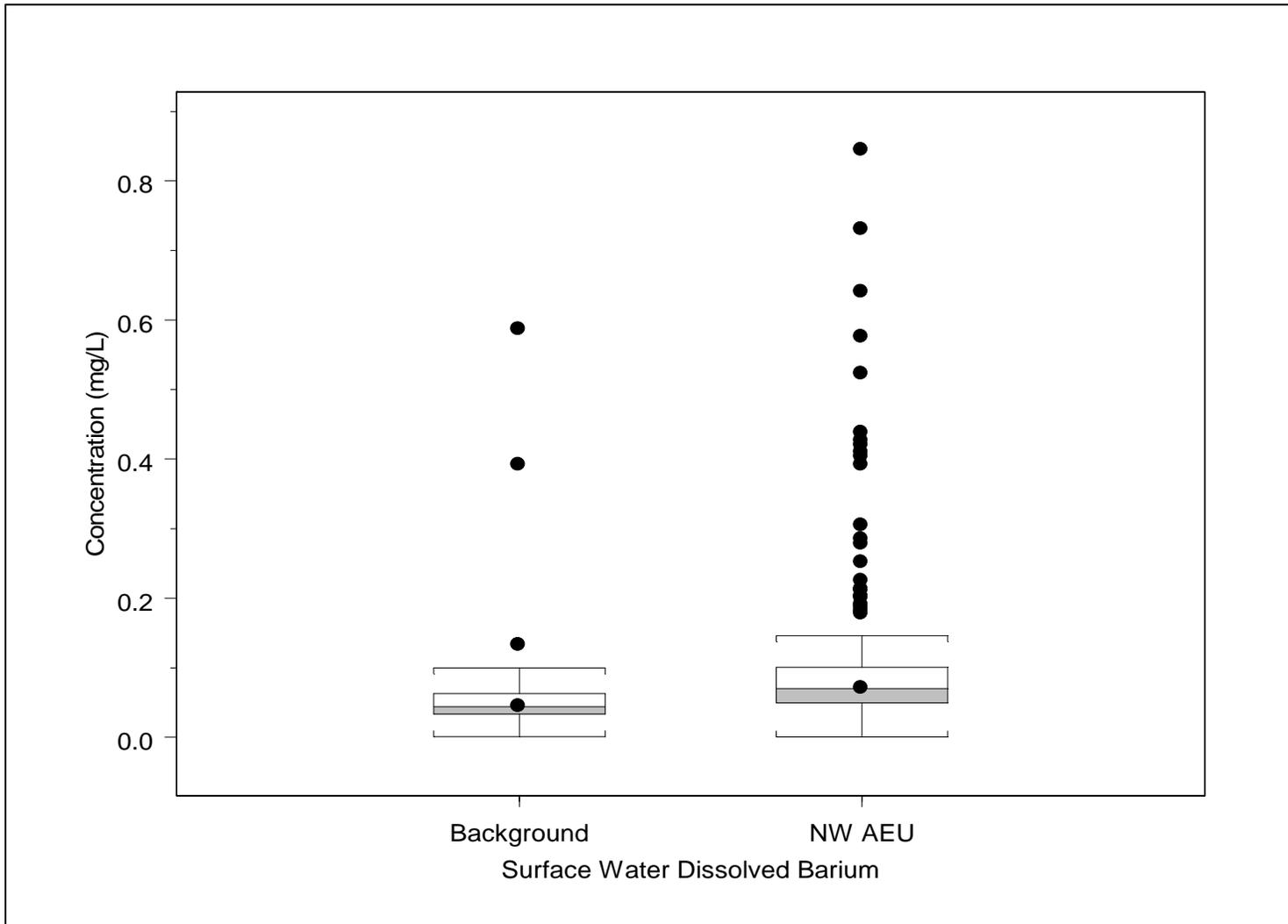
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.29  
NW AEU Surface Water Dissolved Box Plots for Aluminum



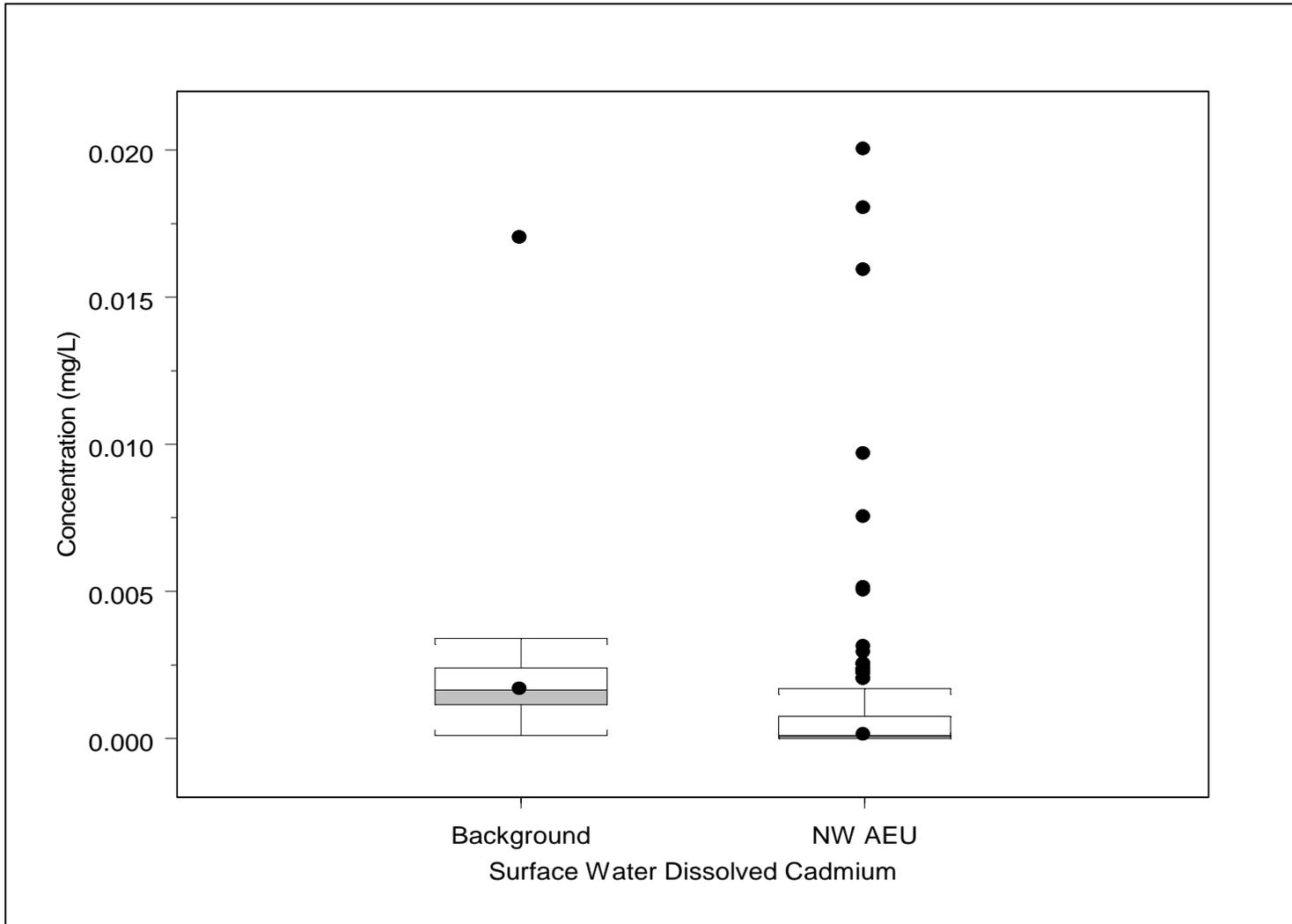
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.30  
NW AEU Surface Water Dissolved Box Plots for Barium



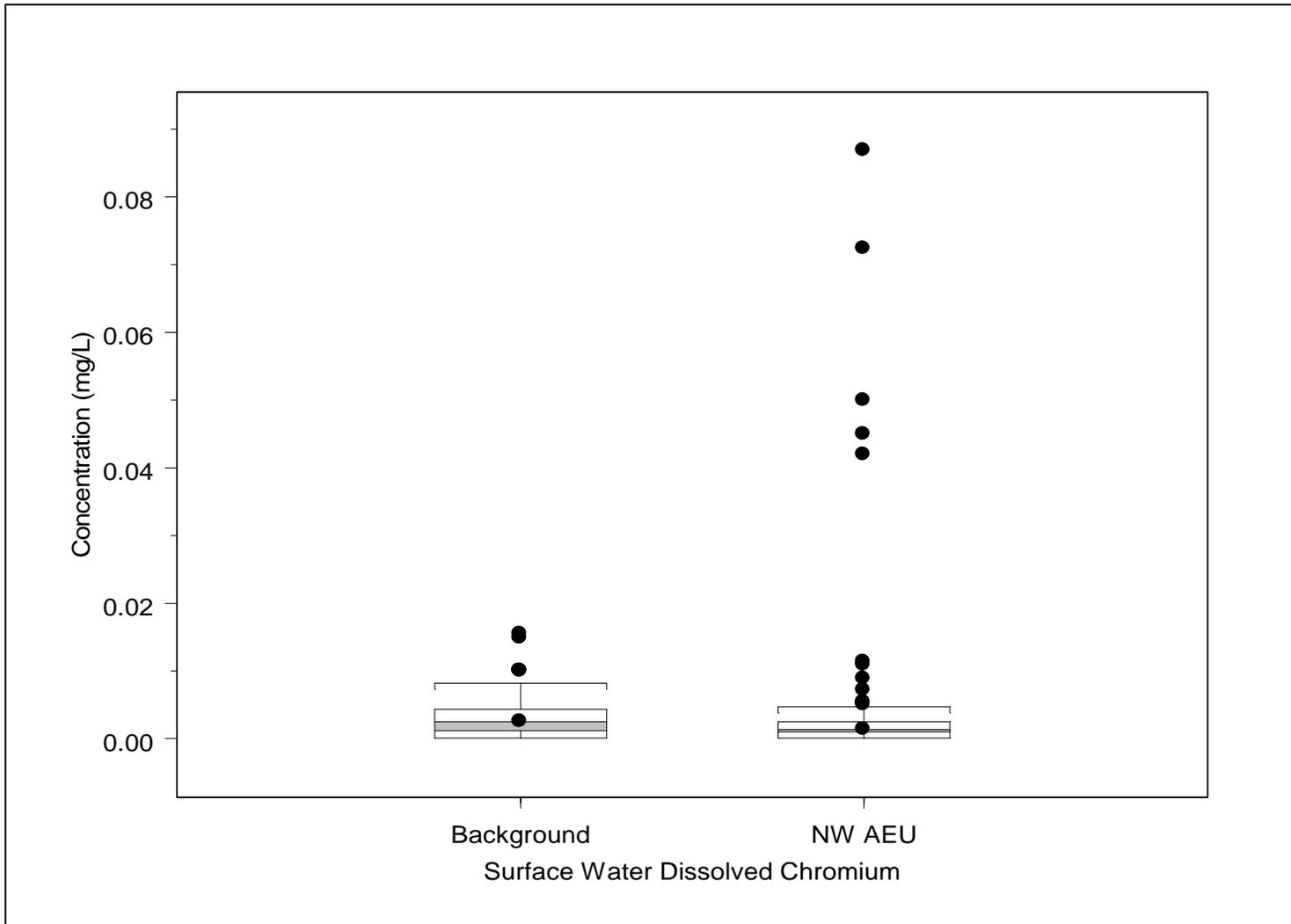
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.31  
NW AEU Surface Water Dissolved Box Plots for Cadmium



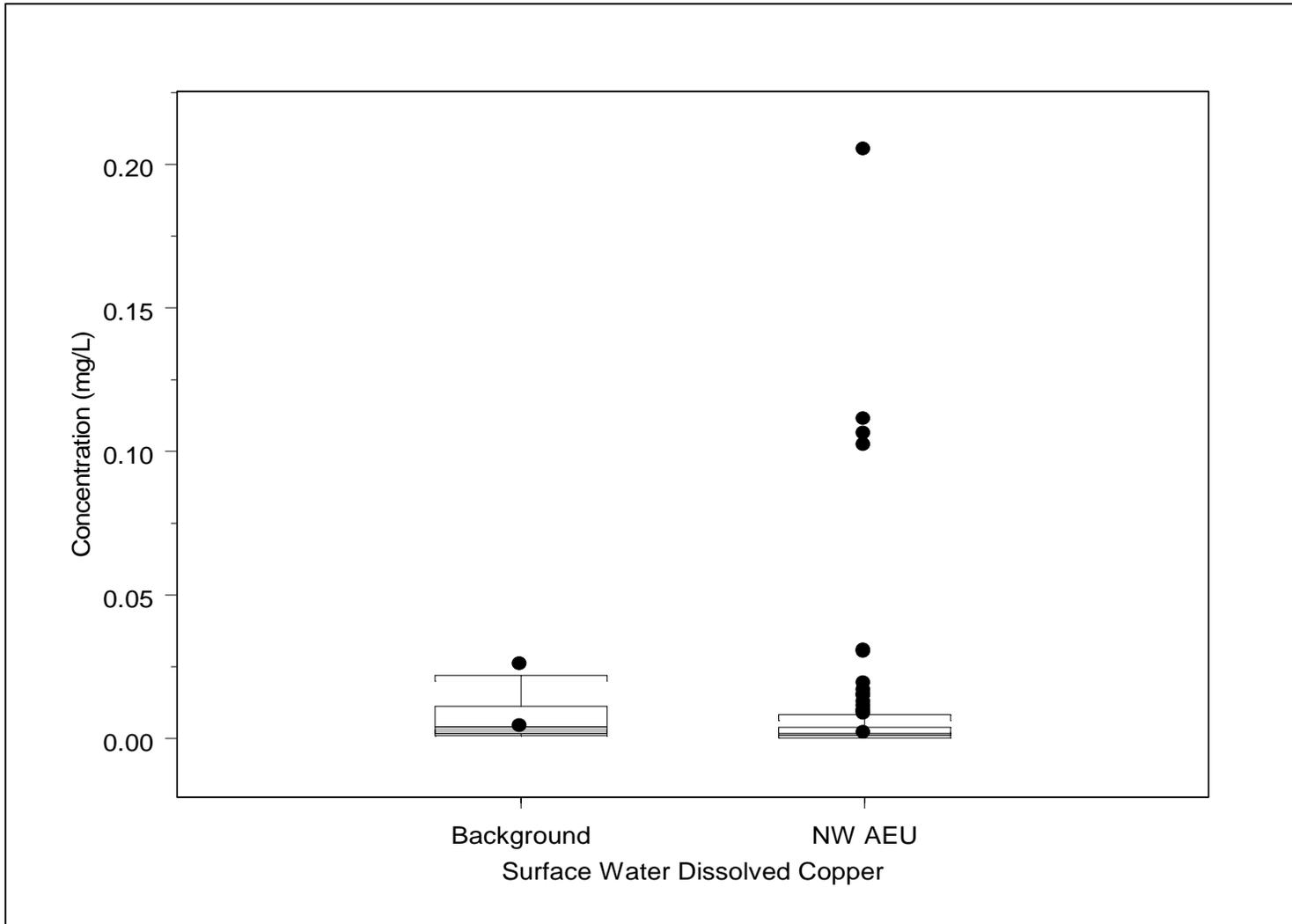
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.32  
NW AEU Surface Water Dissolved Box Plots for Chromium



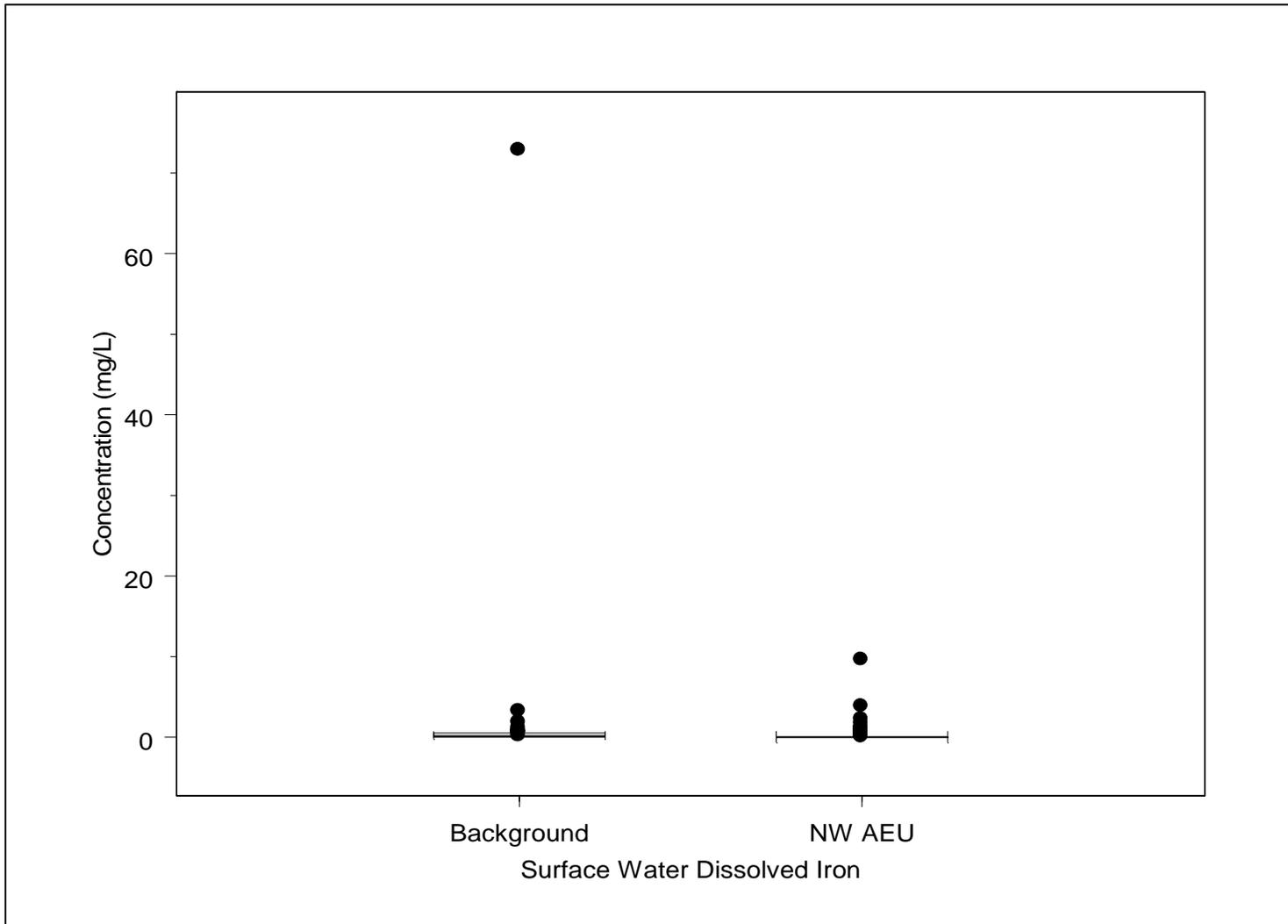
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.33  
NW AEU Surface Water Dissolved Box Plots for Copper



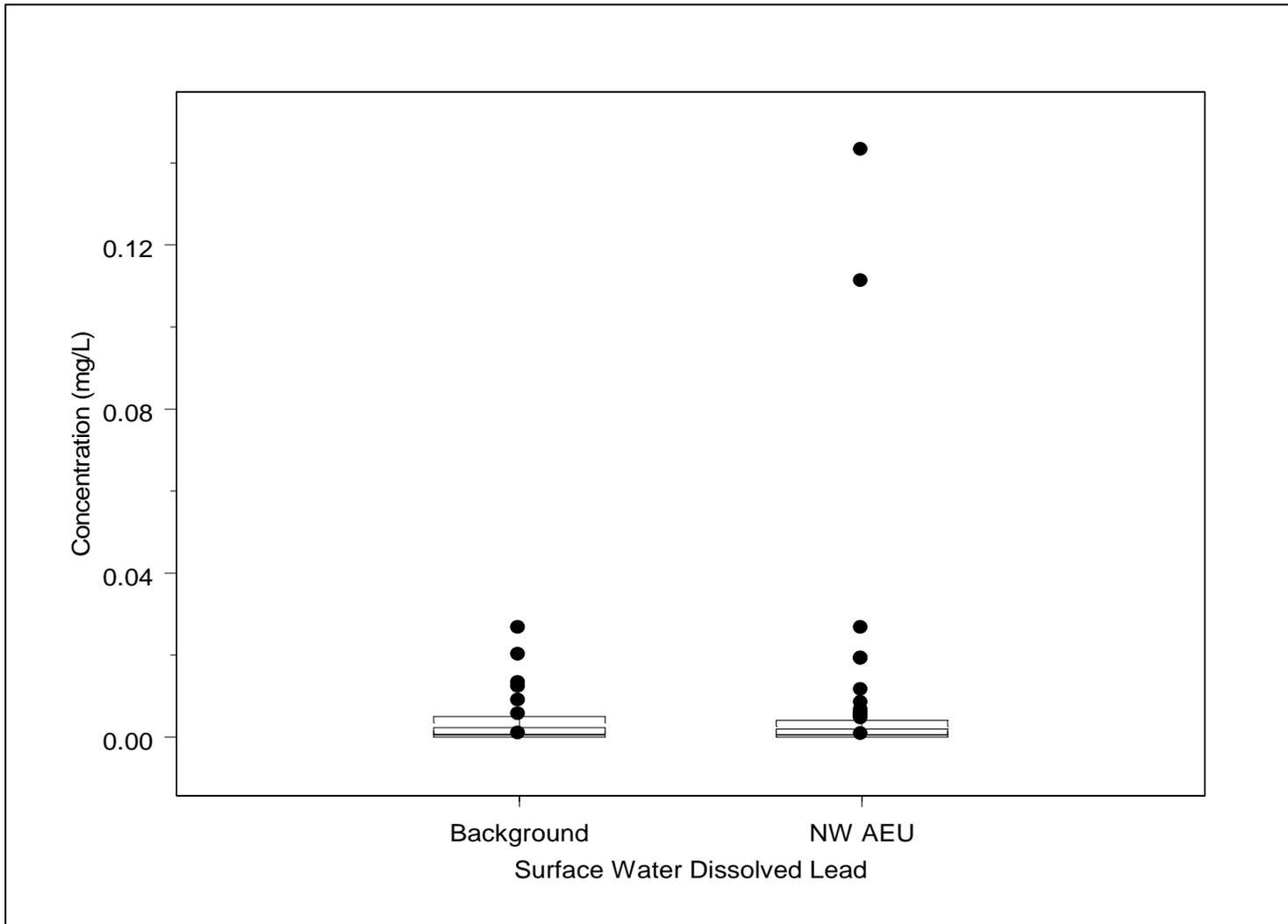
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.34  
NW AEU Surface Water Dissolved Box Plots for Iron



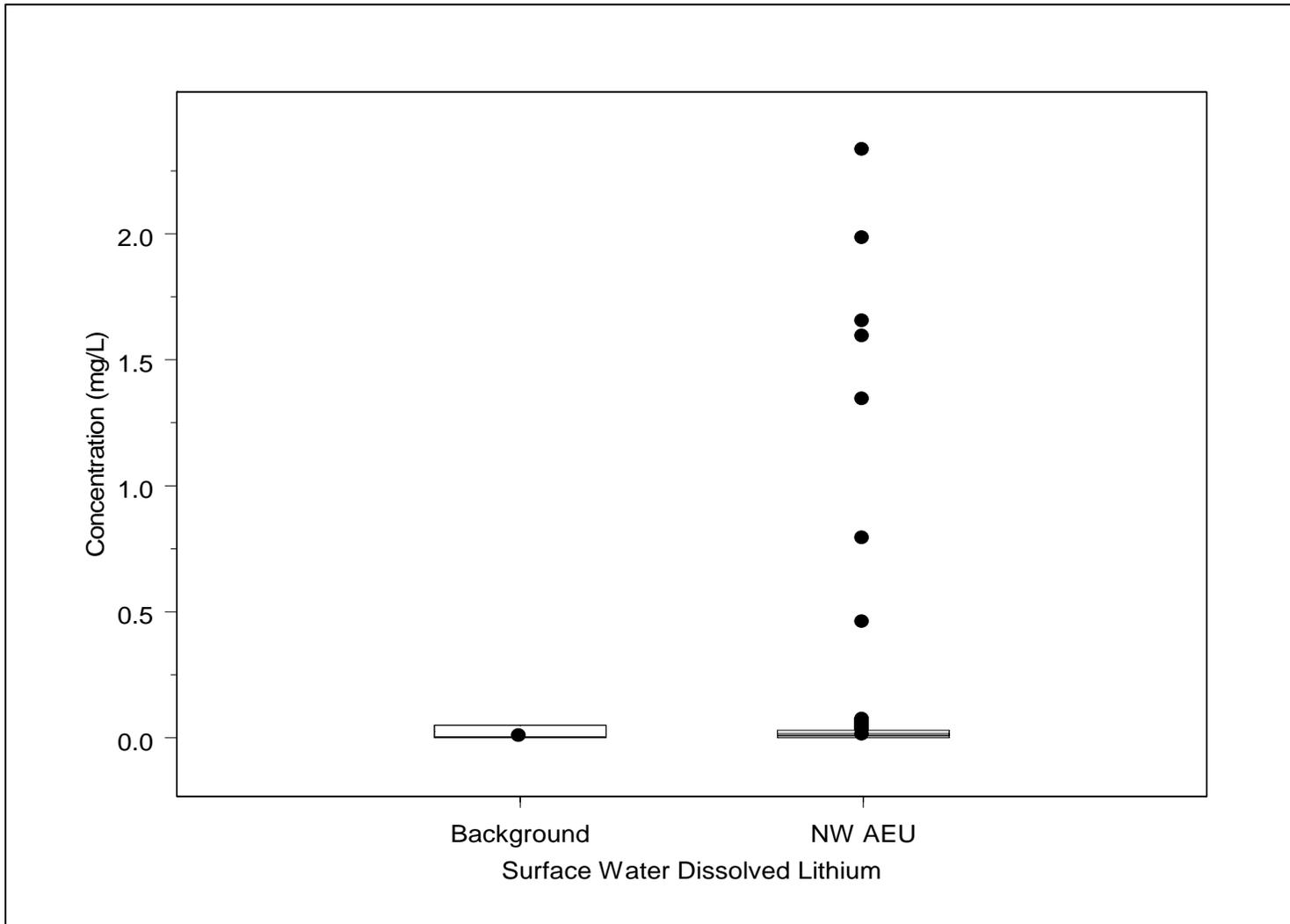
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.35  
NW AEU Surface Water Dissolved Box Plots for Lead



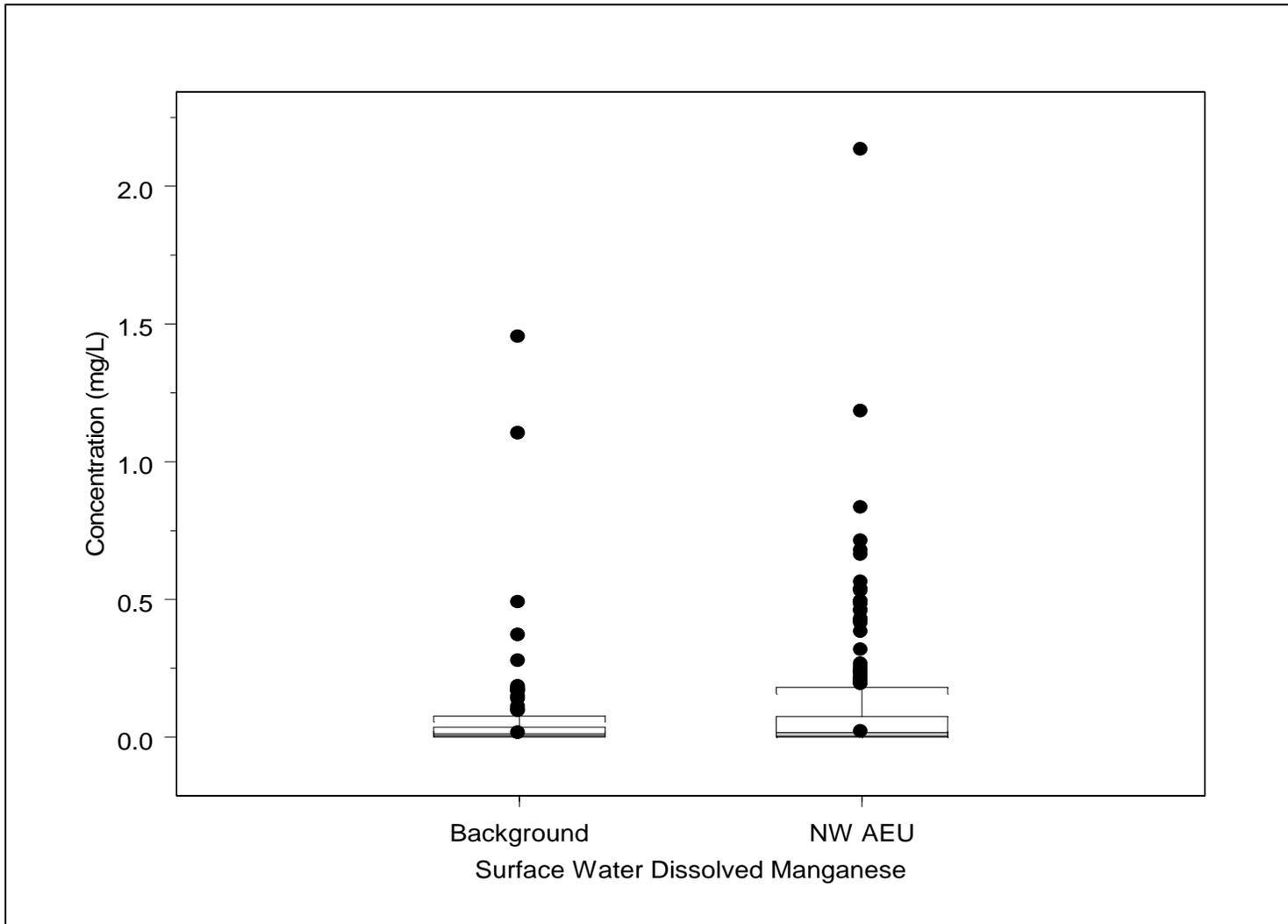
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.36  
NW AEU Surface Water Dissolved Box Plots for Lithium



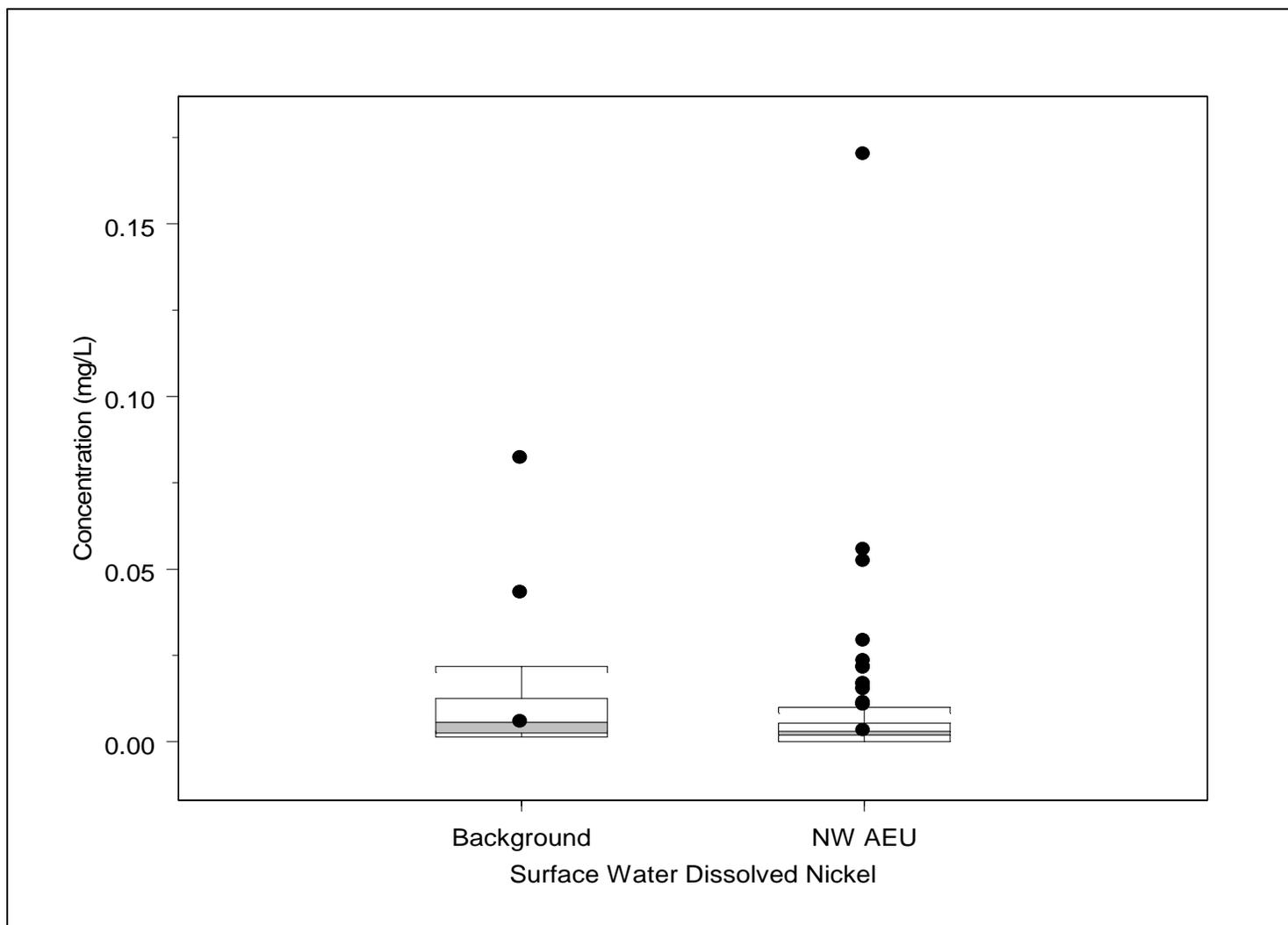
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.37  
NW AEU Surface Water Dissolved Box Plots for Manganese



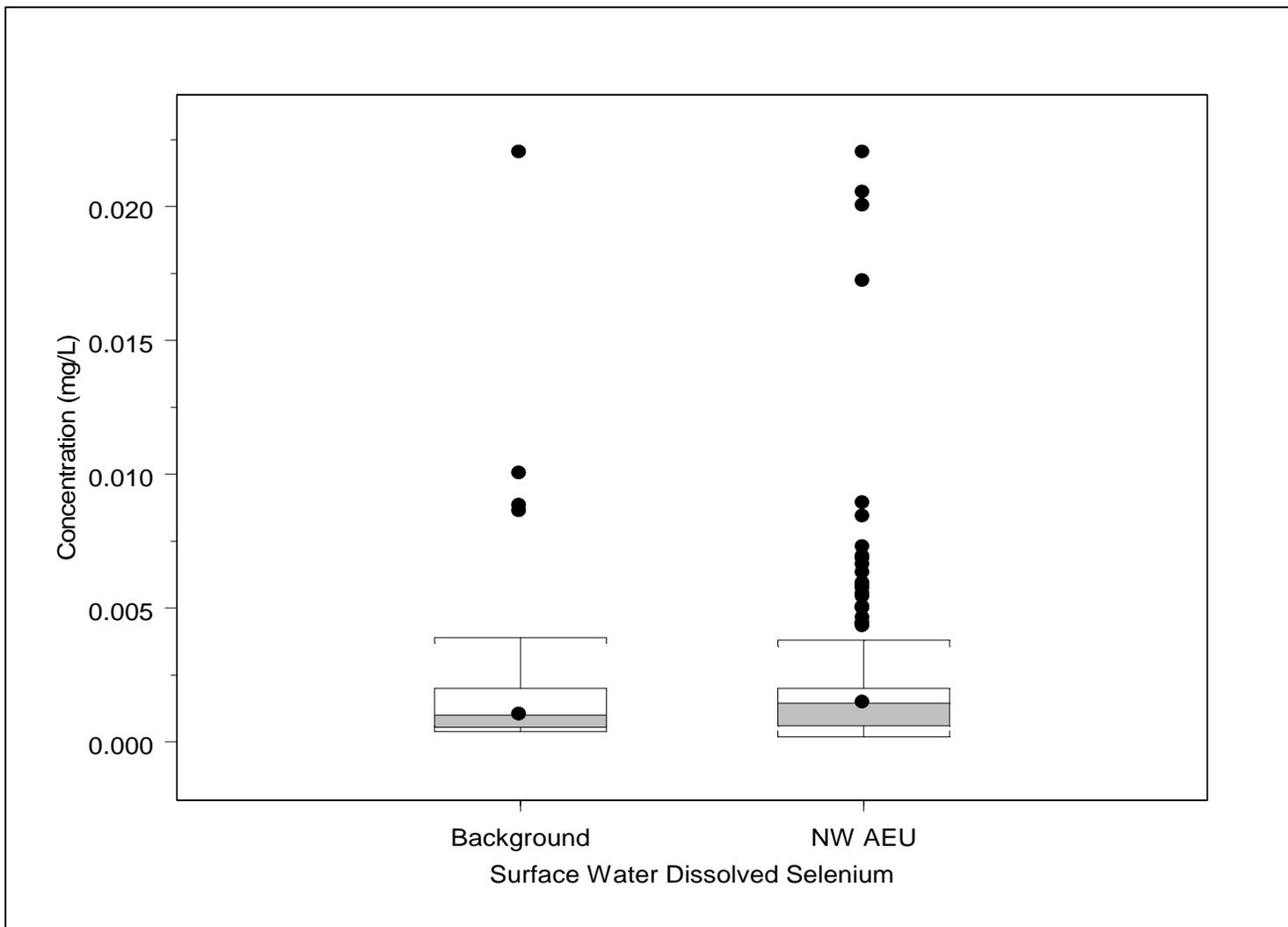
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.38  
NW AEU Surface Water Dissolved Box Plots for Nickel



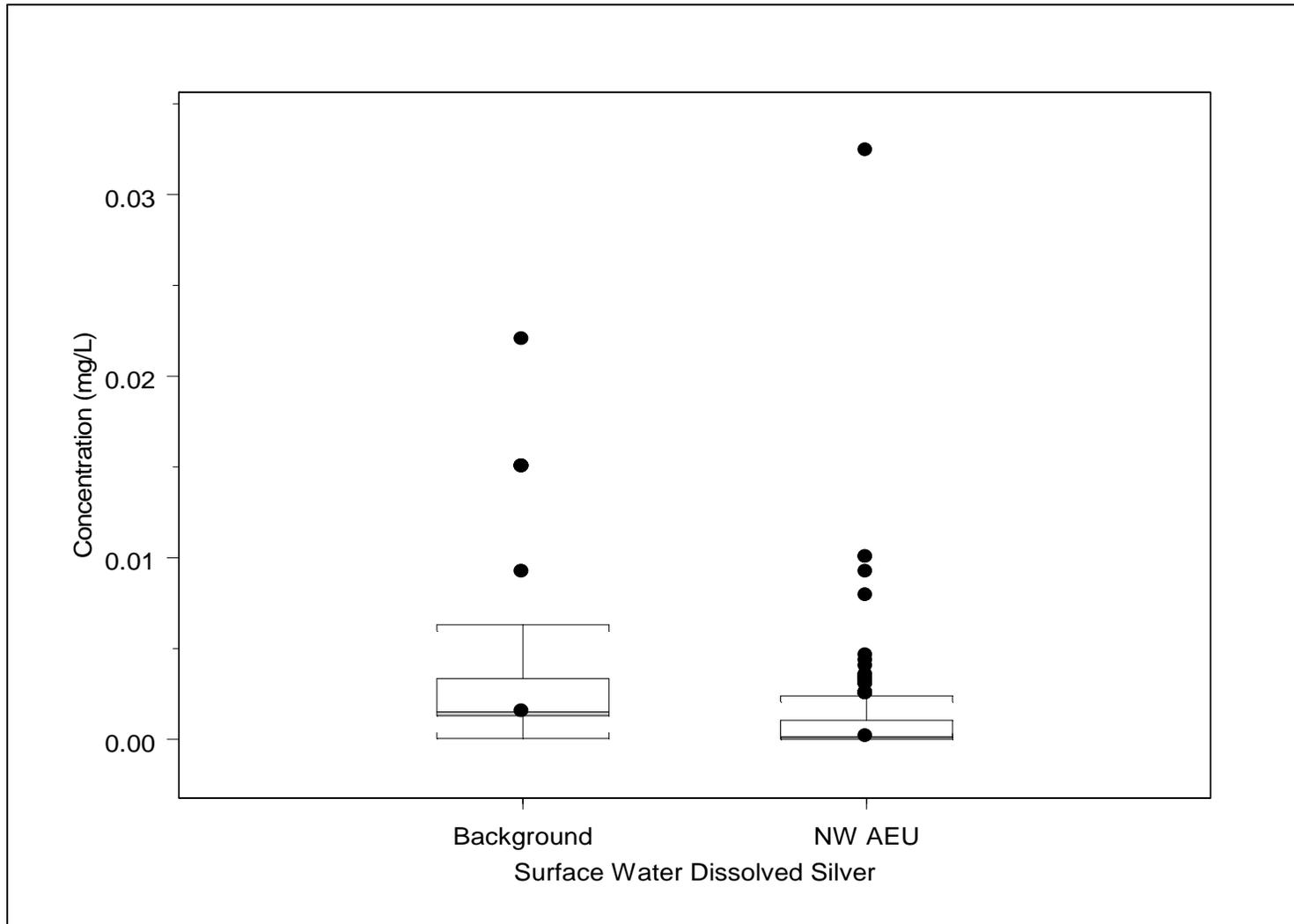
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.39  
NW AEU Surface Water Dissolved Box Plots for Selenium



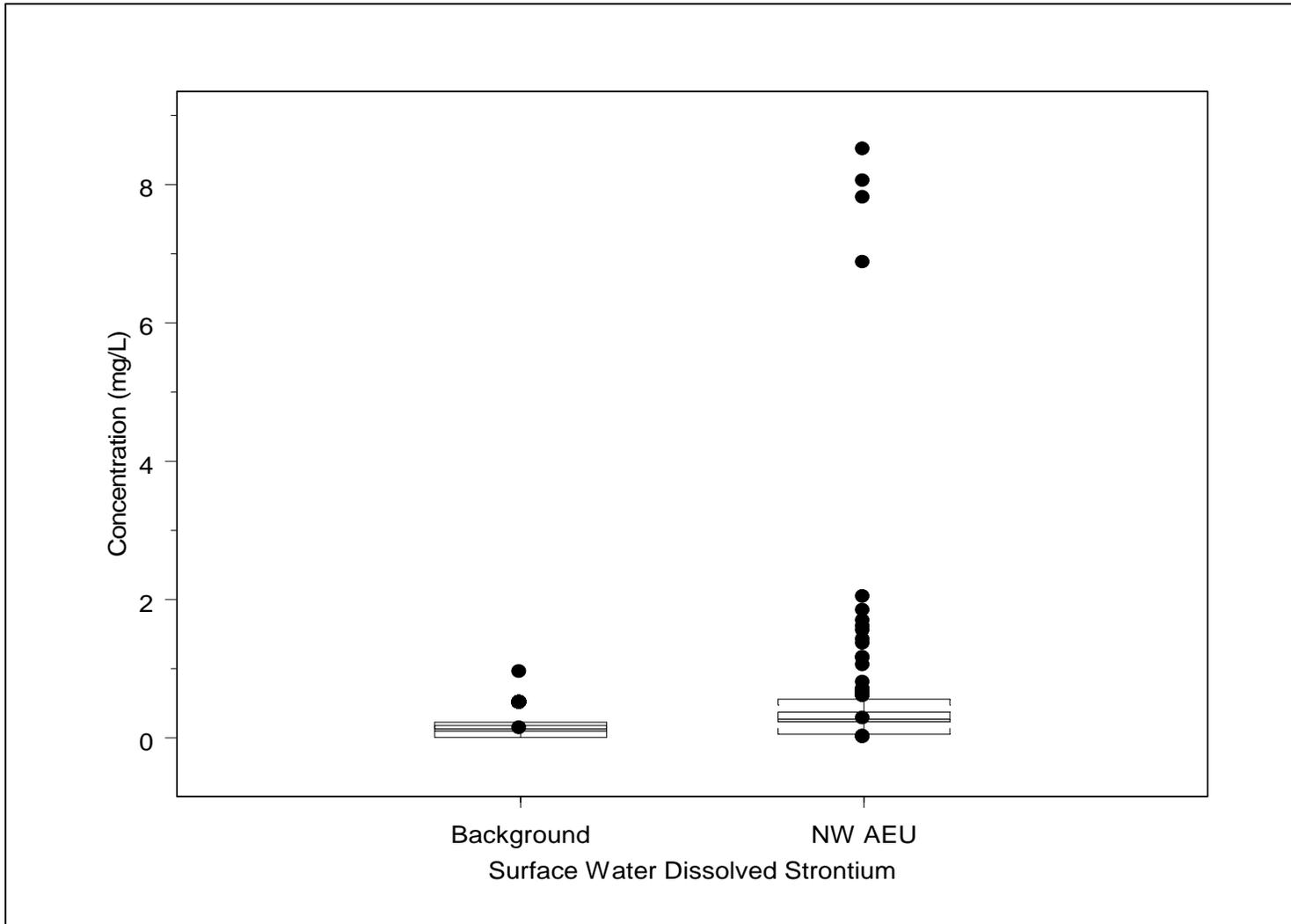
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.40  
NW AEU Surface Water Dissolved Box Plots for Silver



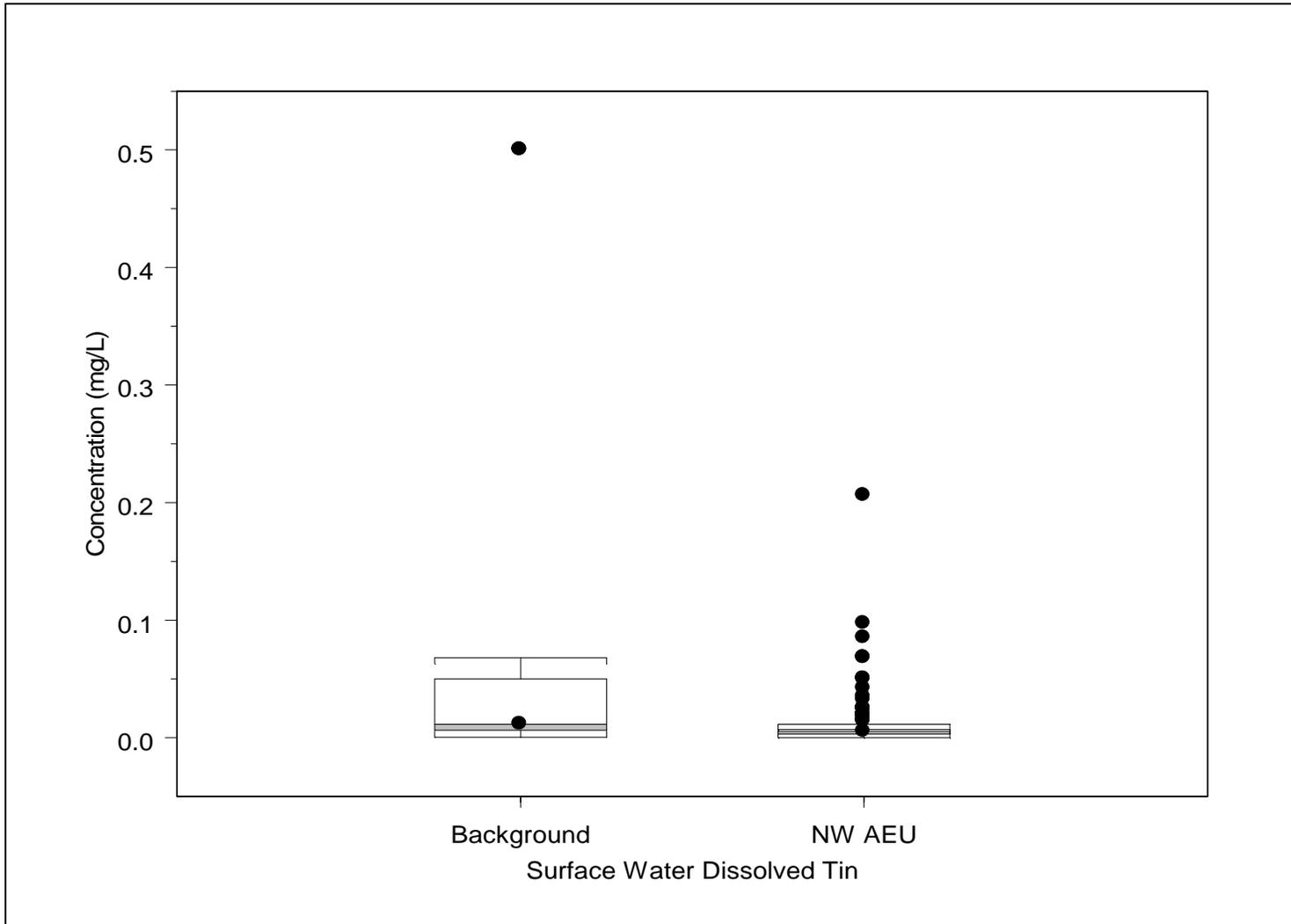
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.41  
NW AEU Surface Water Dissolved Box Plots for Strontium



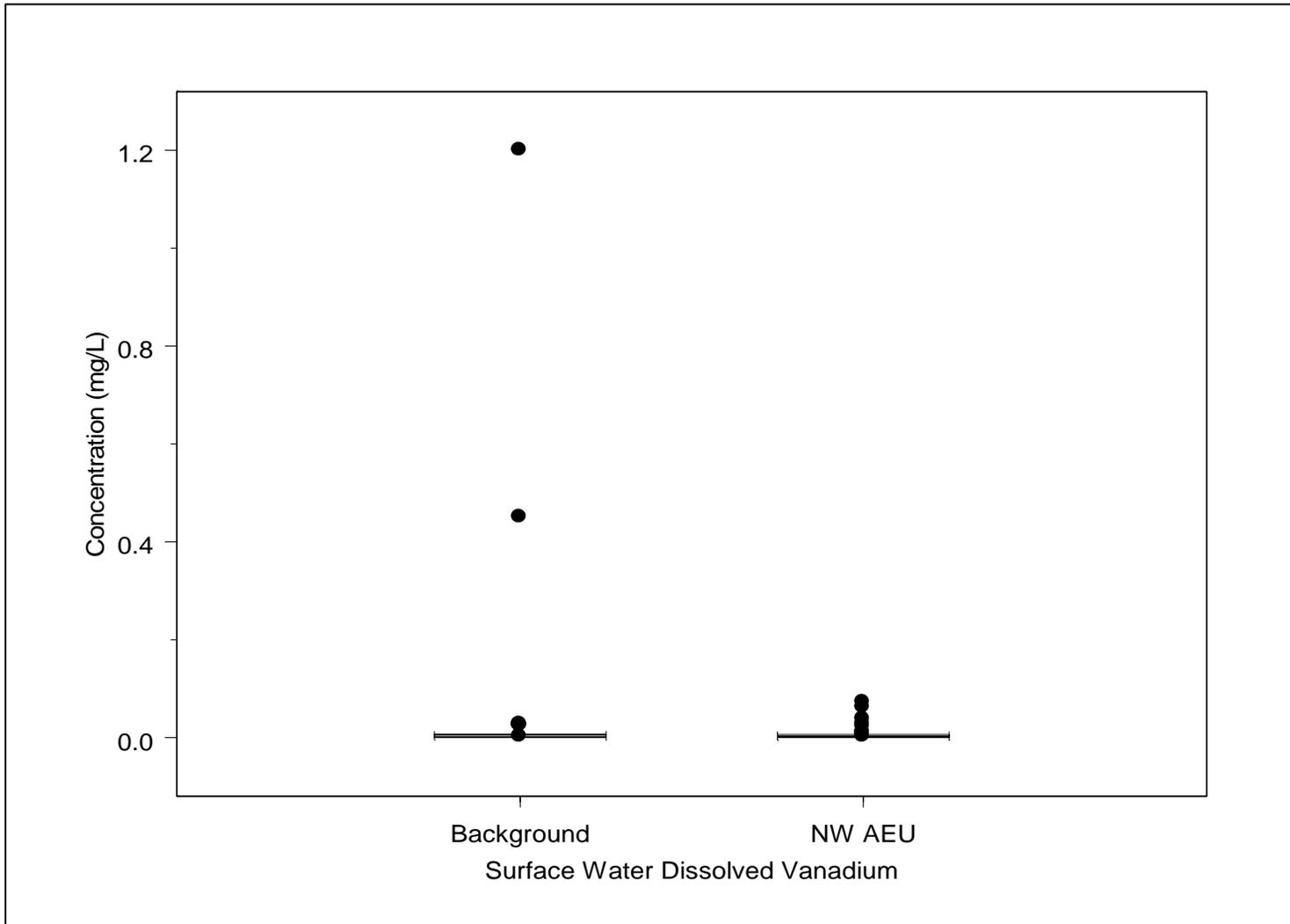
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.42  
NW AEU Surface Water Dissolved Box Plots for Tin



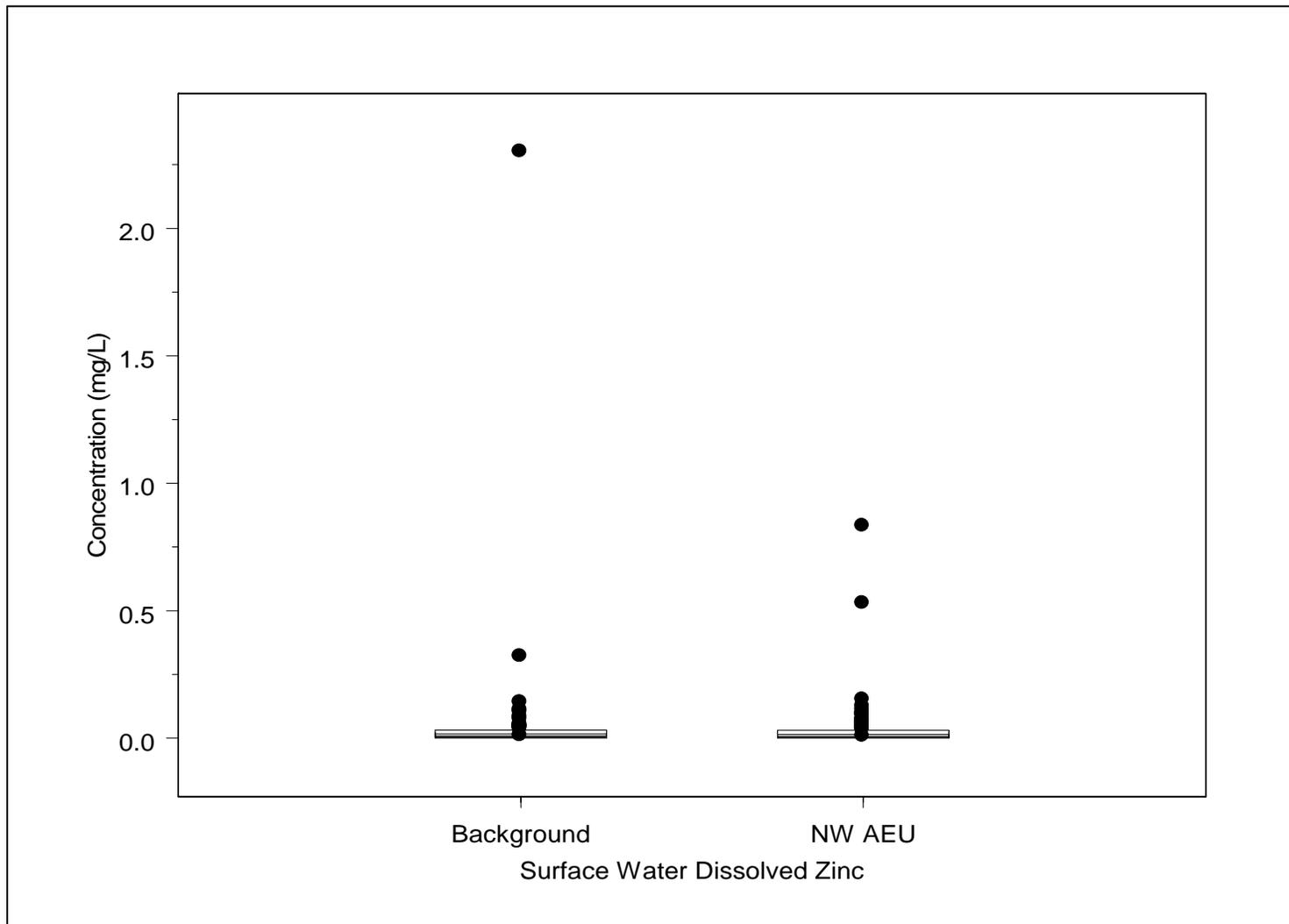
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.43  
NW AEU Surface Water Dissolved Box Plots for Vanadium



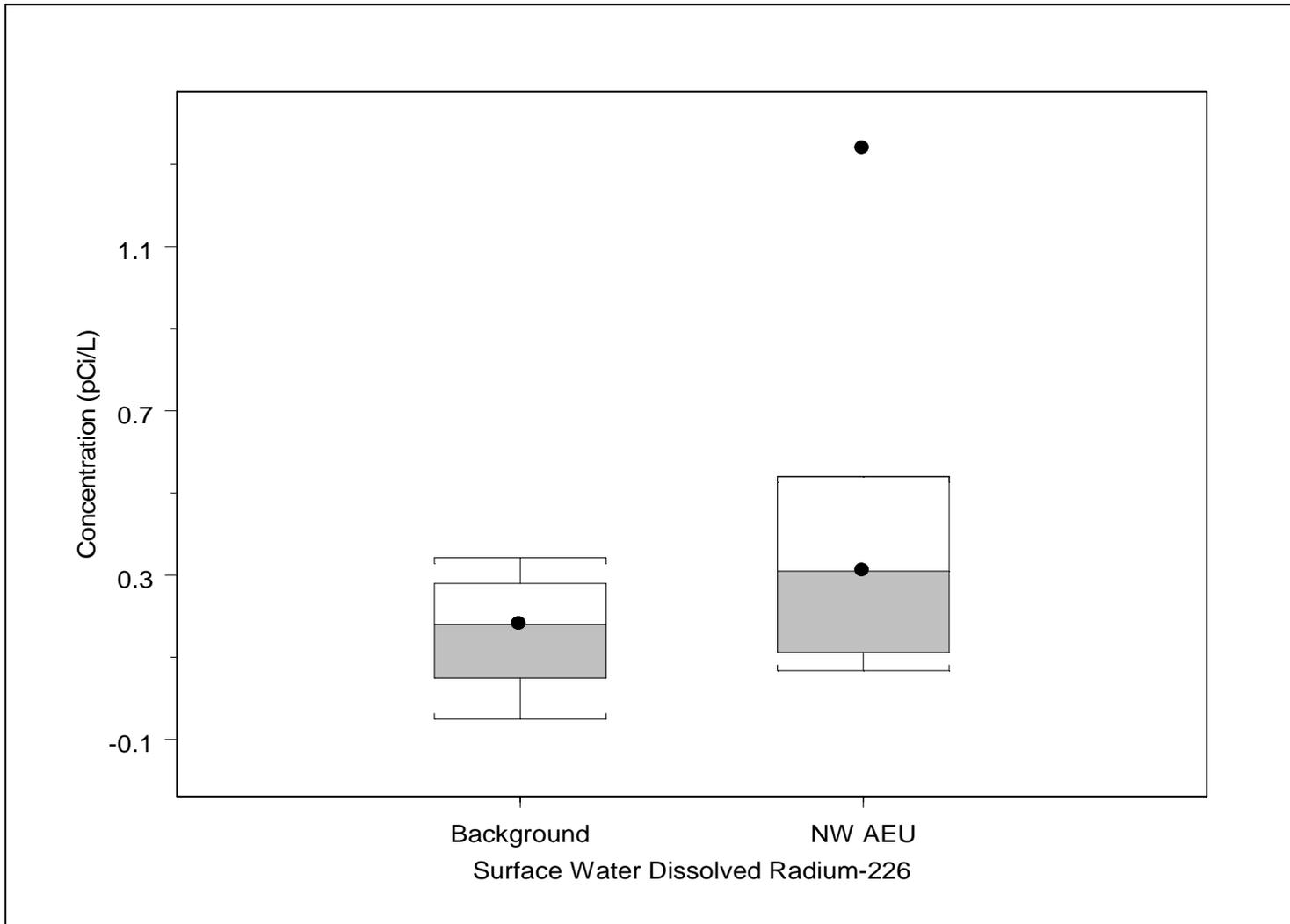
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.44  
NW AEU Surface Water Dissolved Box Plots for Zinc



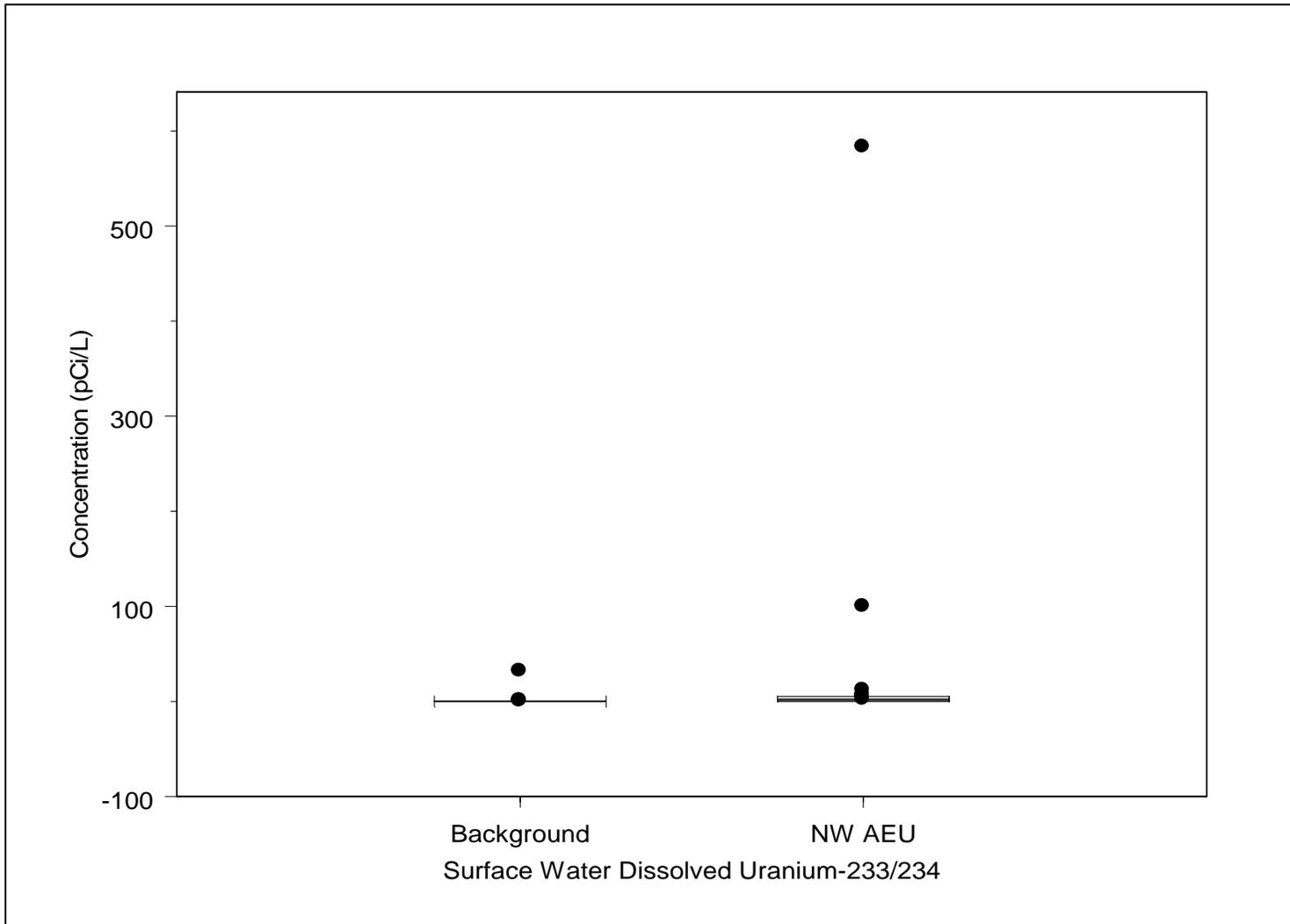
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.45  
NW AEU Surface Water Dissolved Box Plots for Radium-226



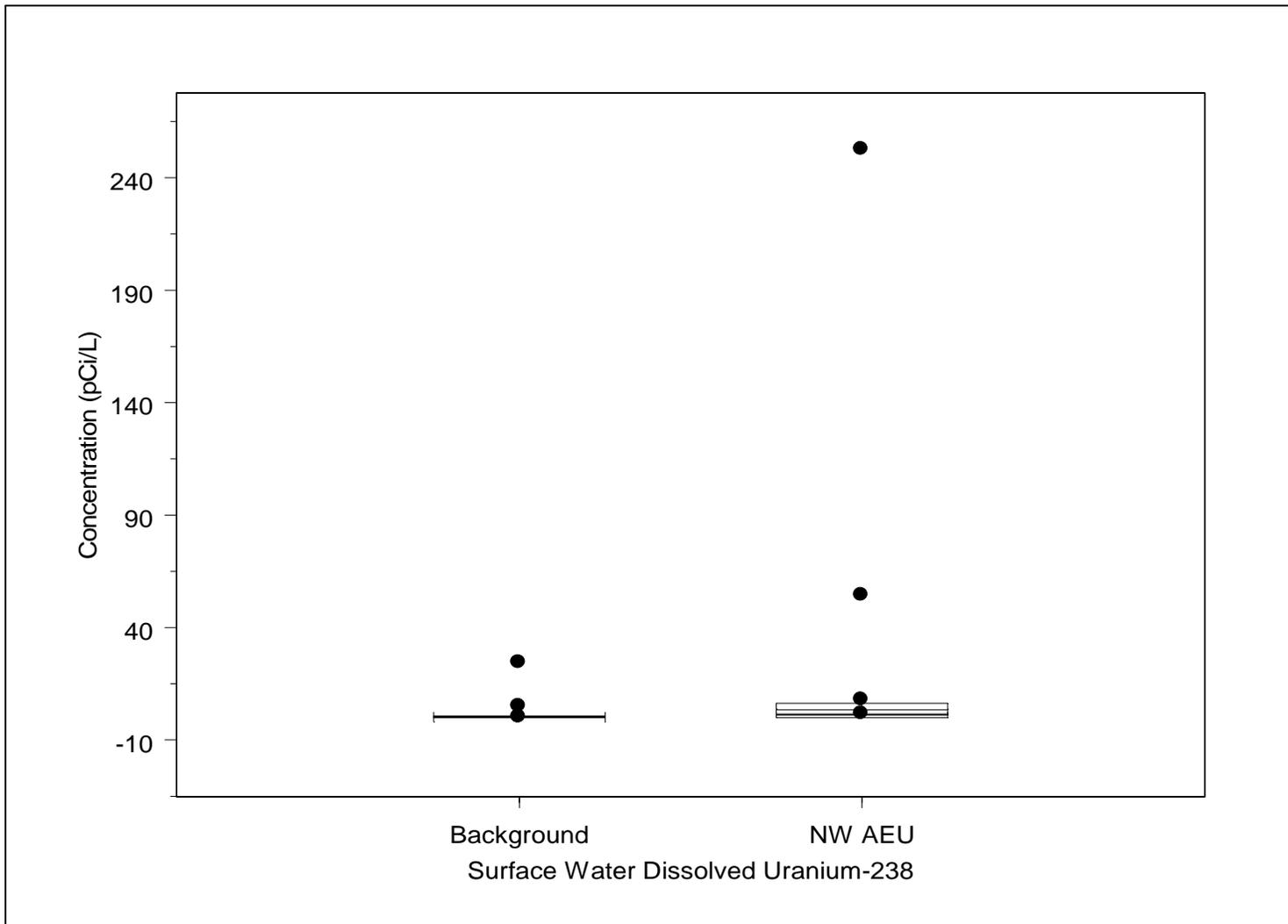
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.46  
NW AEU Surface Water Dissolved Box Plots for Uranium-233/234



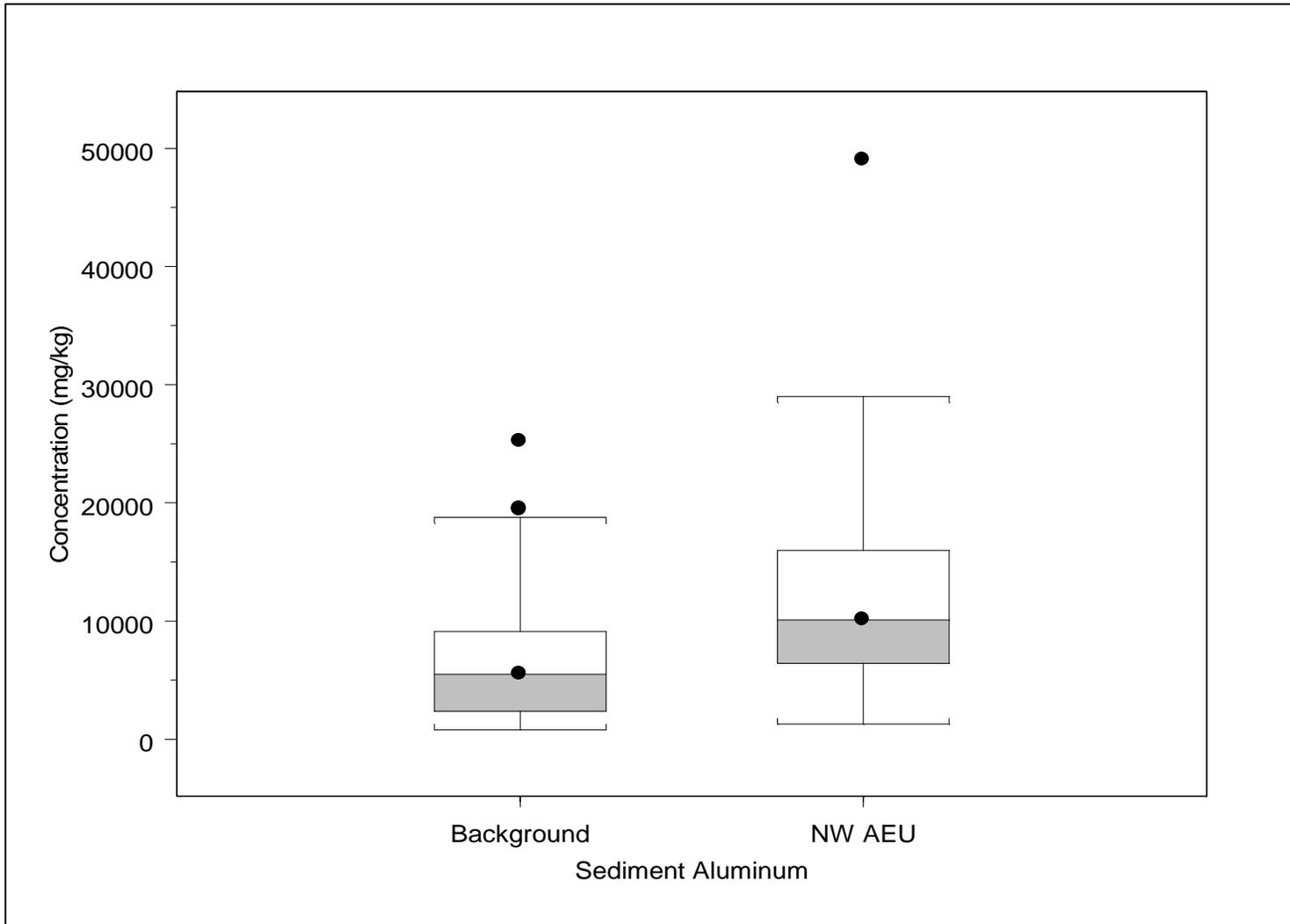
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.47  
NW AEU Surface Water Dissolved Box Plots for Uranium-238



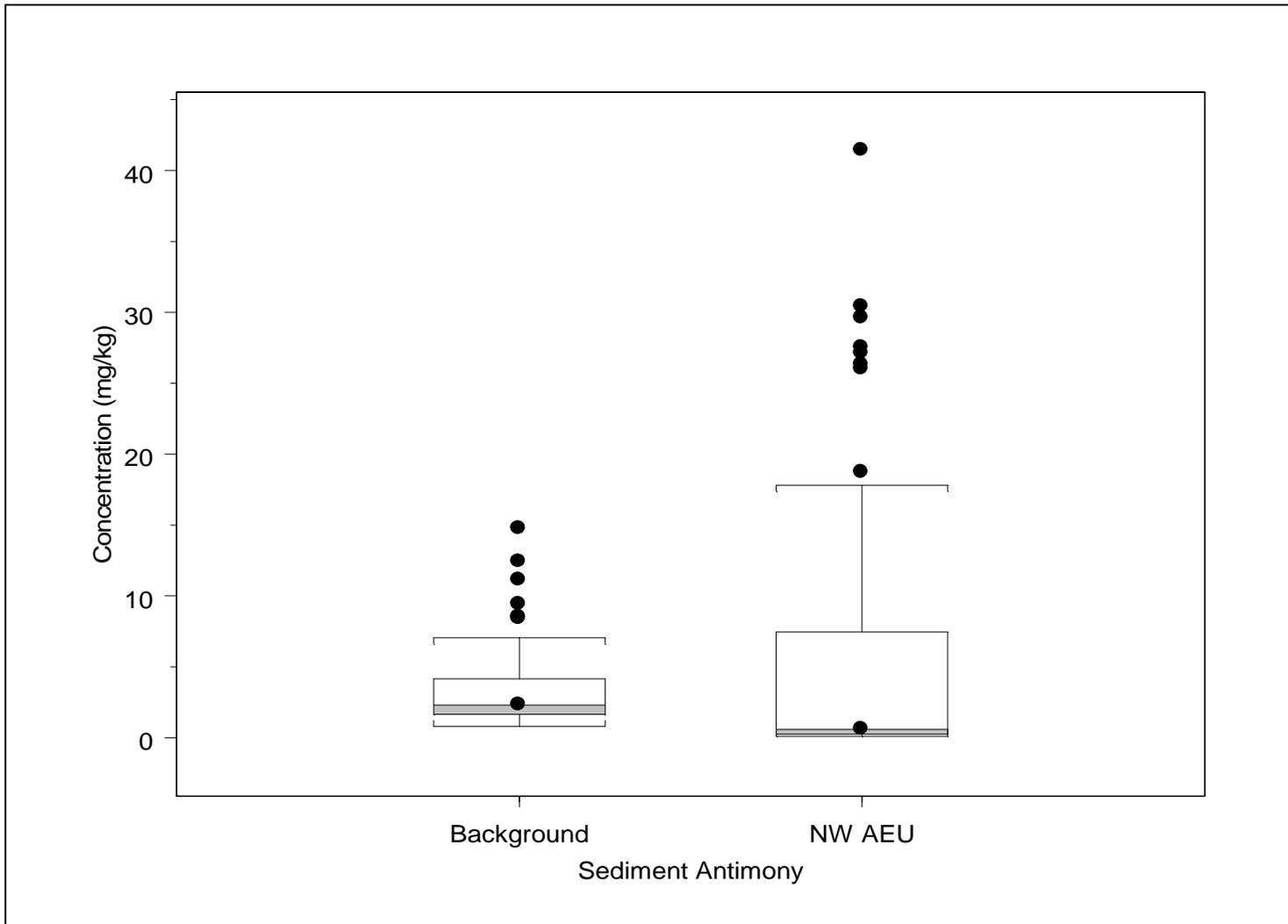
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.48  
NW AEU Sediment Box Plots for Aluminum



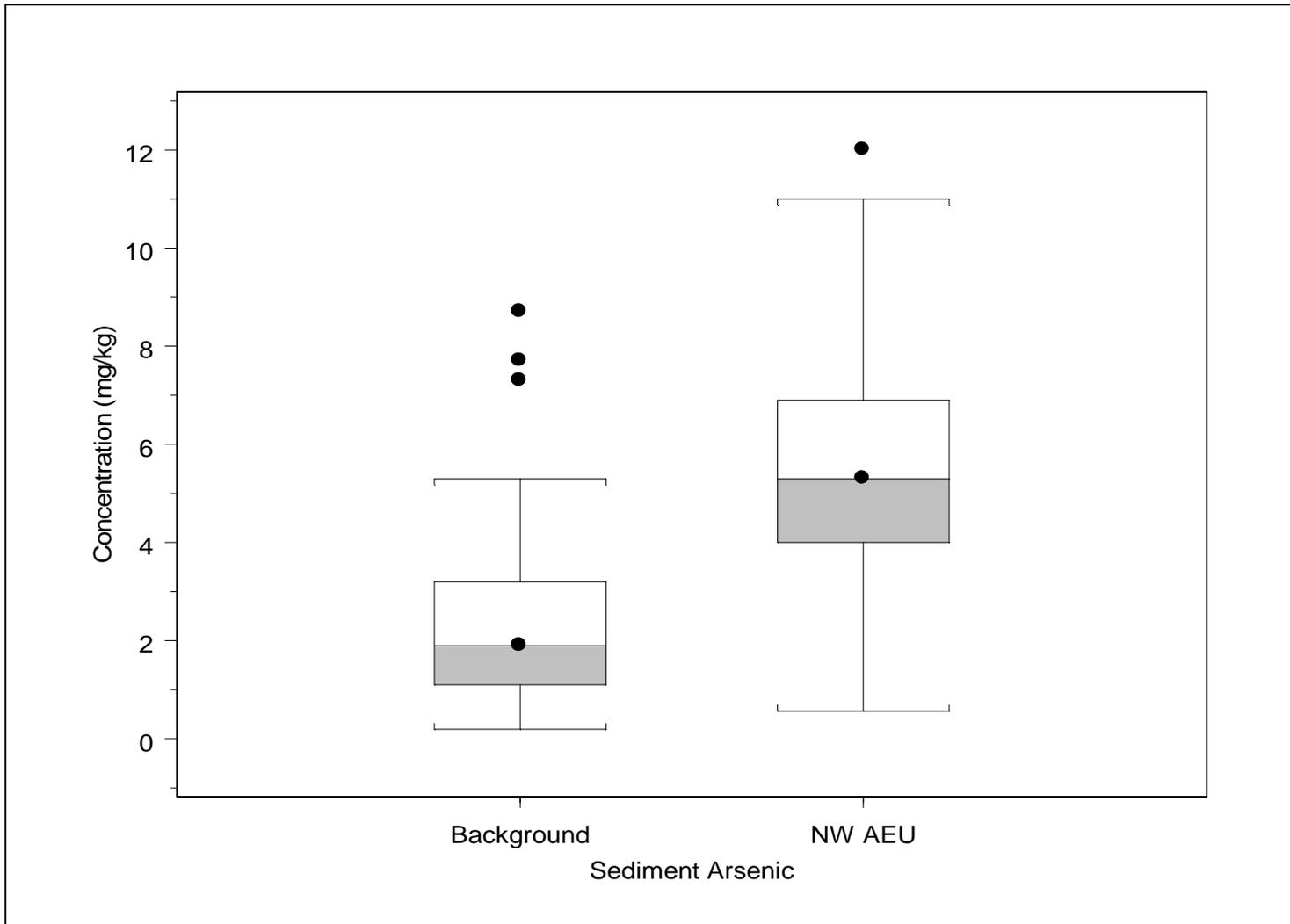
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.49  
NW AEU Sediment Box Plots for Antimony



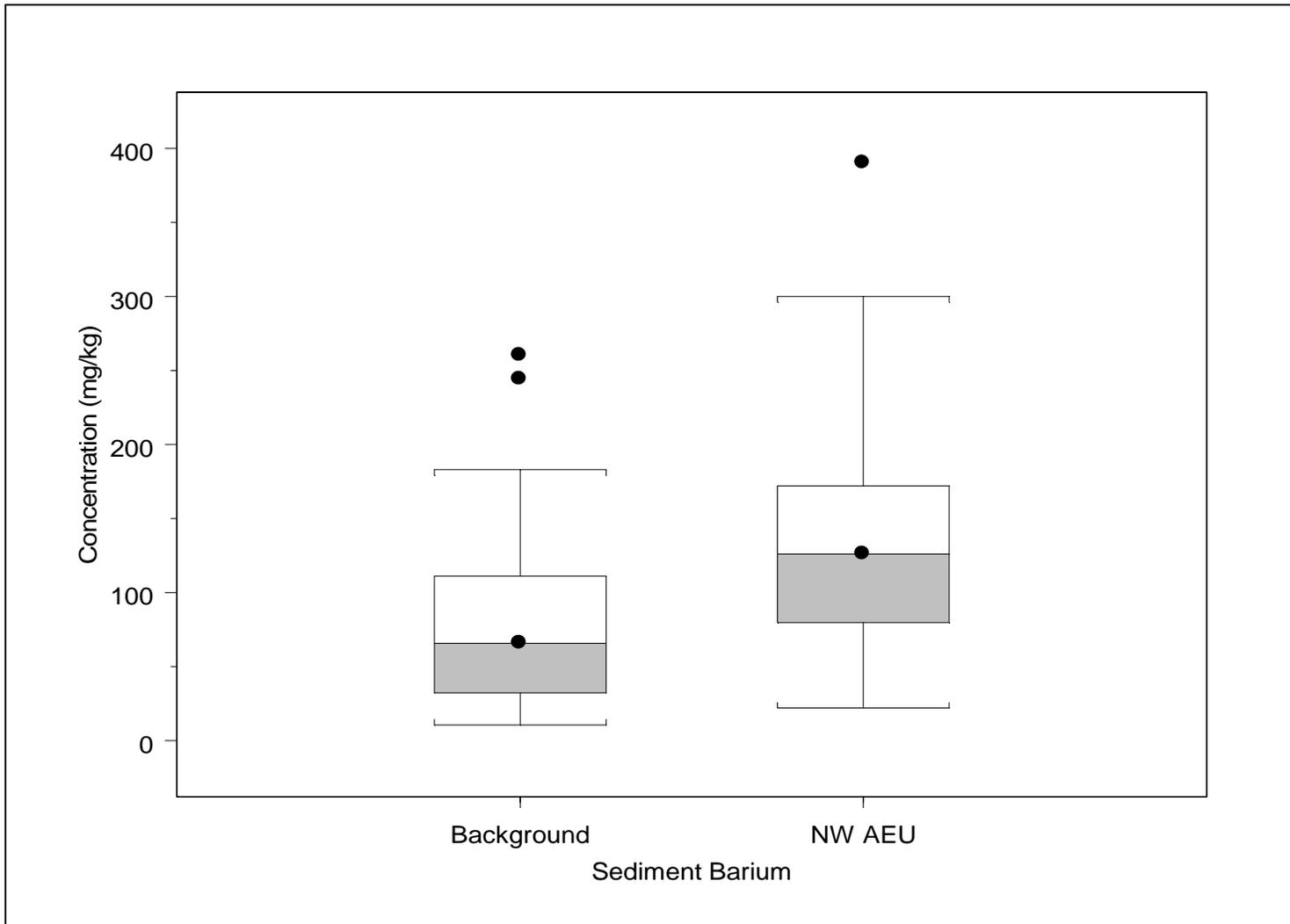
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.50  
NW AEU Sediment Box Plots for Arsenic



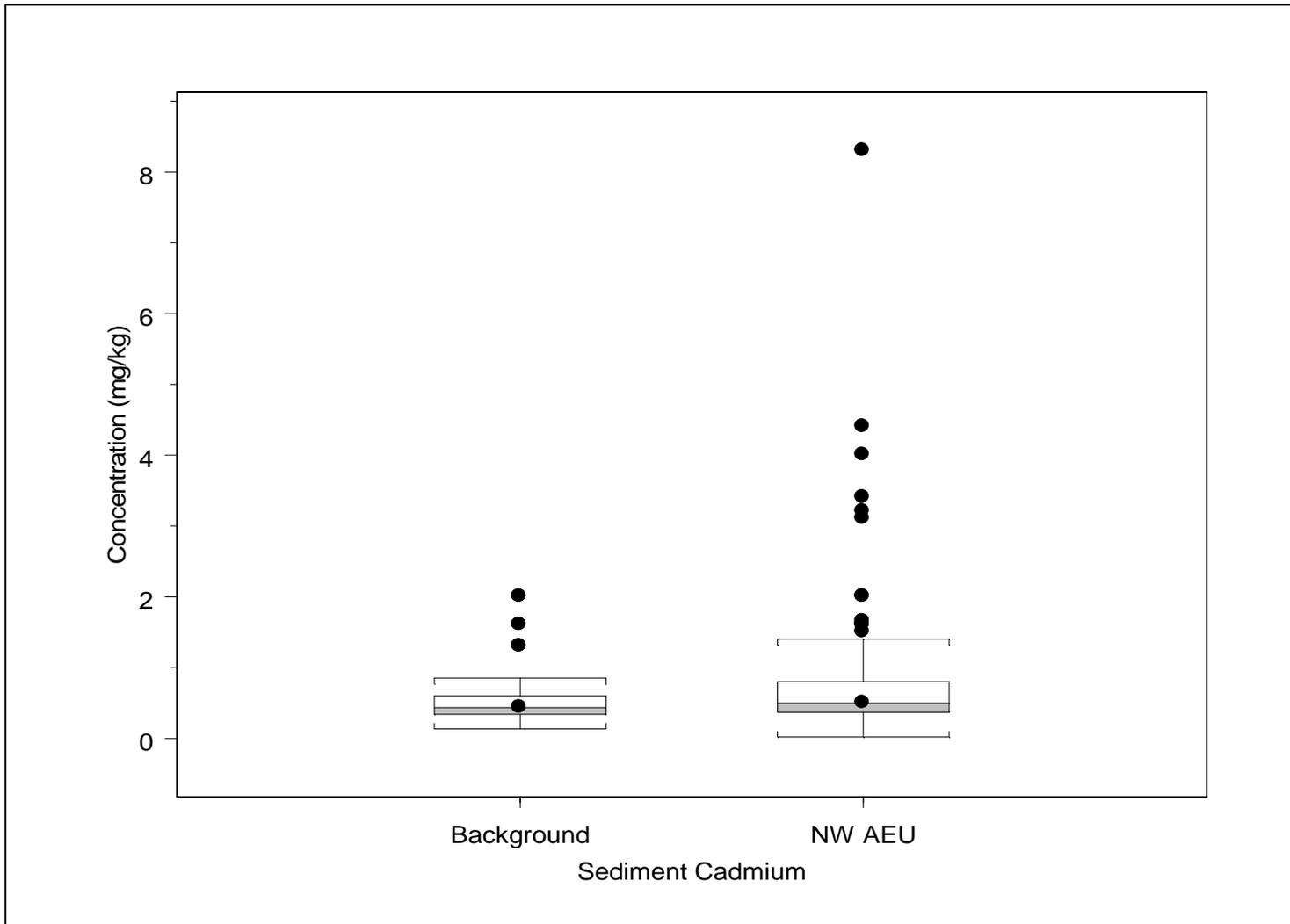
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.51  
NW AEU Sediment Box Plots for Barium



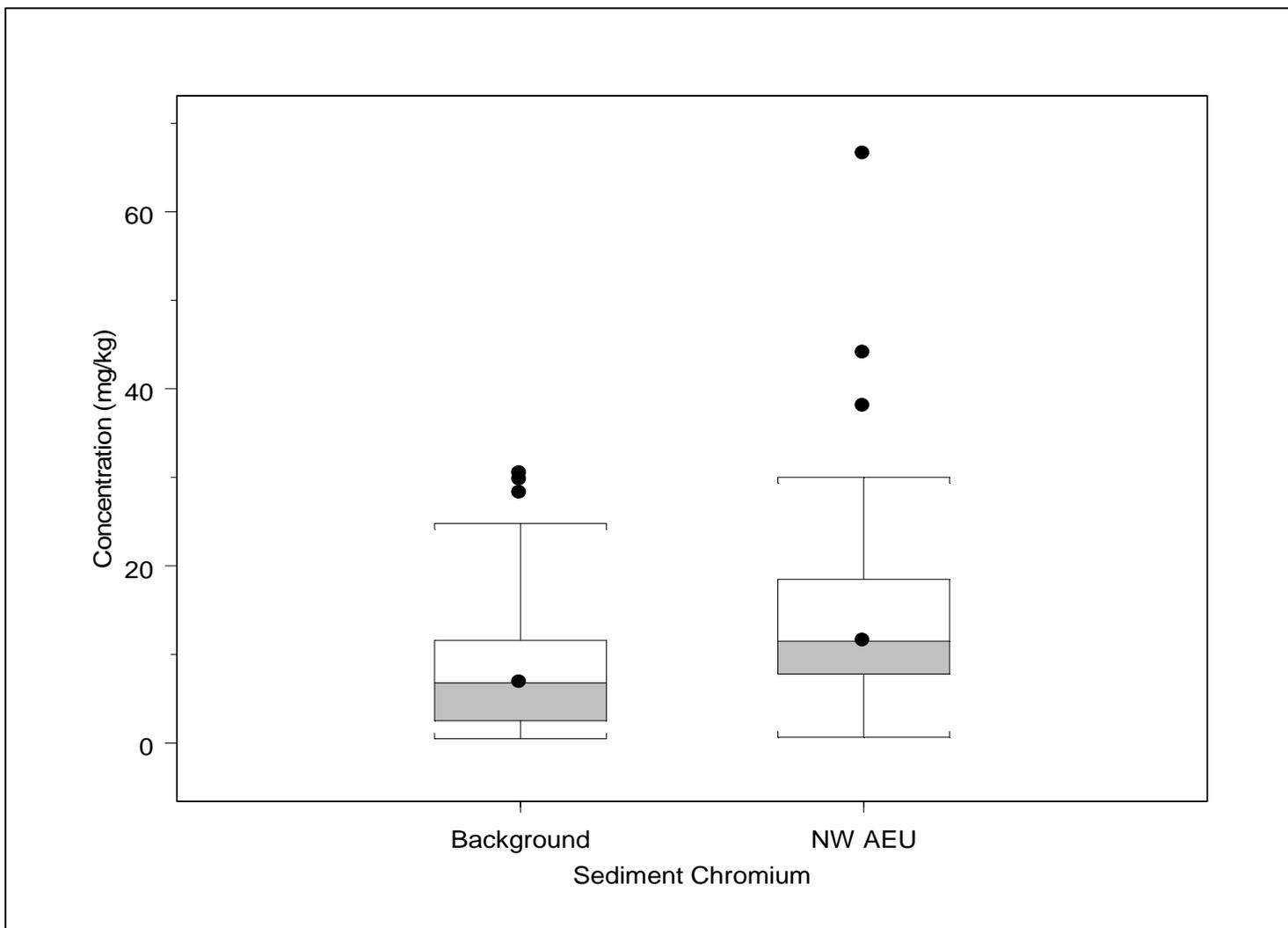
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.52  
NW AEU Sediment Box Plots for Cadmium



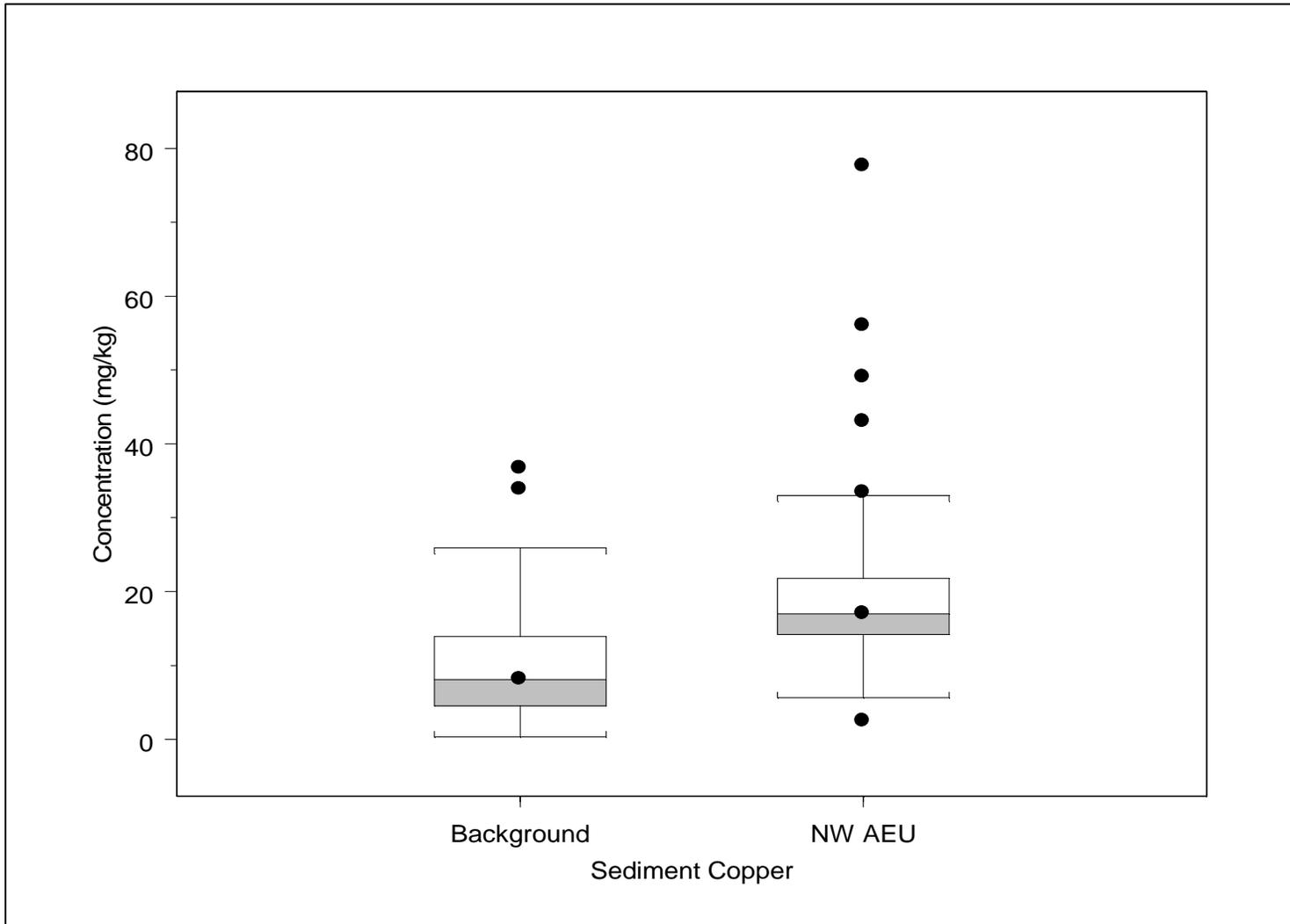
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.53  
NW AEU Sediment Box Plots for Chromium



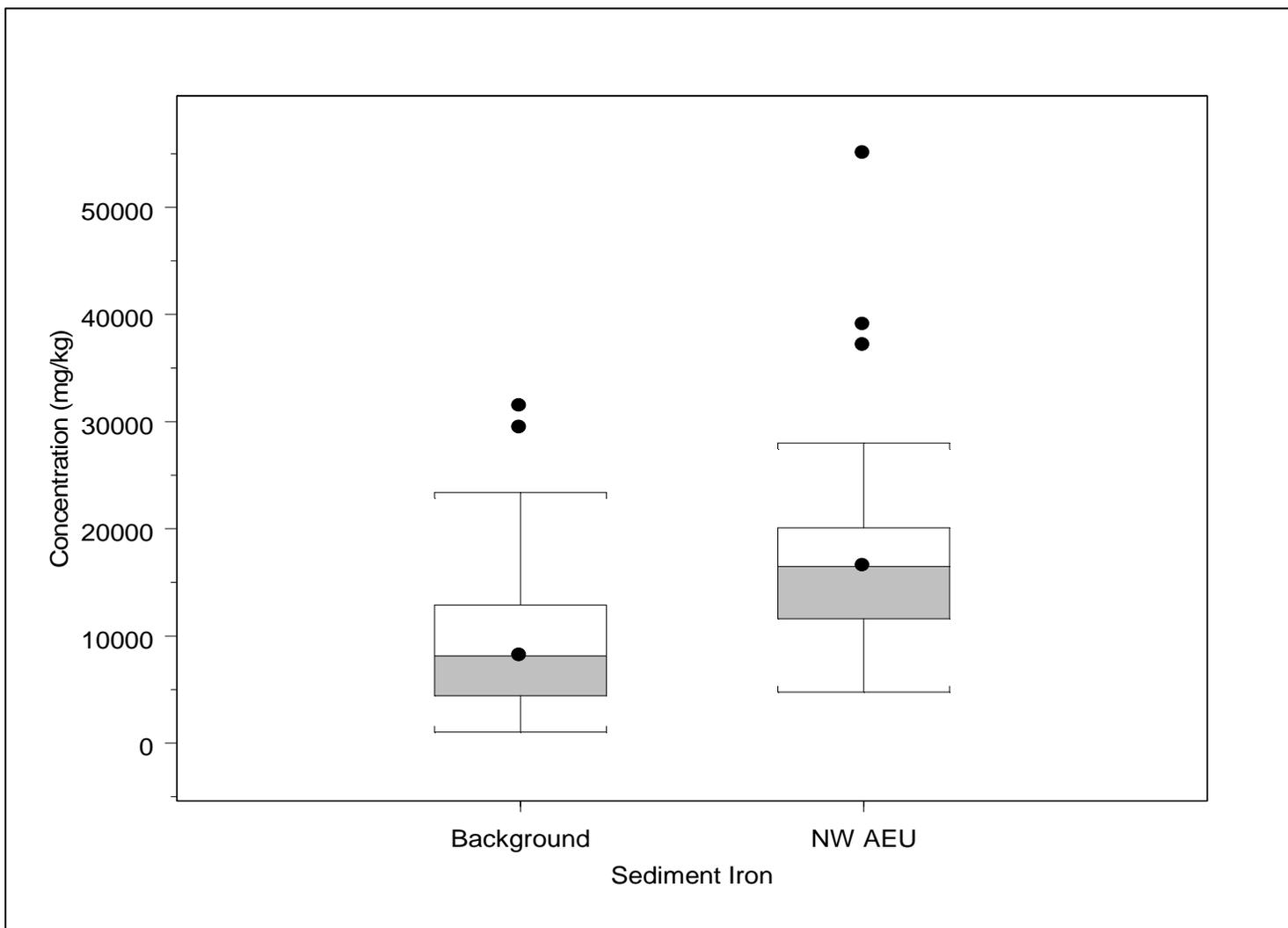
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.54  
NW AEU Sediment Box Plots for Copper



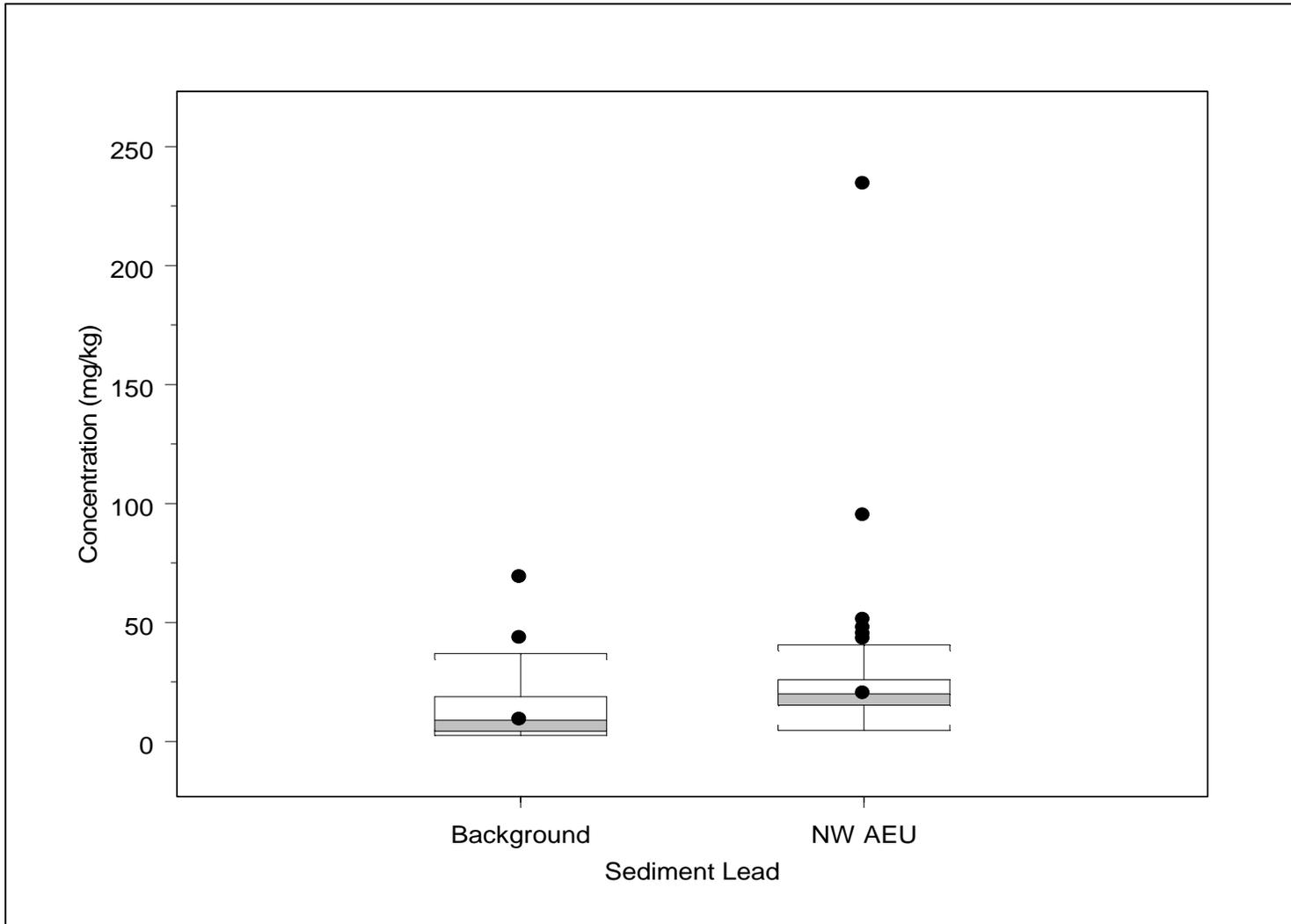
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.55  
NW AEU Sediment Box Plots for Iron



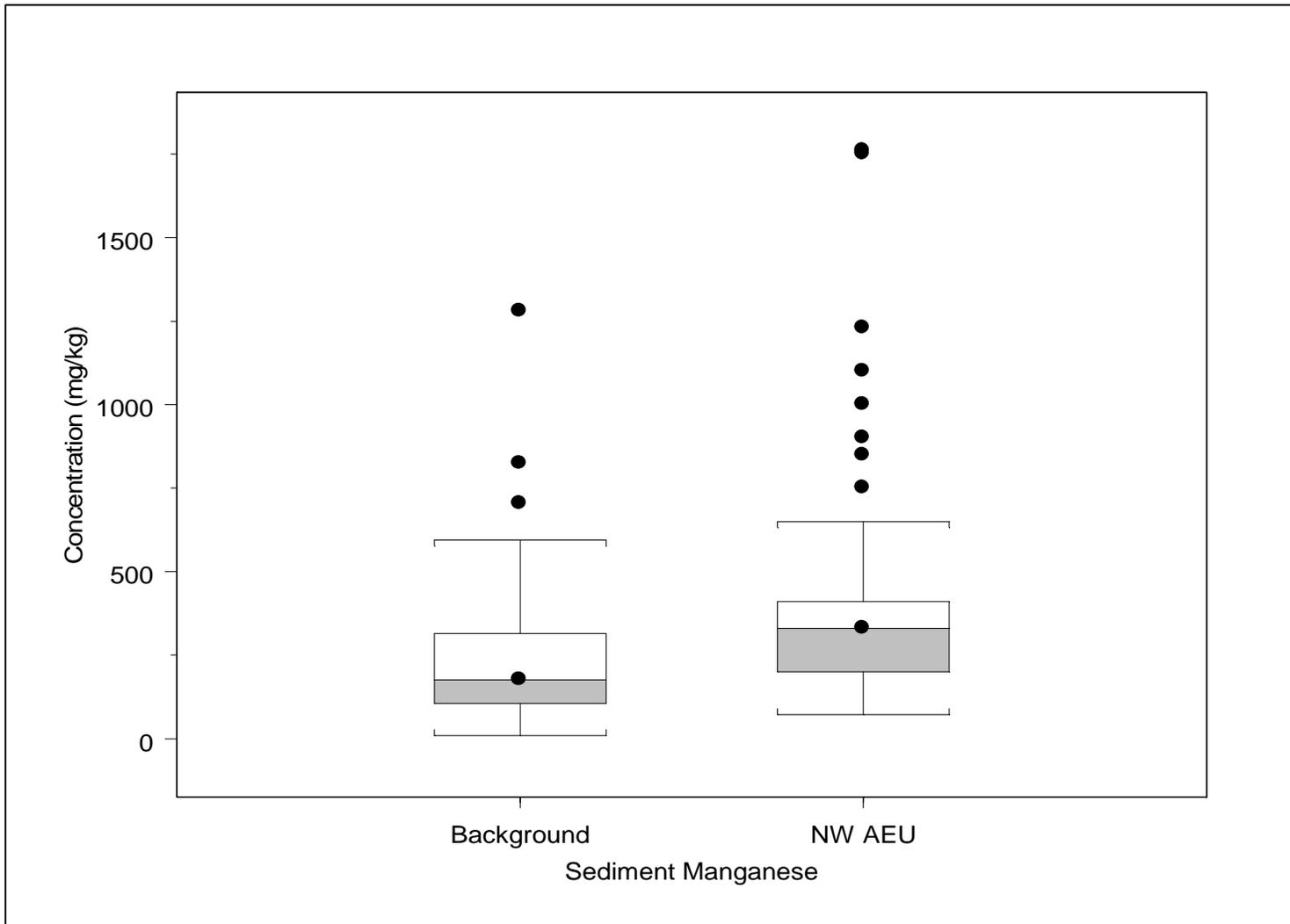
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.56  
NW AEU Sediment Box Plots for Lead



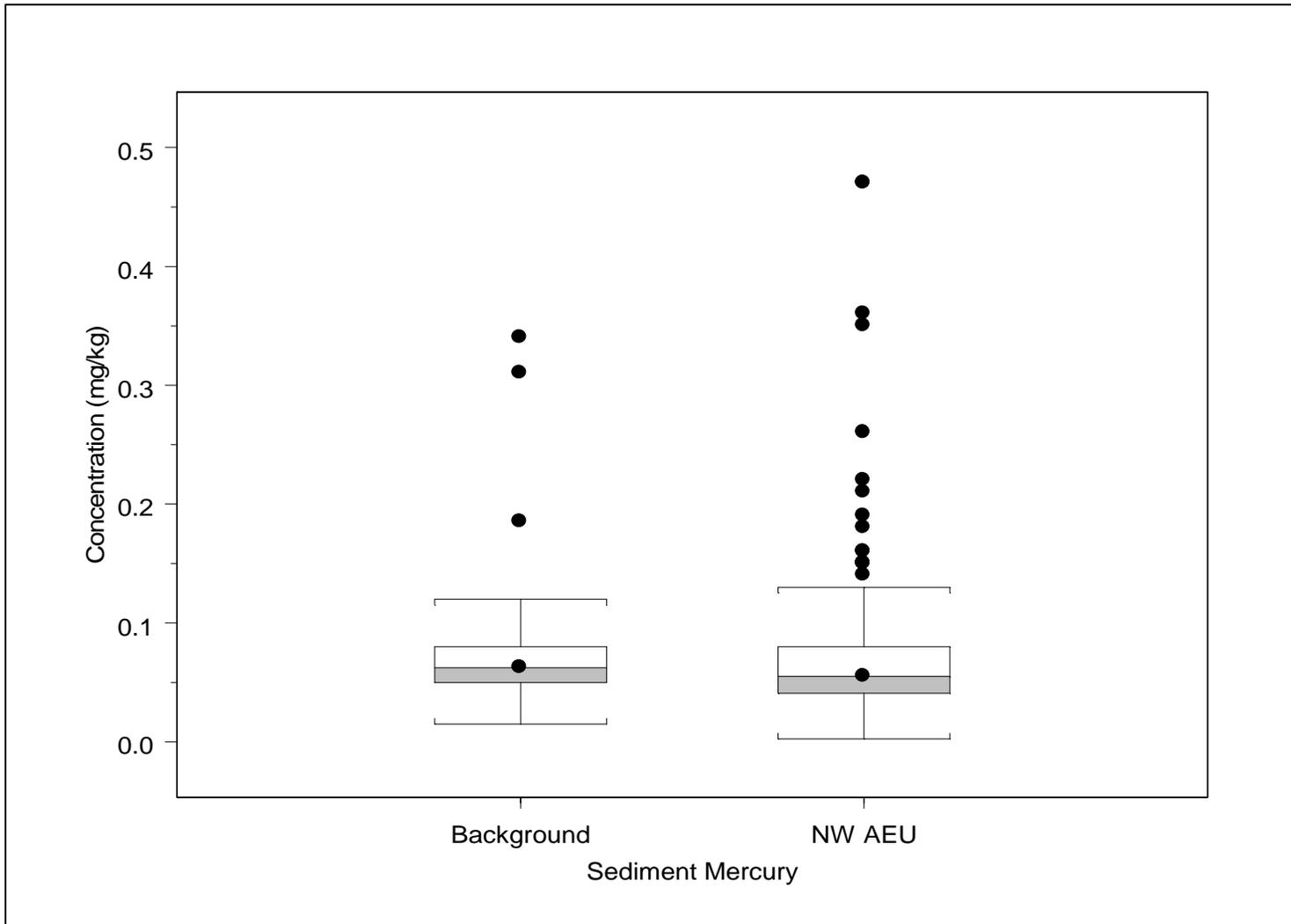
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.57  
NW AEU Sediment Box Plots for Manganese



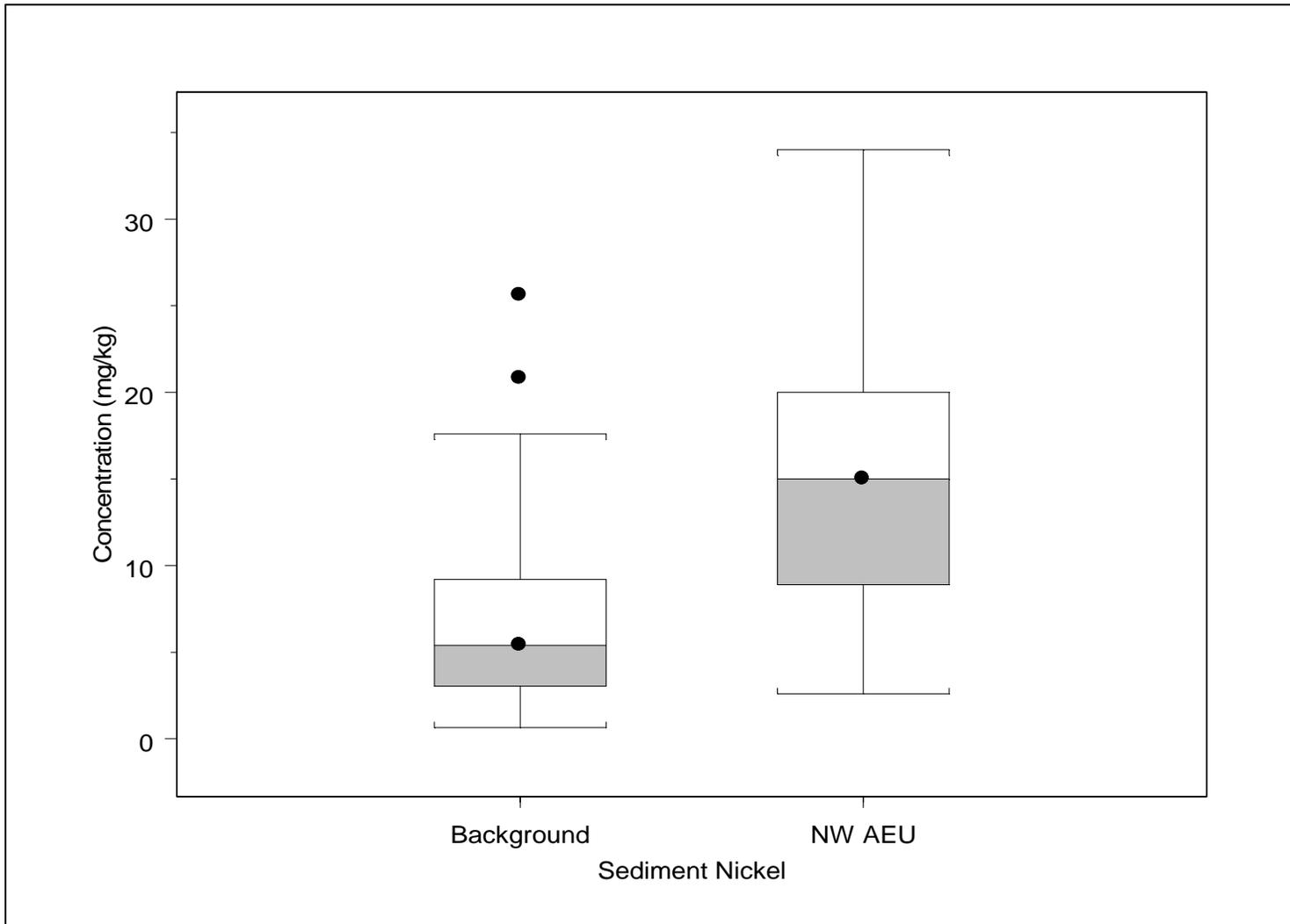
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.58  
NW AEU Sediment Box Plots for Mercury



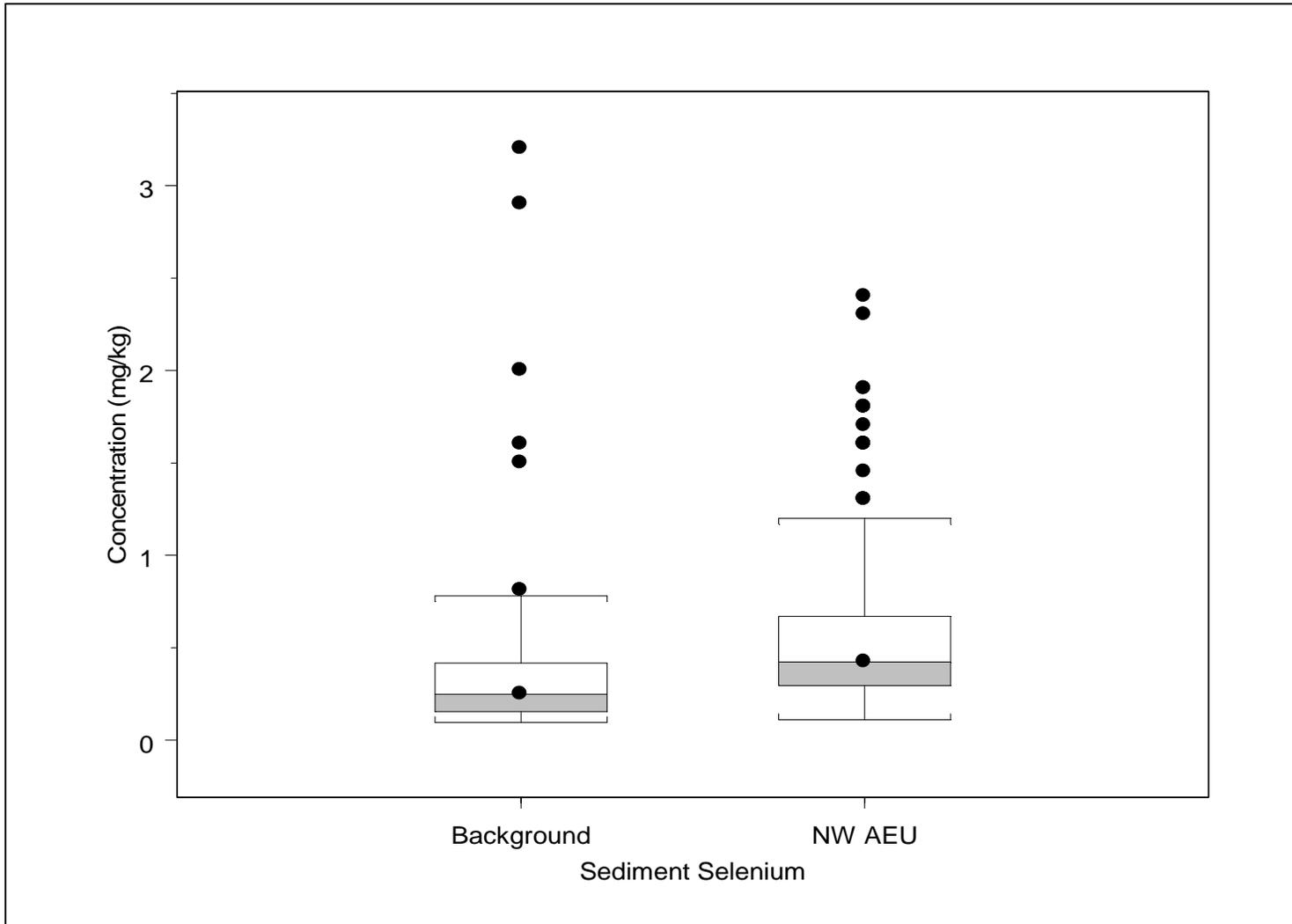
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.59  
NW AEU Sediment Box Plots for Nickel



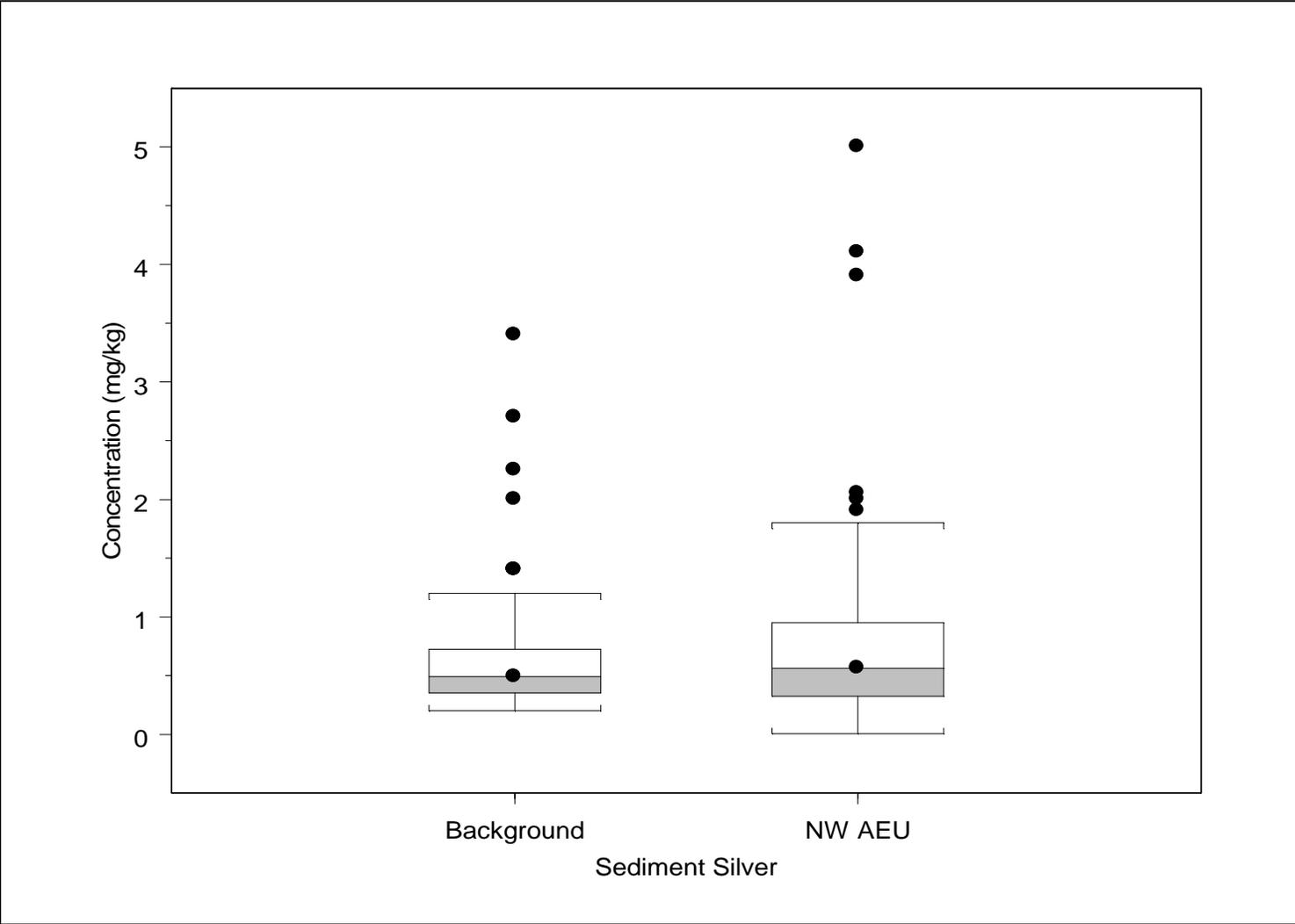
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.60  
NW AEU Sediment Box Plots for Selenium



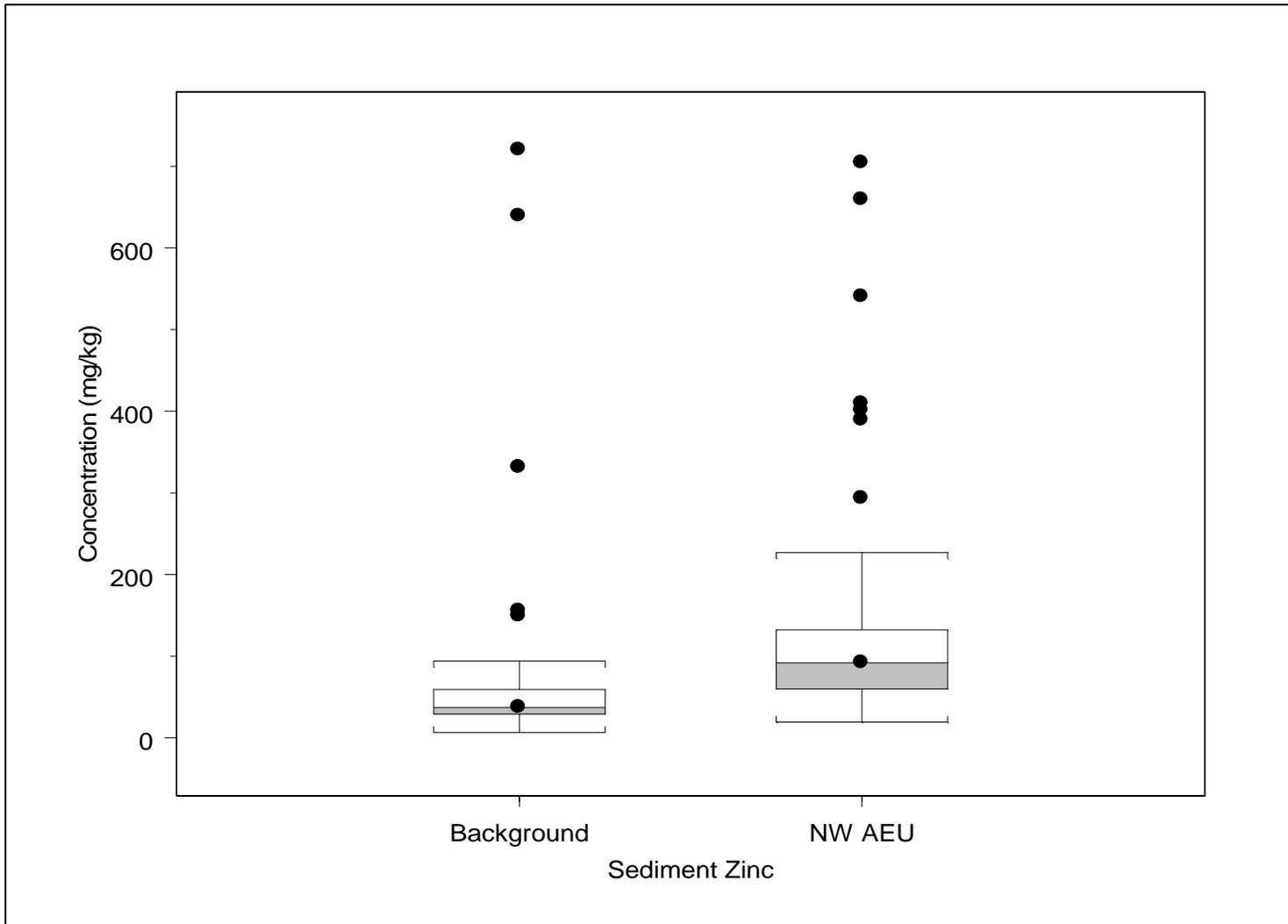
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.61  
NW AEU Sediment Box Plots for Silver



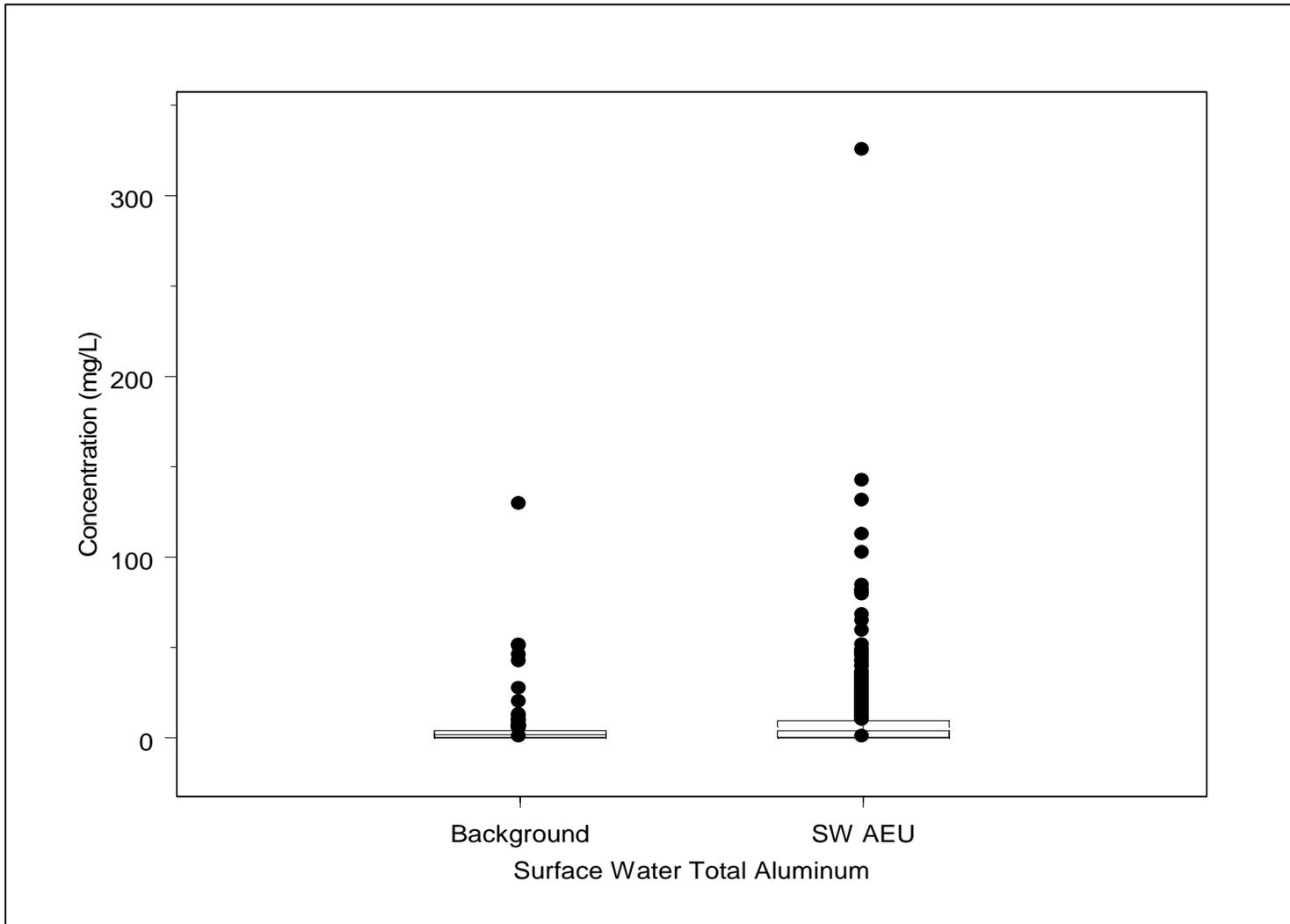
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.NW AEU.62  
NW AEU Sediment Box Plots for Zinc



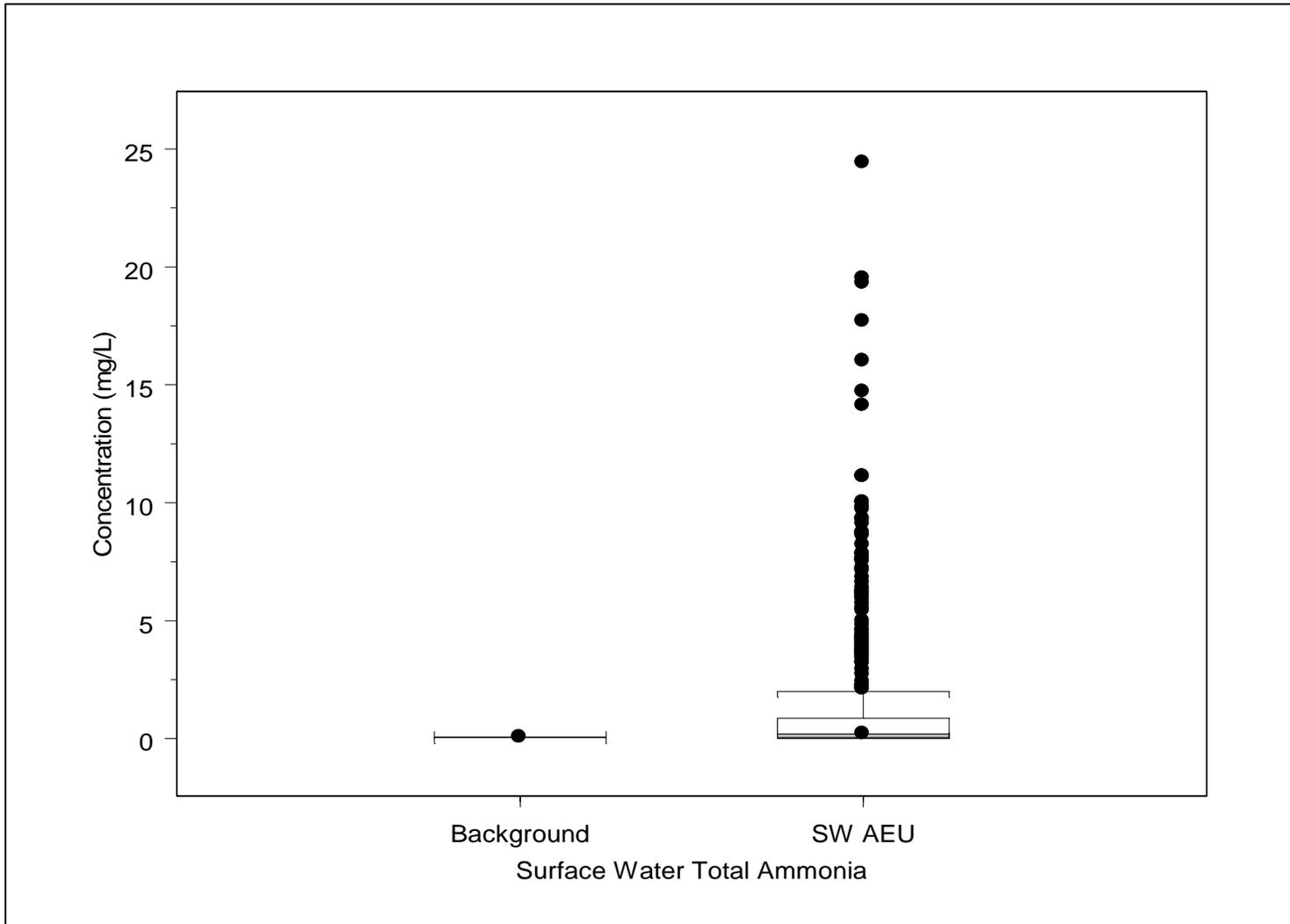
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



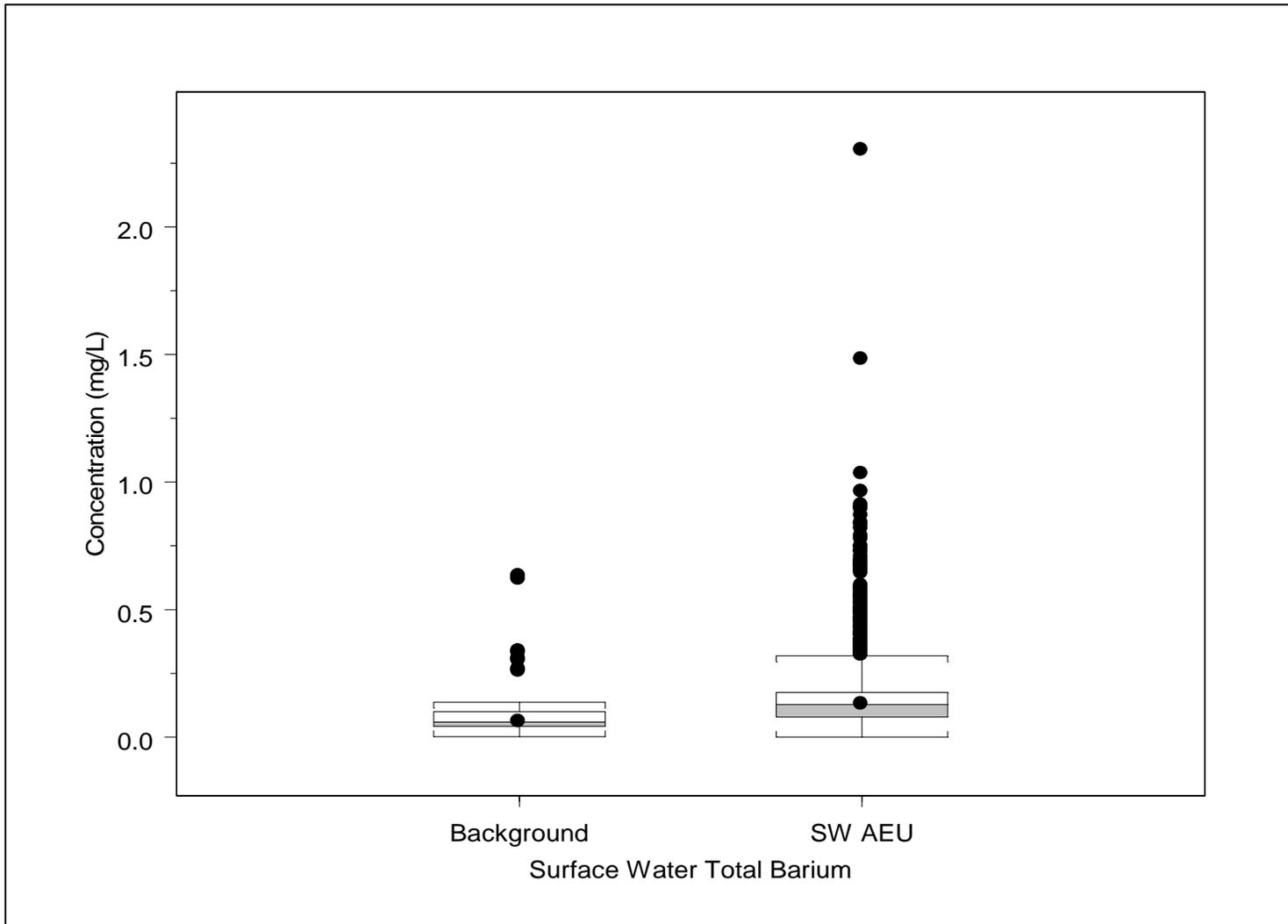
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



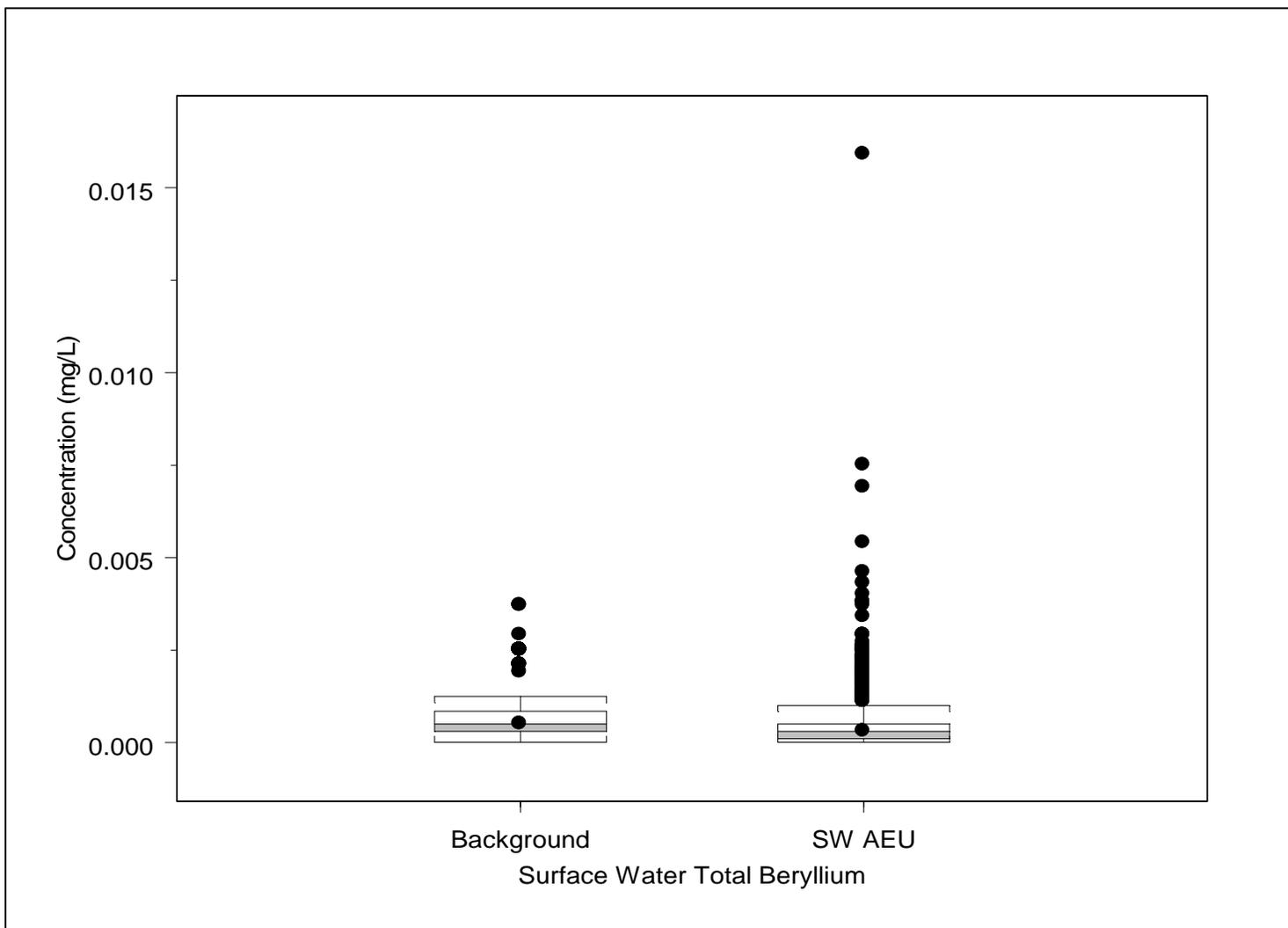
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



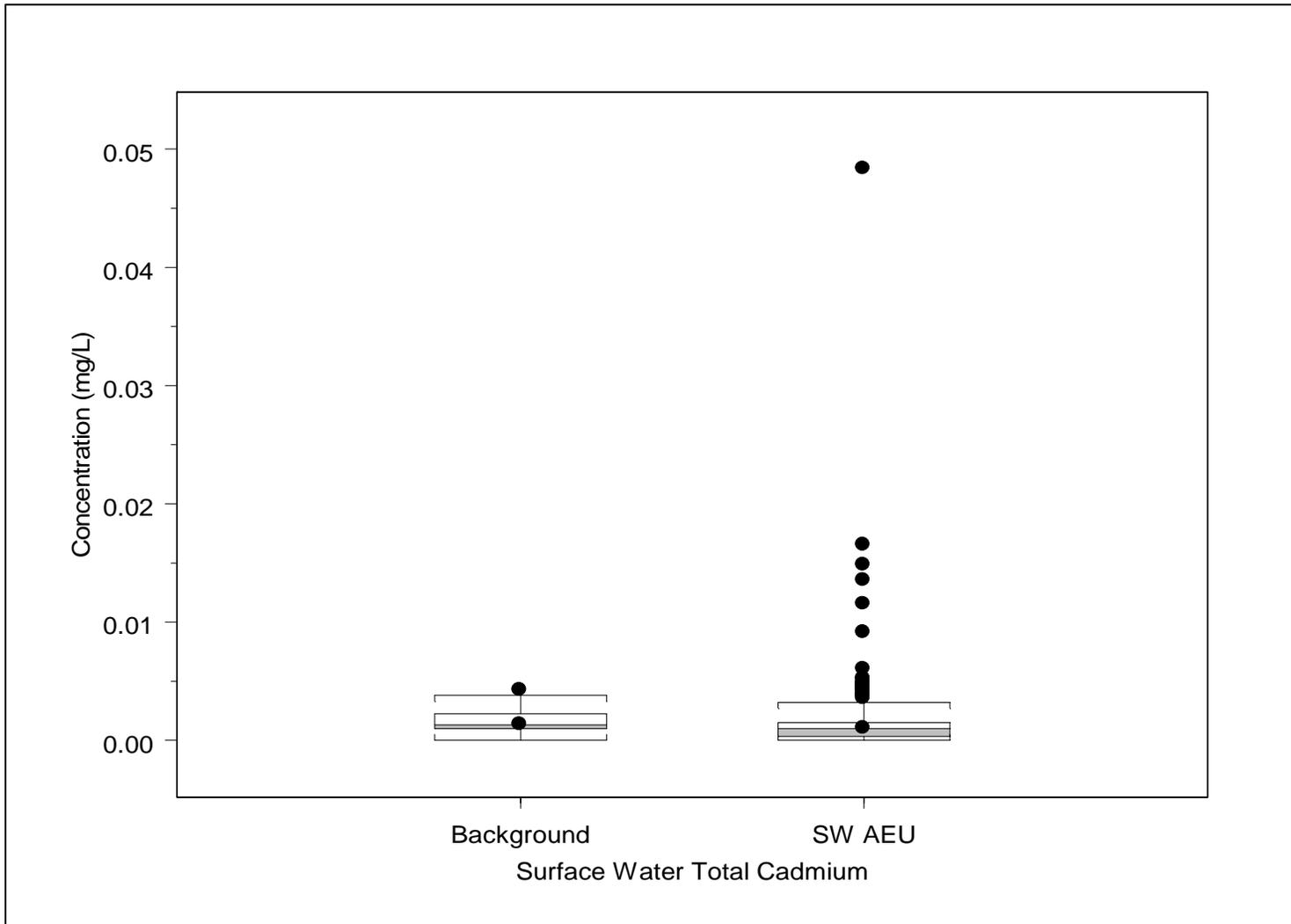
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



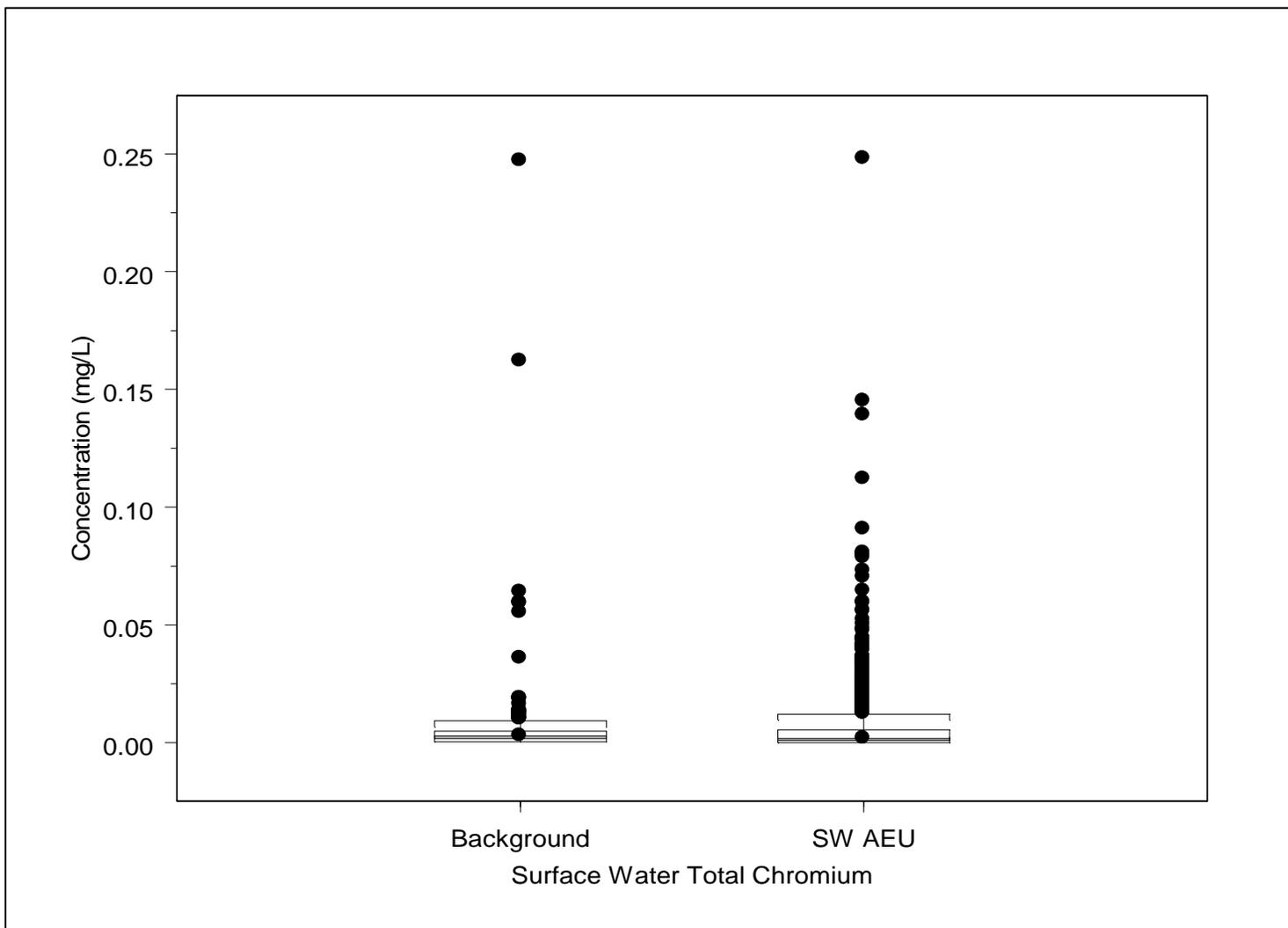
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



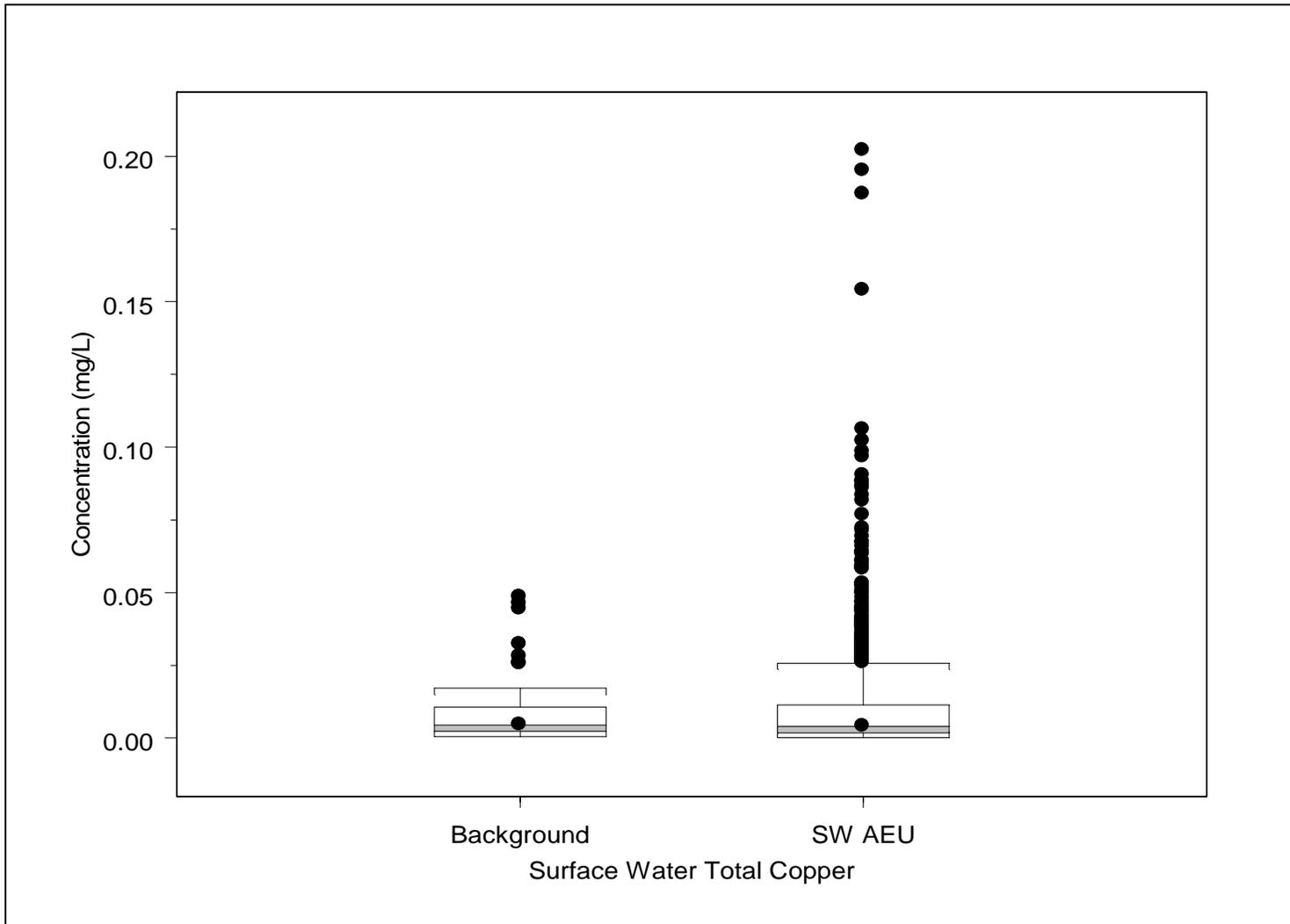
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



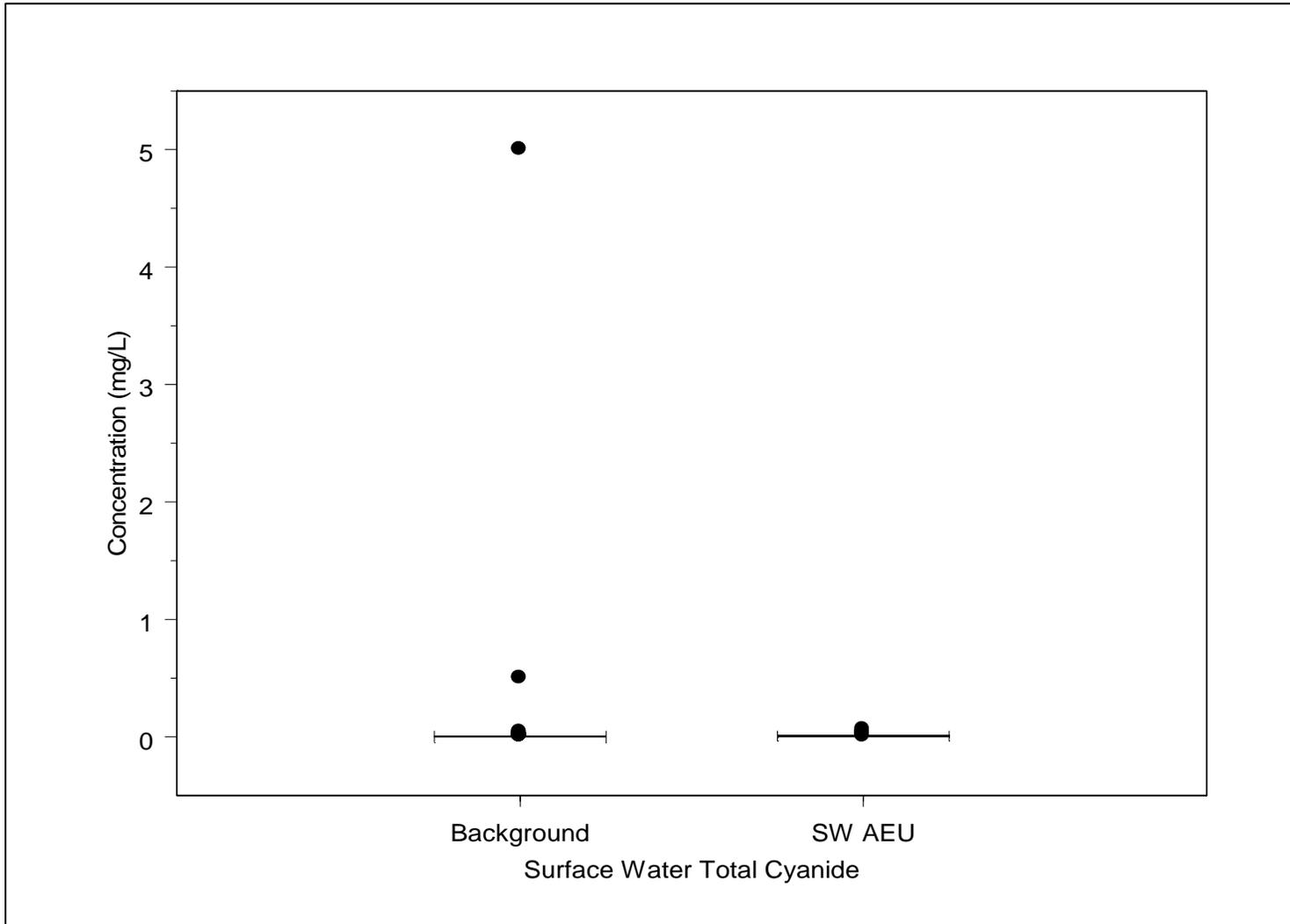
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.7  
SW AEU Surface Water Total Box Plots for Copper



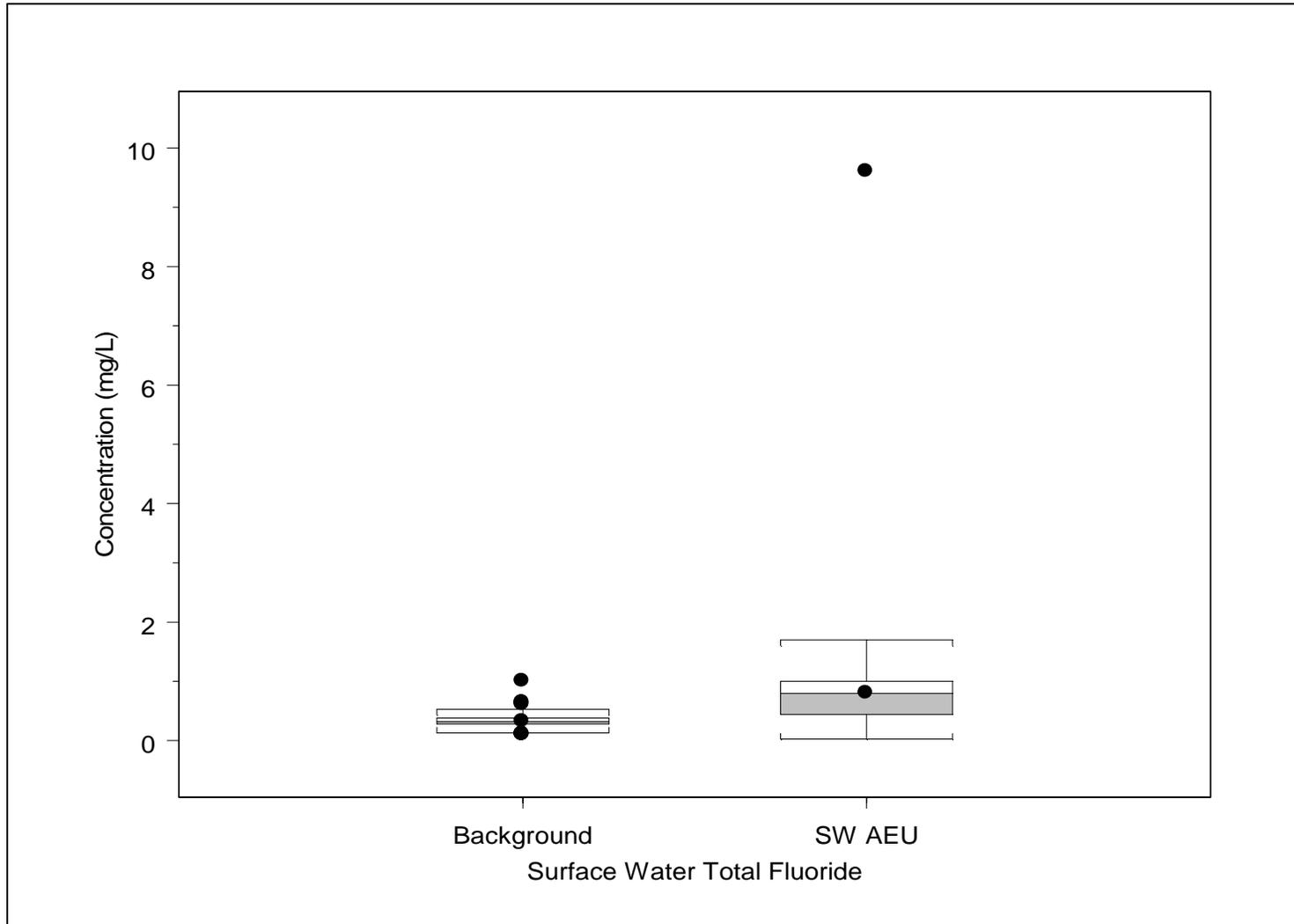
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.8  
SW AEU Surface Water Total Box Plots for Cyanide



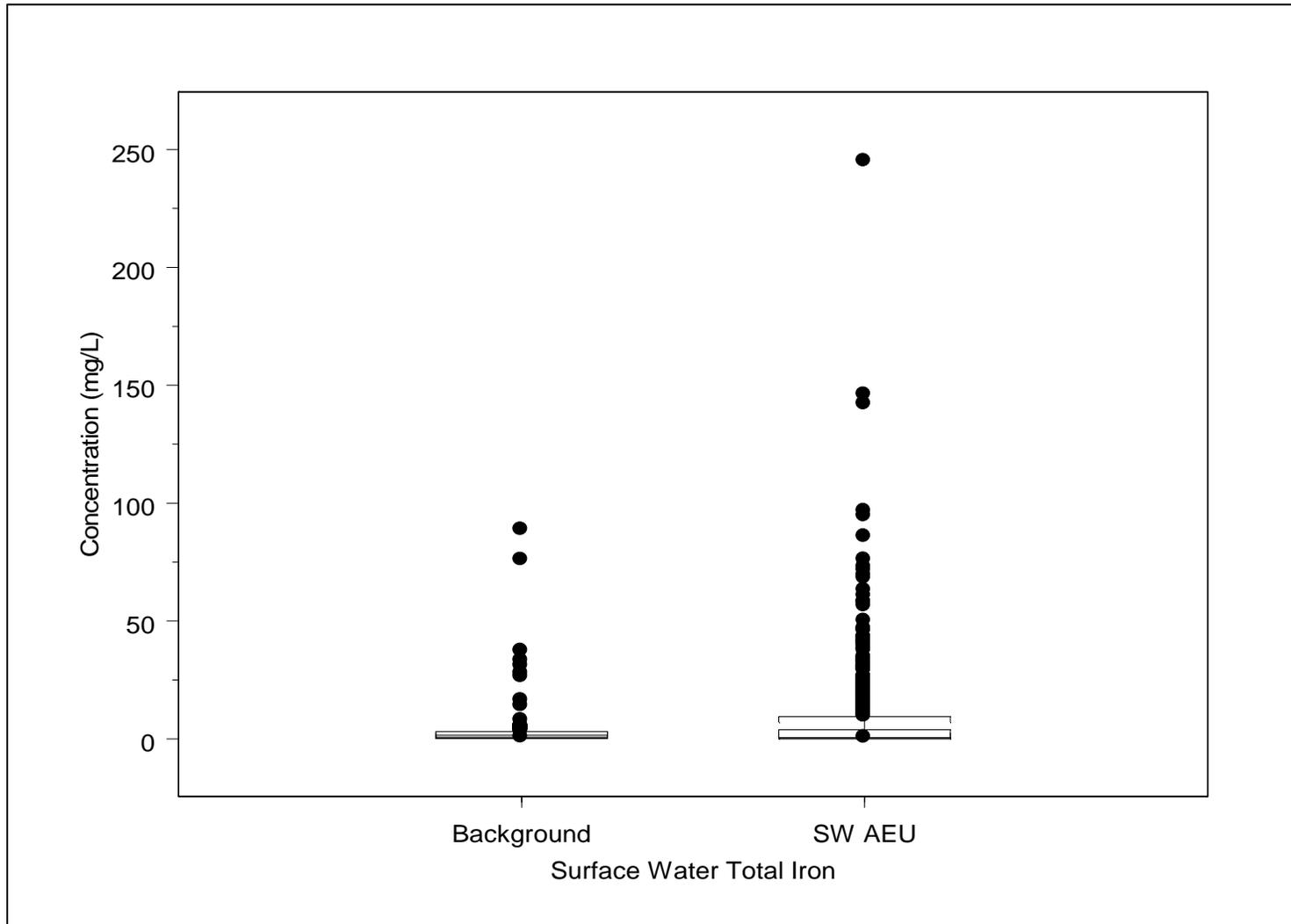
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.9  
SW AEU Surface Water Total Box Plots for Fluoride



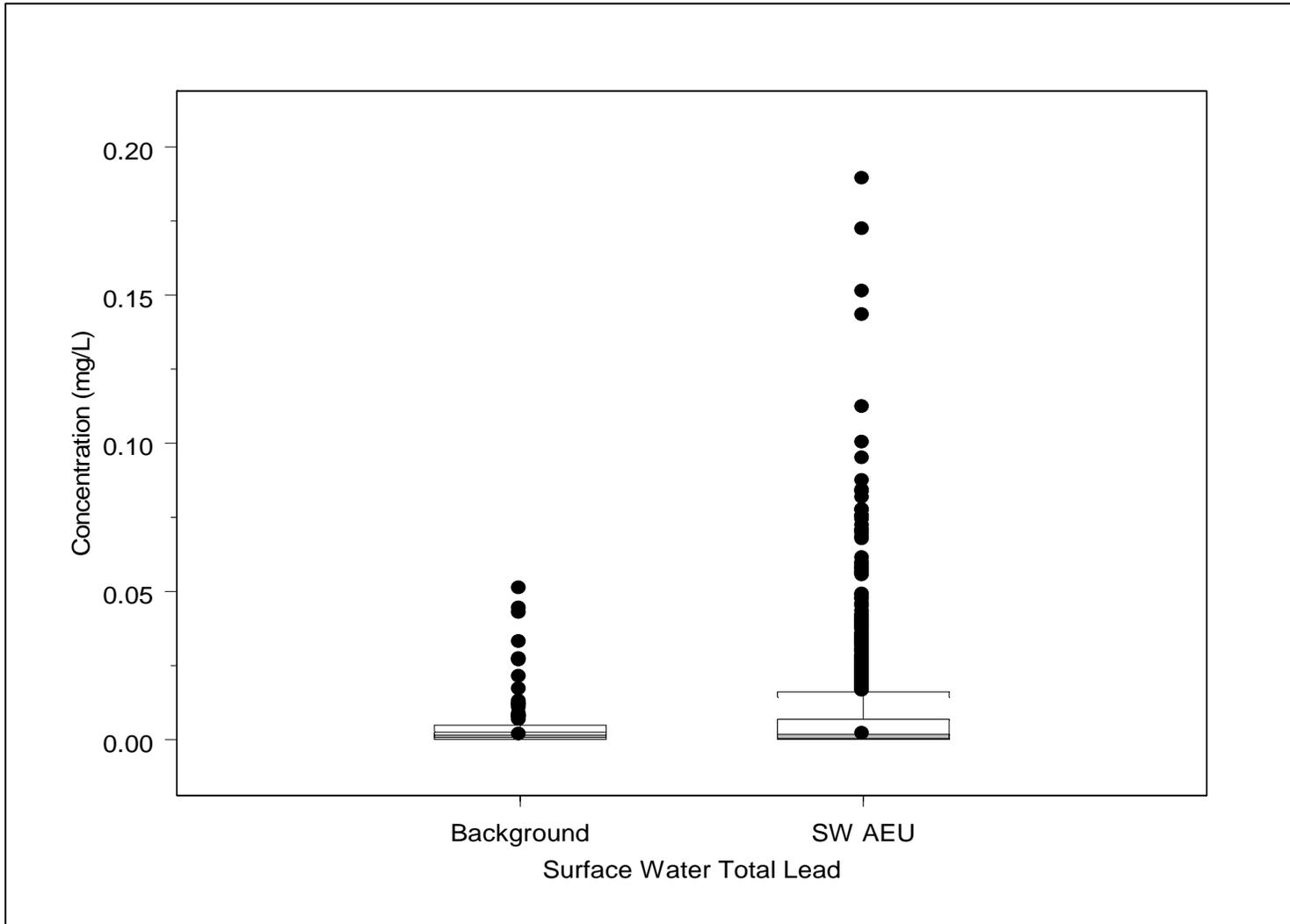
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



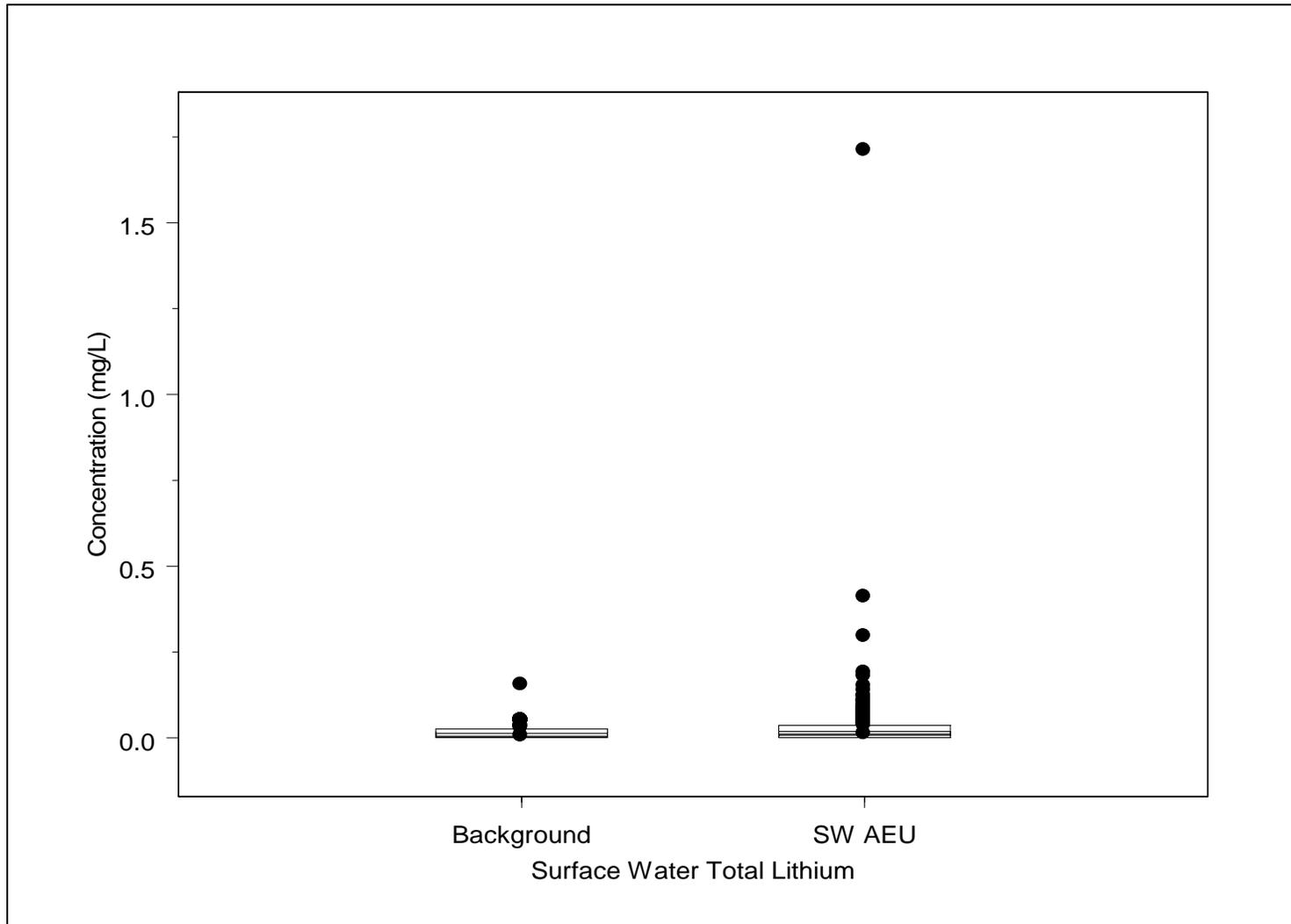
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.11  
SW AEU Surface Water Total Box Plots for Lead



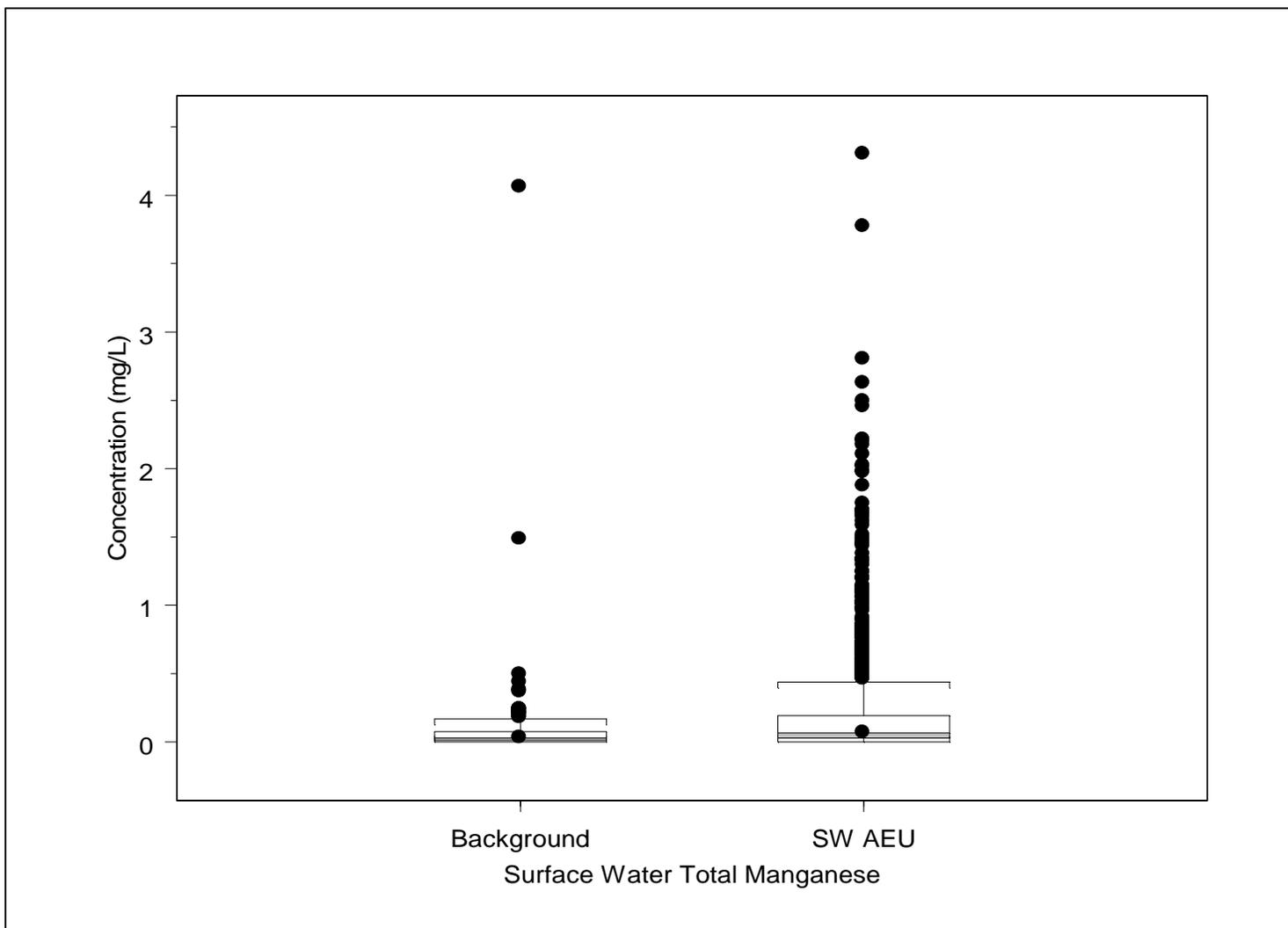
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.12  
SW AEU Surface Water Total Box Plots for Lithium



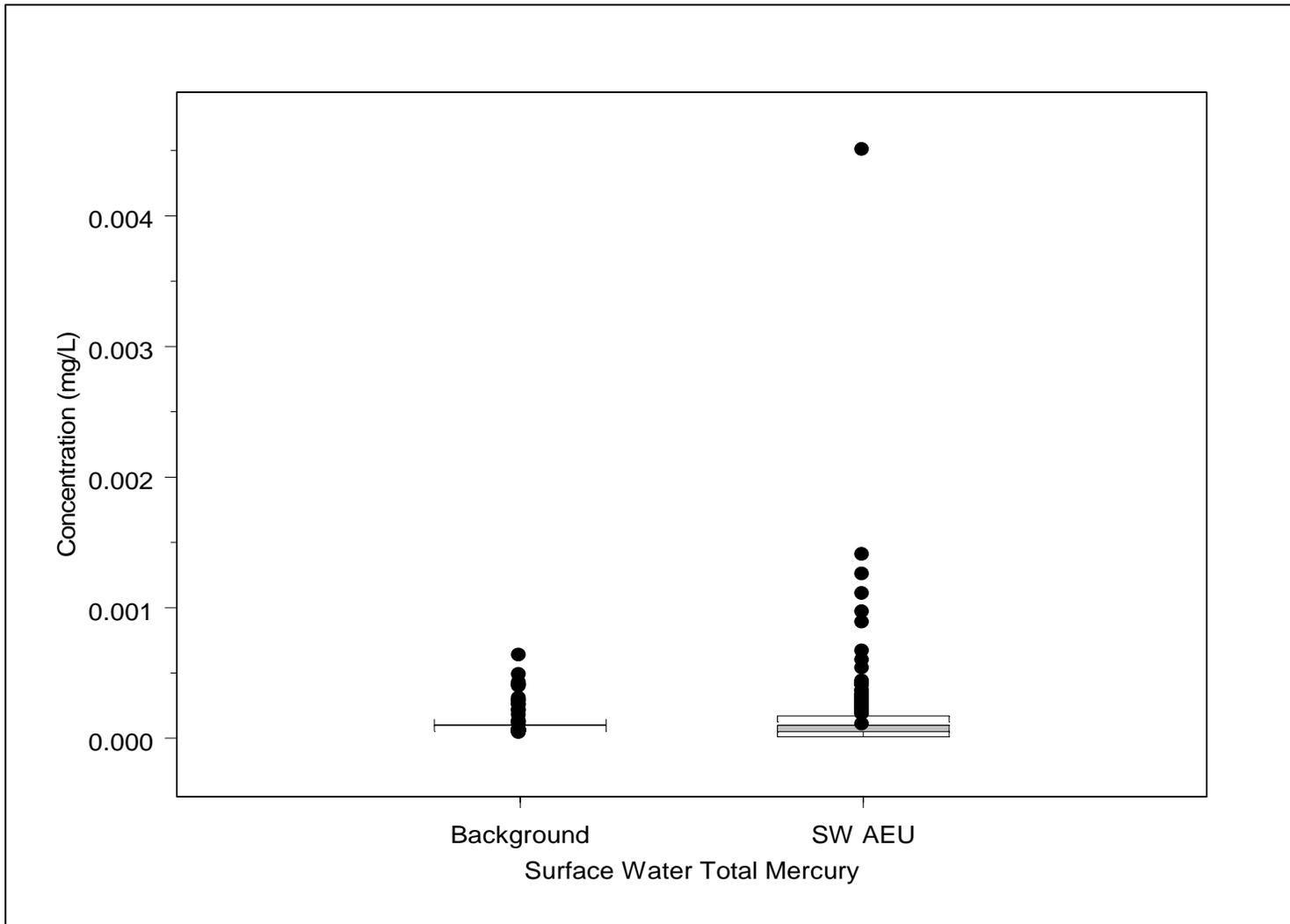
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.13  
SW AEU Surface Water Total Box Plots for Manganese



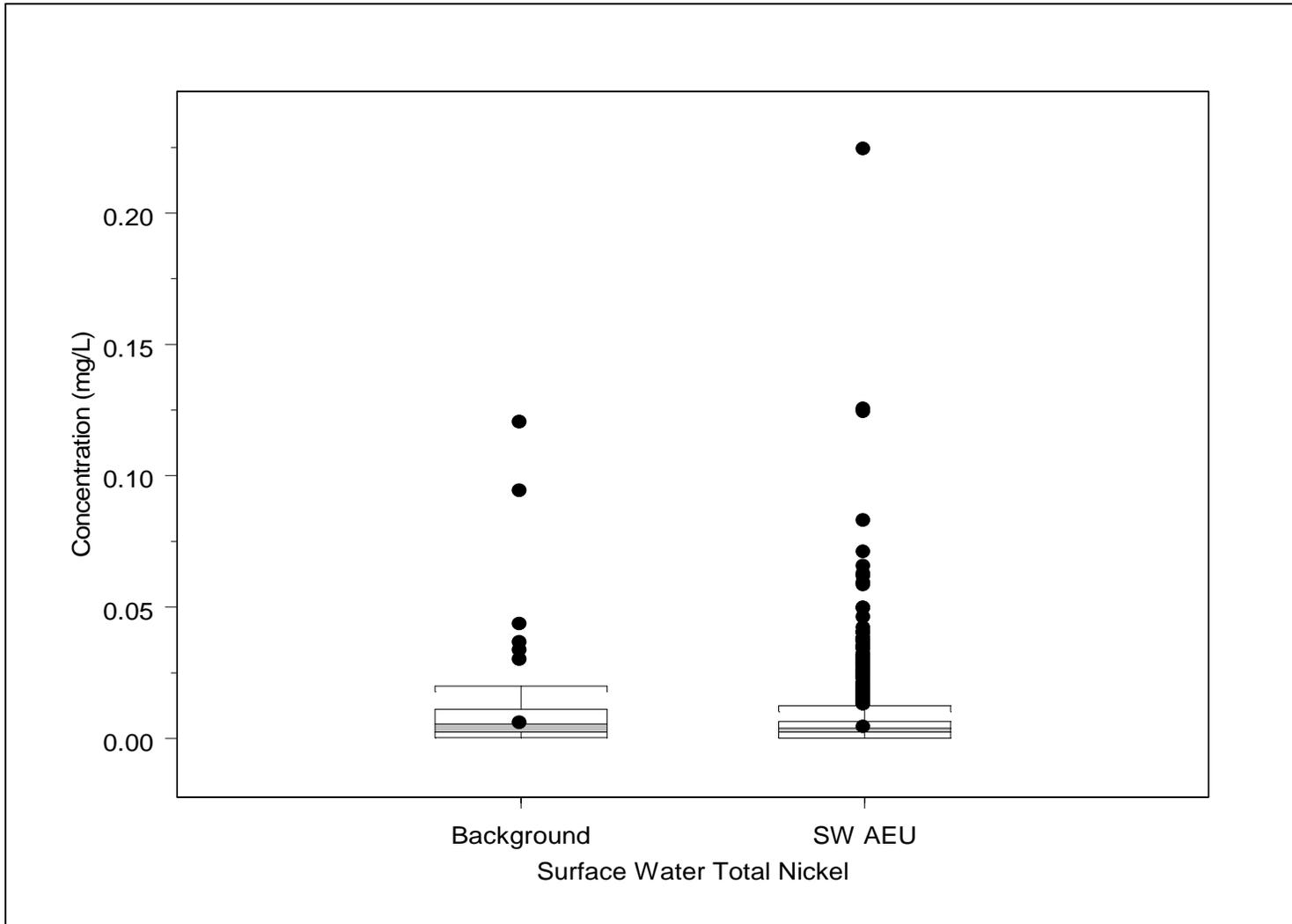
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.14  
SW AEU Surface Water Total Box Plots for Mercury



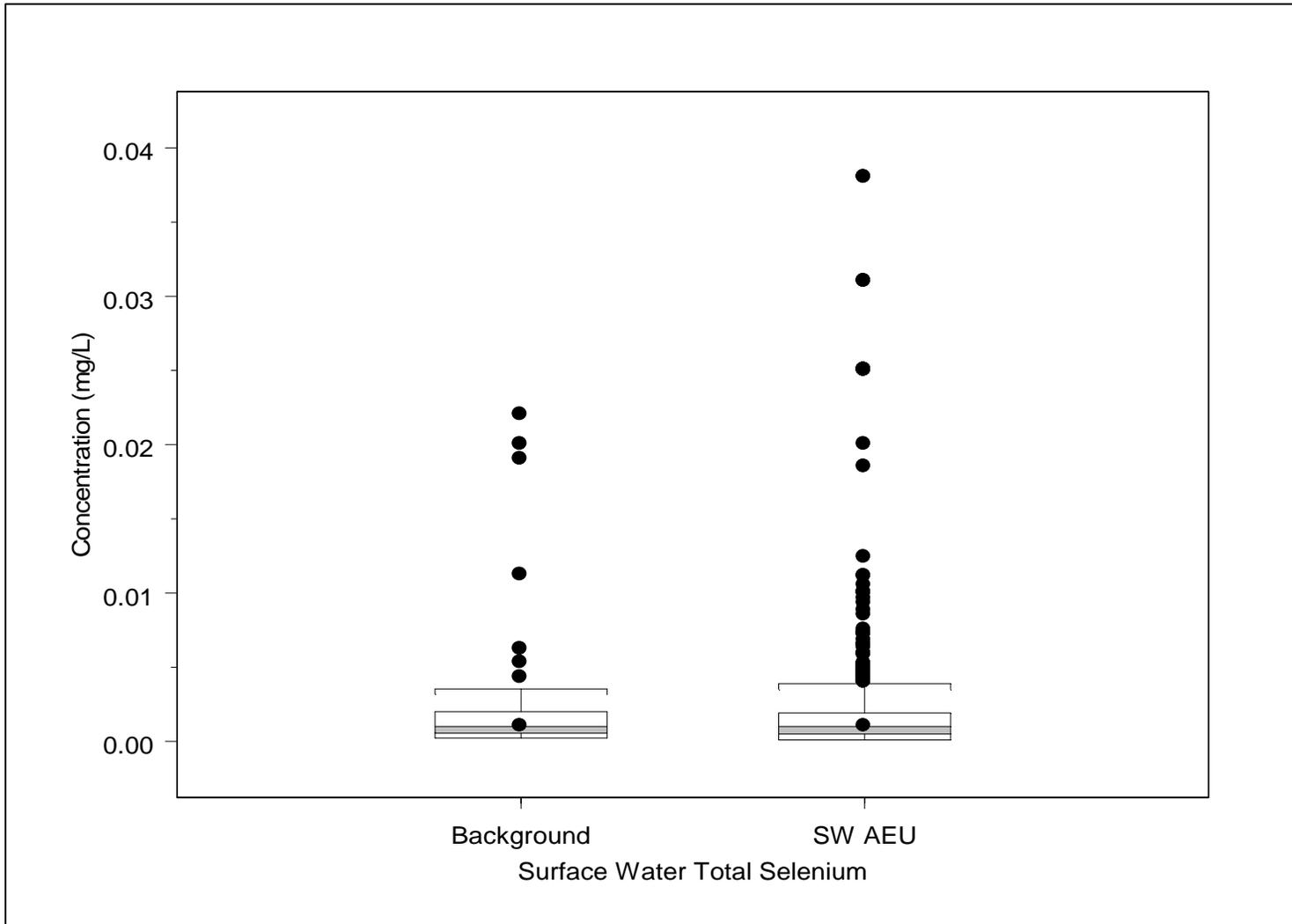
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.15  
SW AEU Surface Water Total Box Plots for Nickel



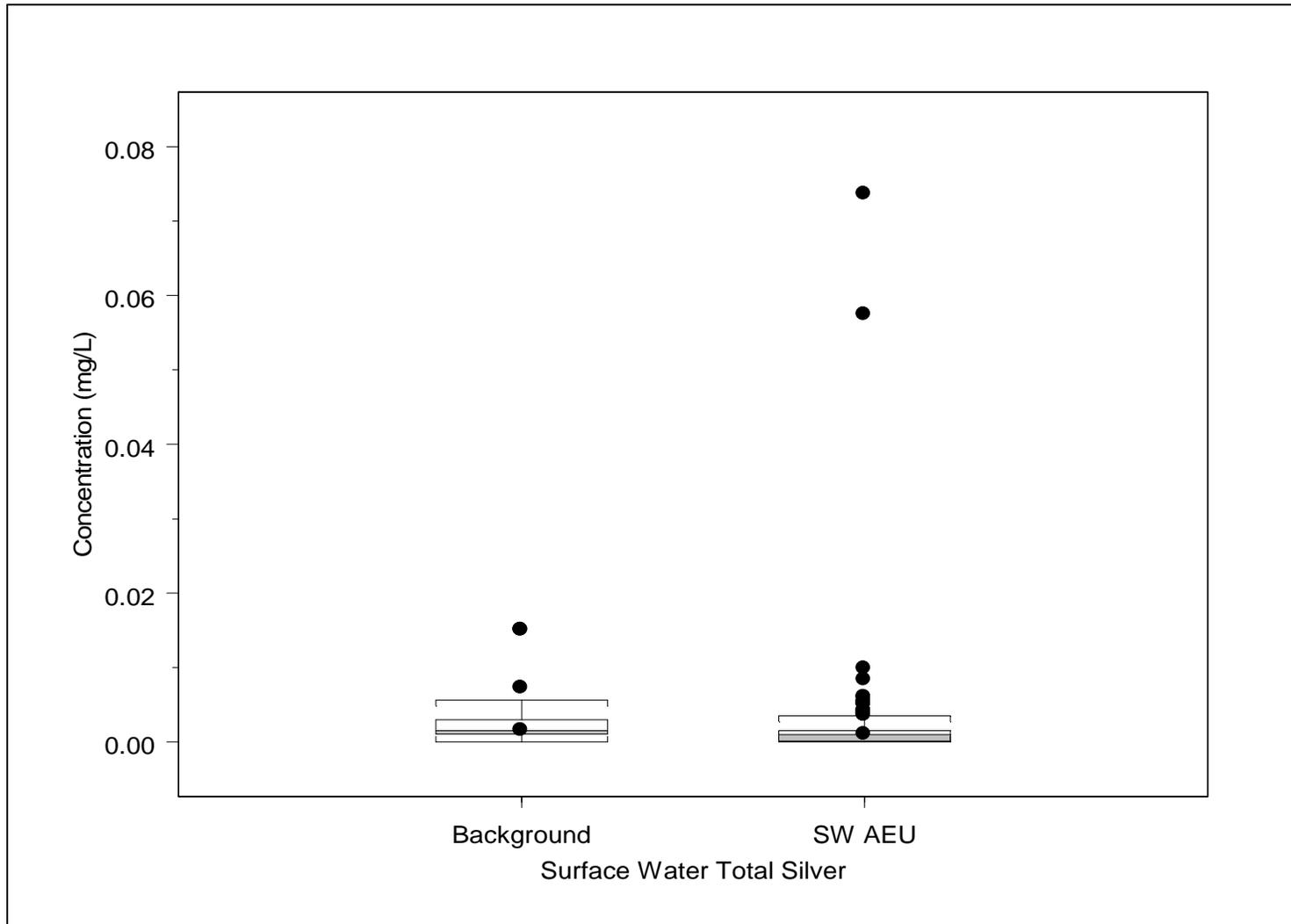
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.16  
SW AEU Surface Water Total Box Plots for Selenium



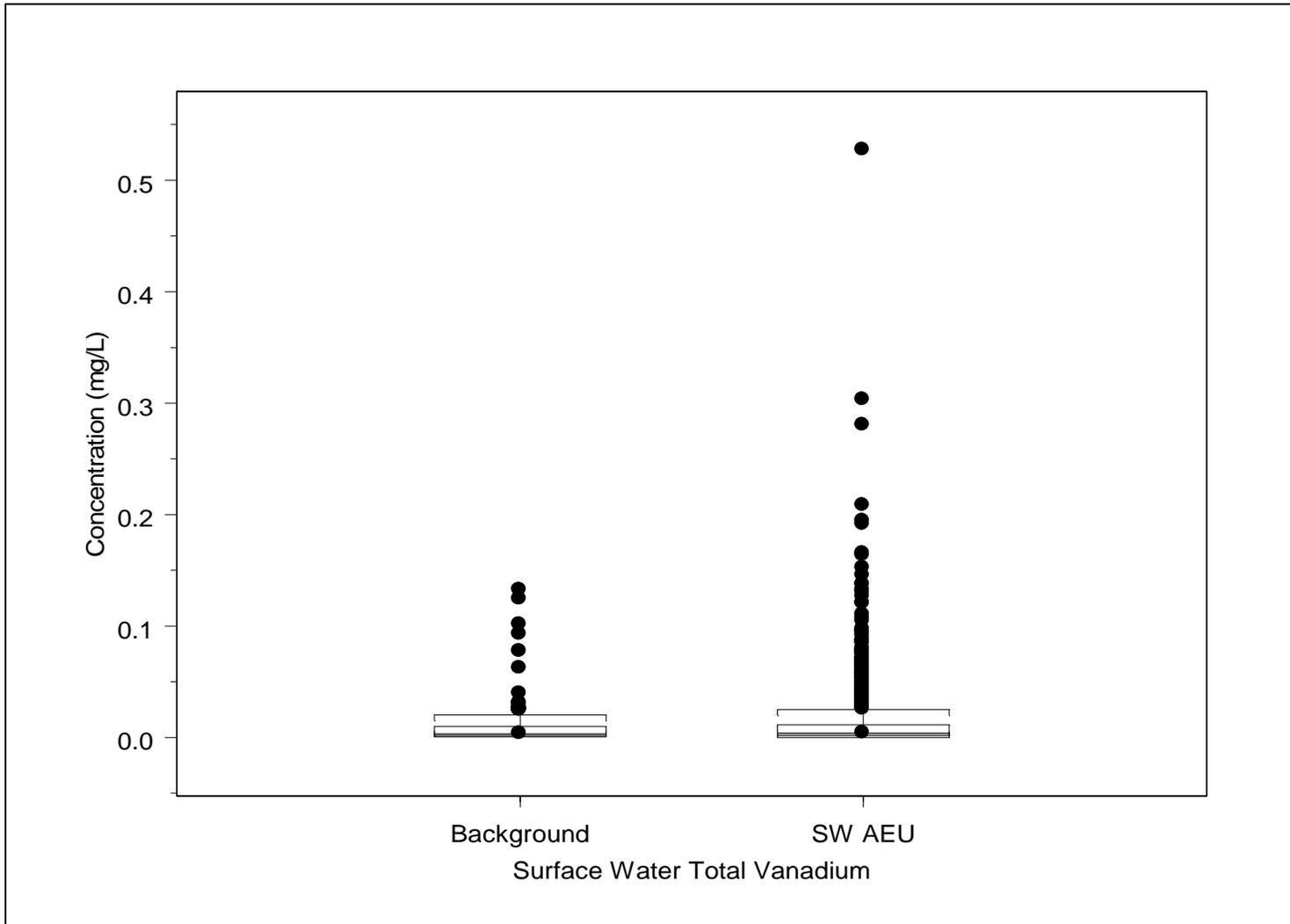
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.17  
SW AEU Surface Water Total Box Plots for Silver



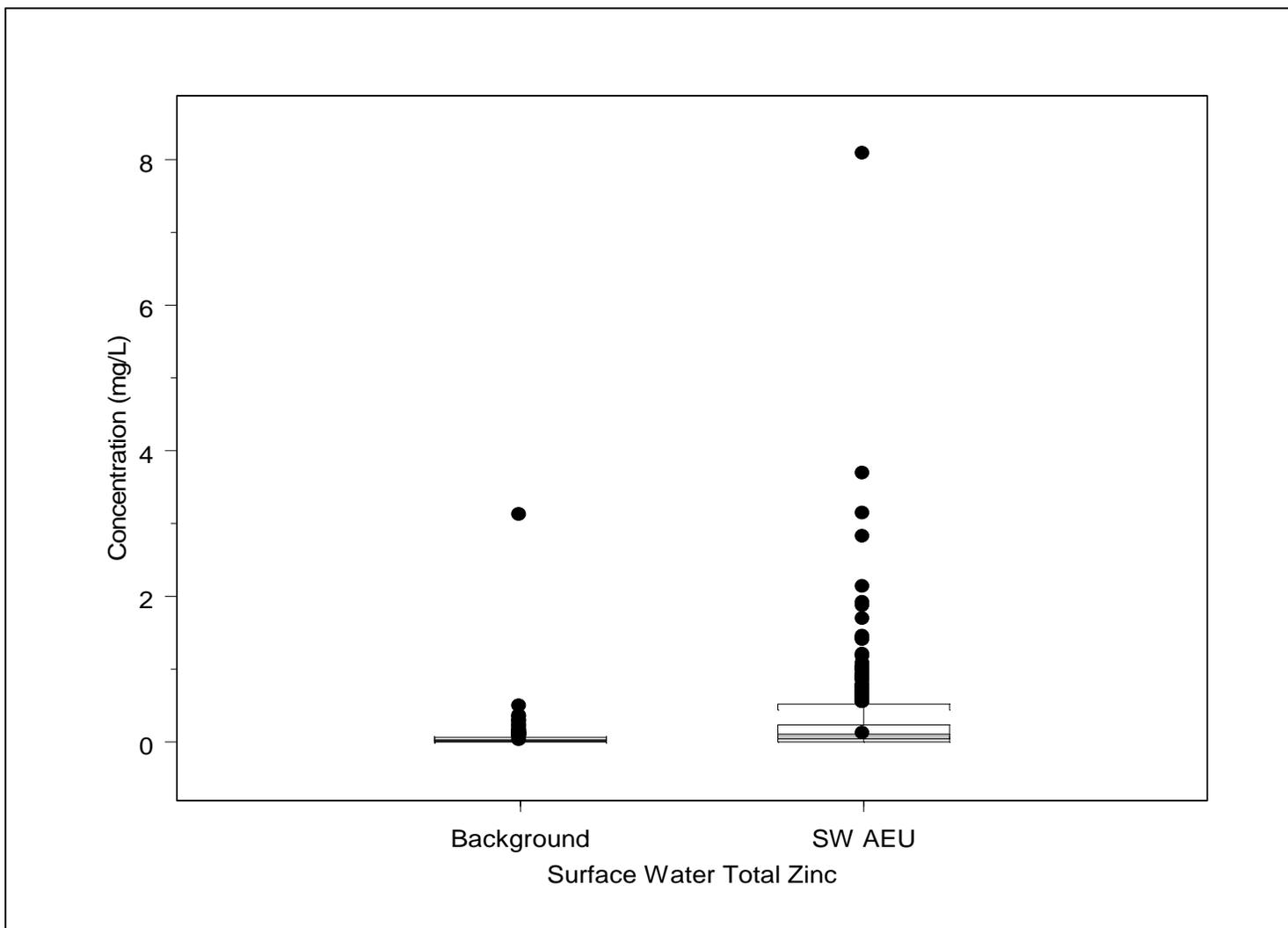
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.18  
SW AEU Surface Water Total Box Plots for Vanadium



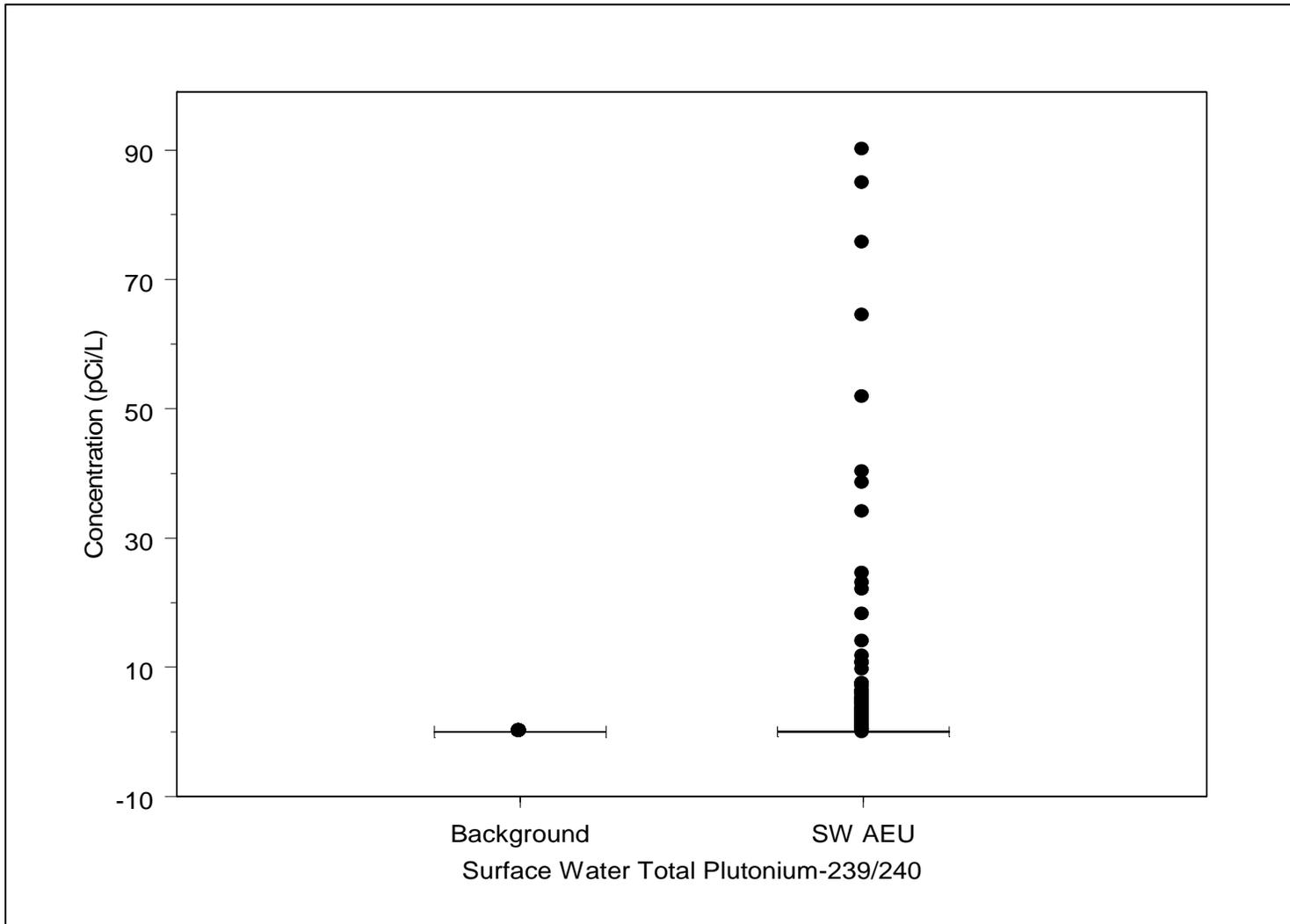
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.19  
SW AEU Surface Water Total Box Plots for Zinc



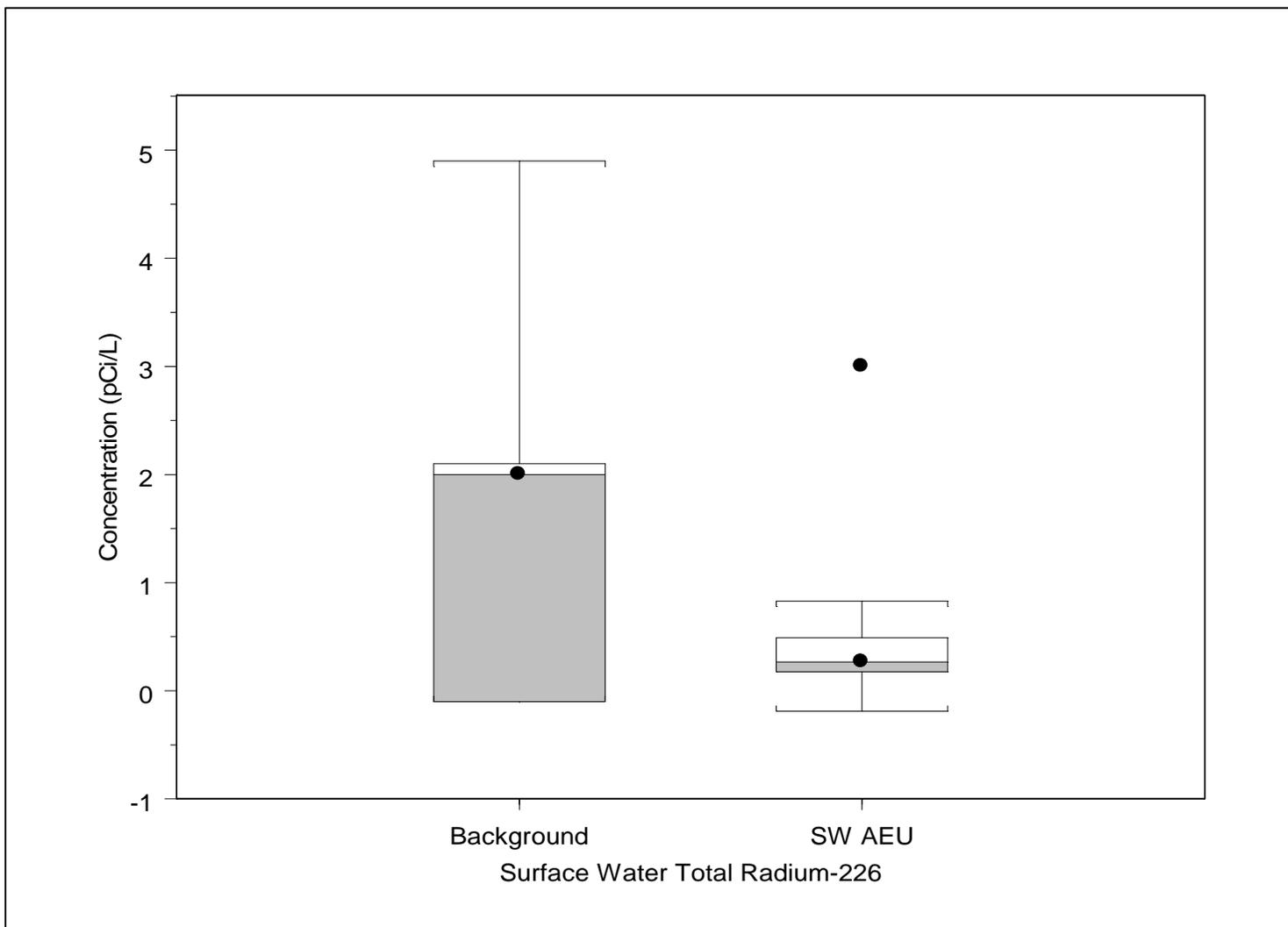
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.20  
SW AEU Surface Water Total Box Plots for Plutonium-239/240



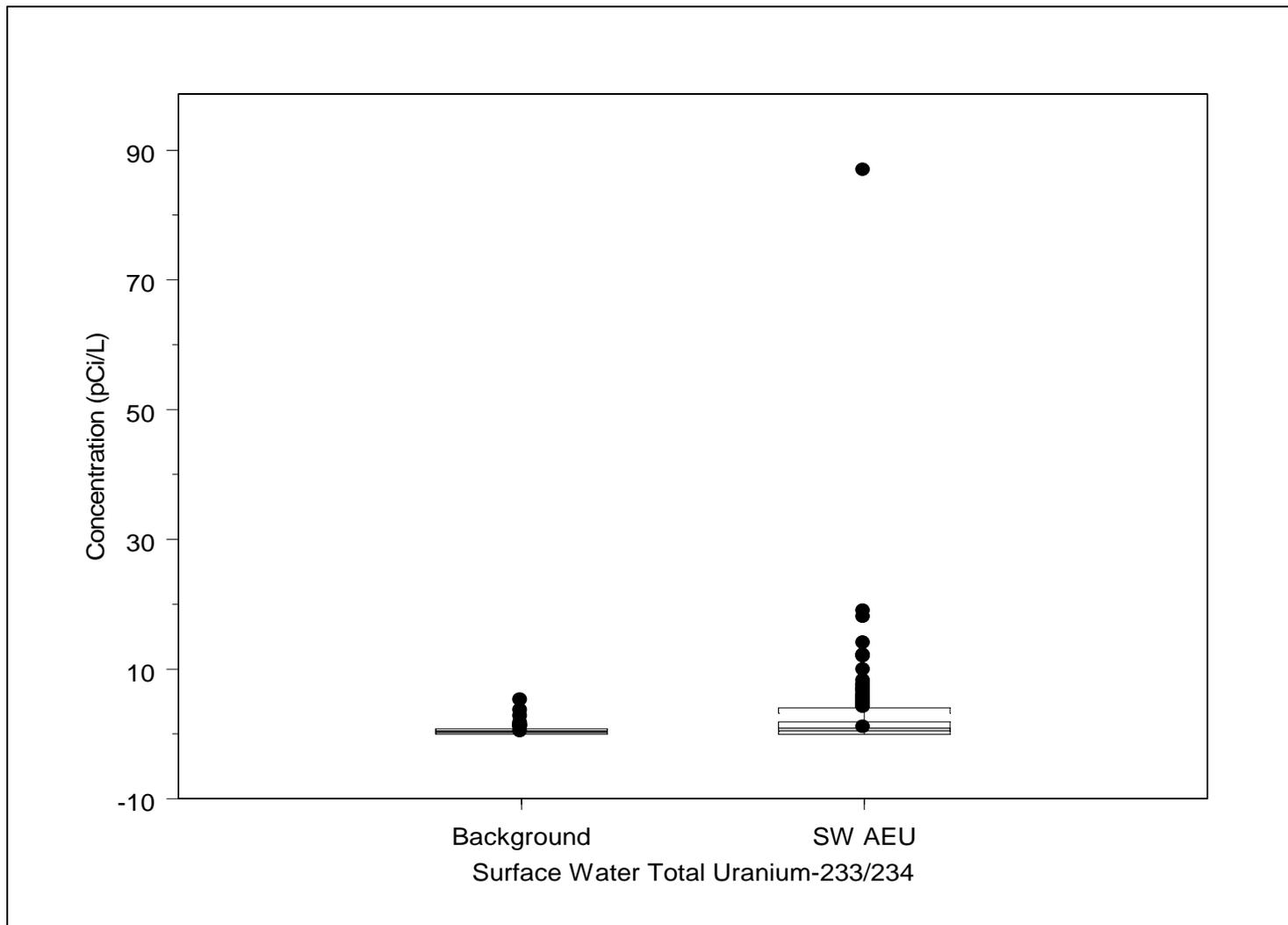
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.21  
SW AEU Surface Water Total Box Plots for Radium-226



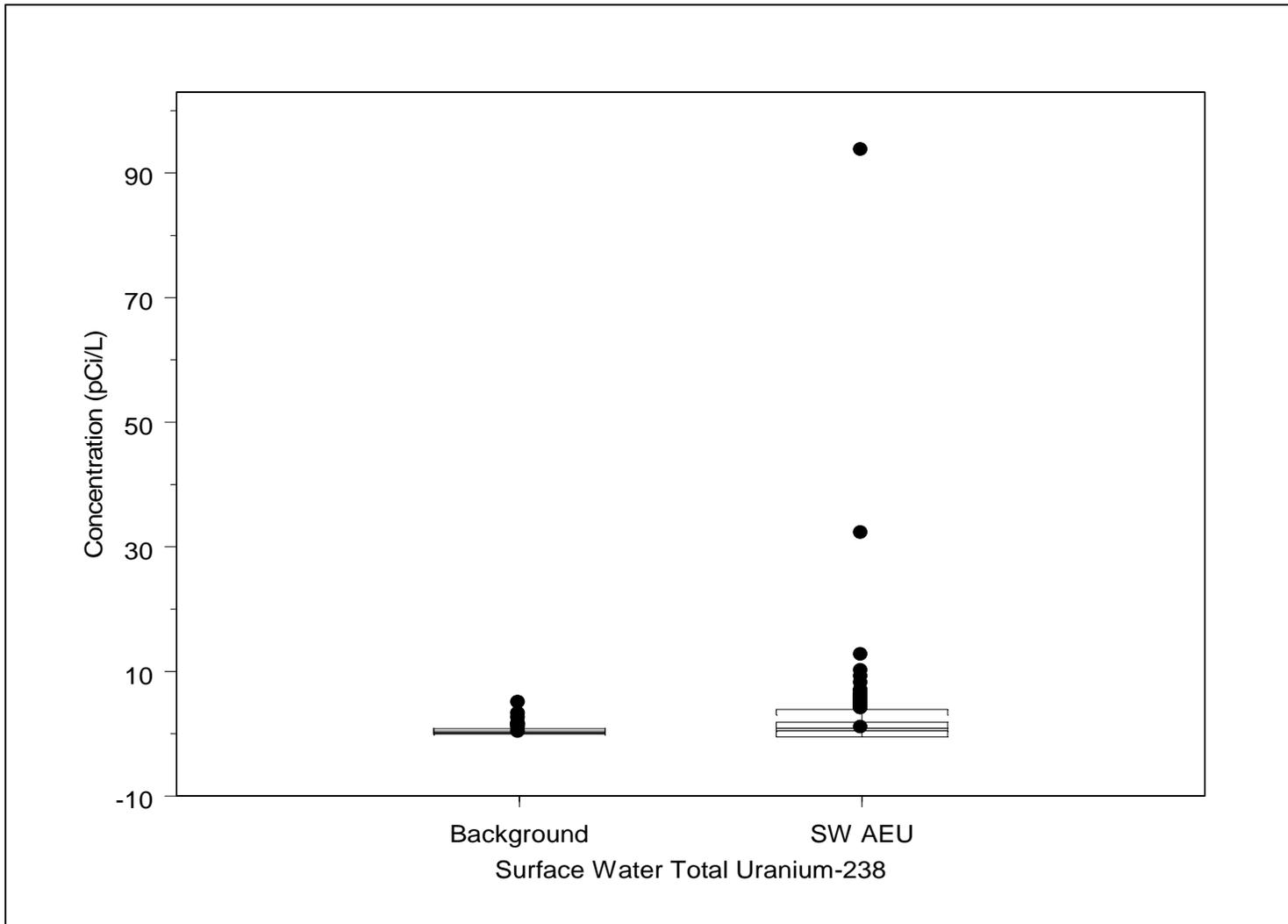
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.22  
SW AEU Surface Water Total Box Plots for Uranium-233/234



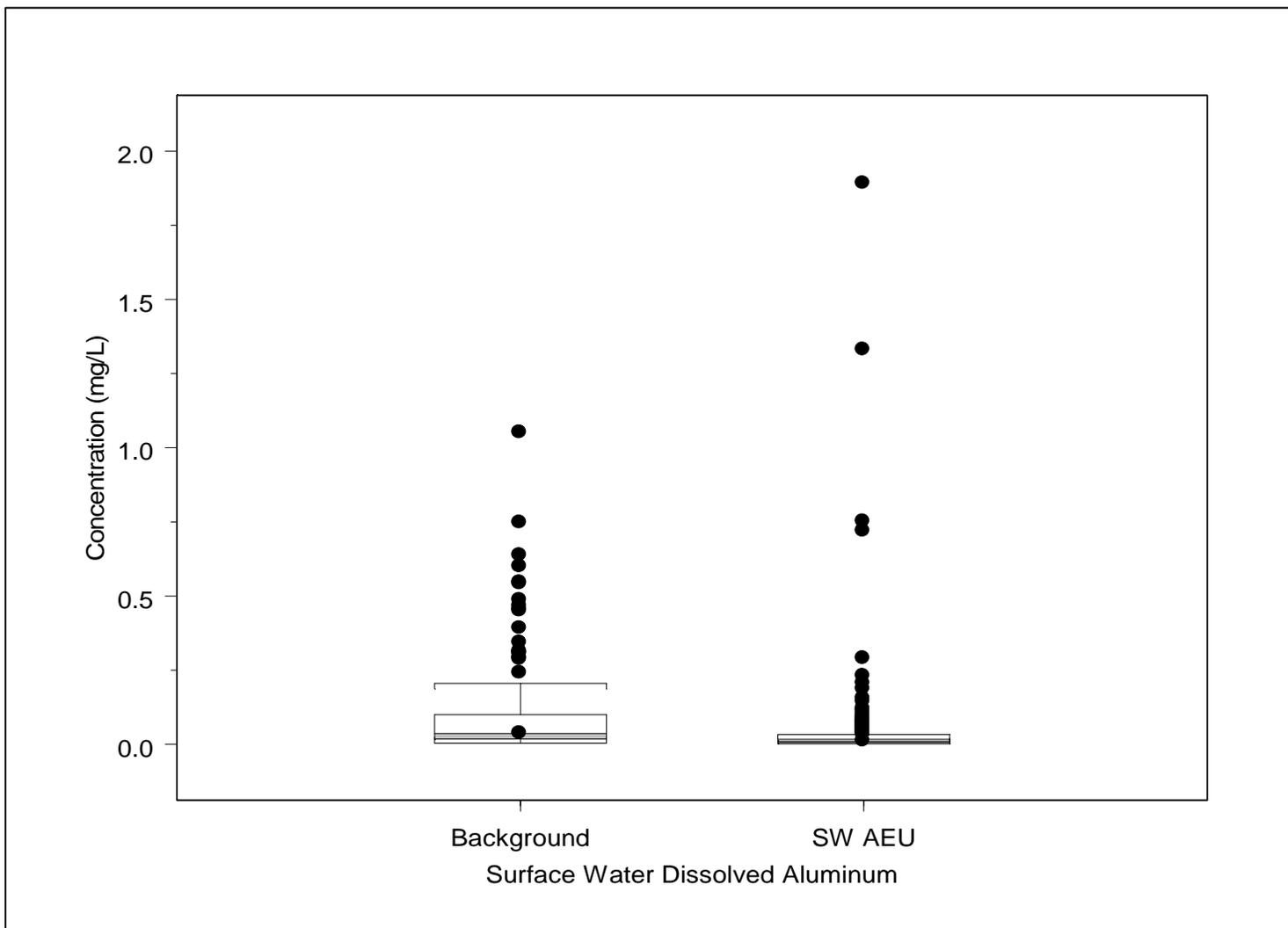
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.23  
SW AEU Surface Water Total Box Plots for Uranium-238



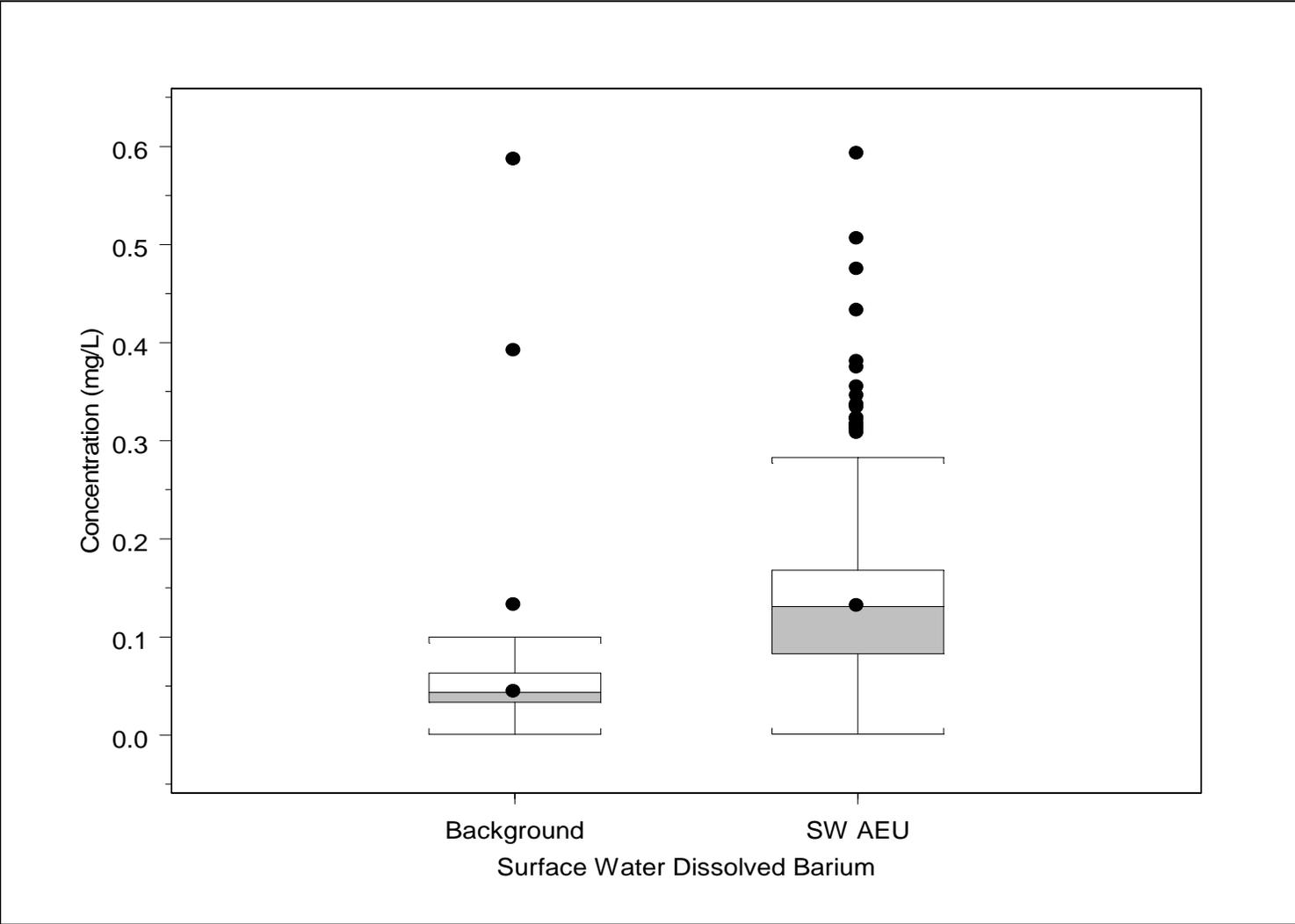
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.24  
SW AEU Surface Water Dissolved Box Plots for Aluminum



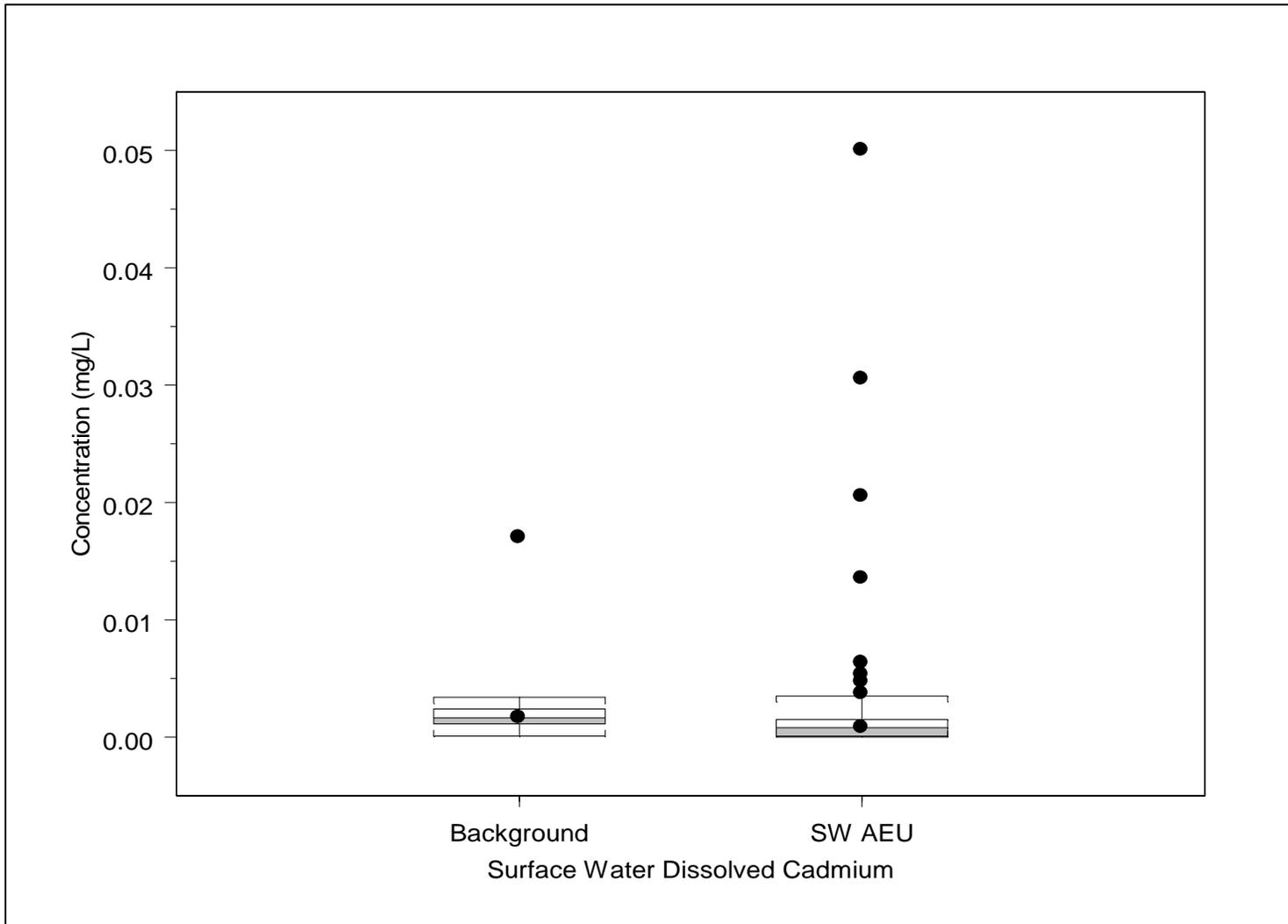
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.25  
SW AEU Surface Water Dissolved Box Plots for Barium



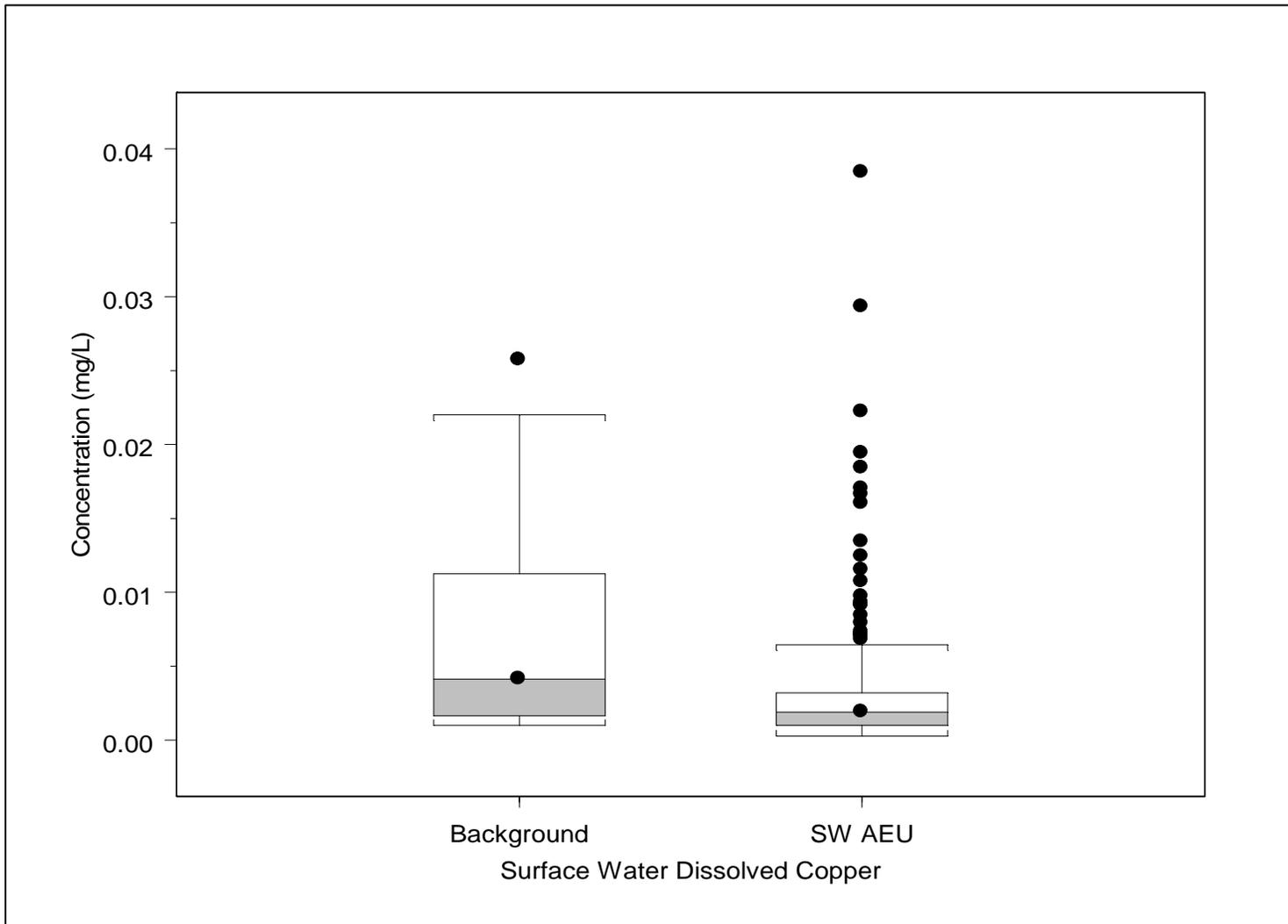
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.26  
SW AEU Surface Water Dissolved Box Plots for Cadmium



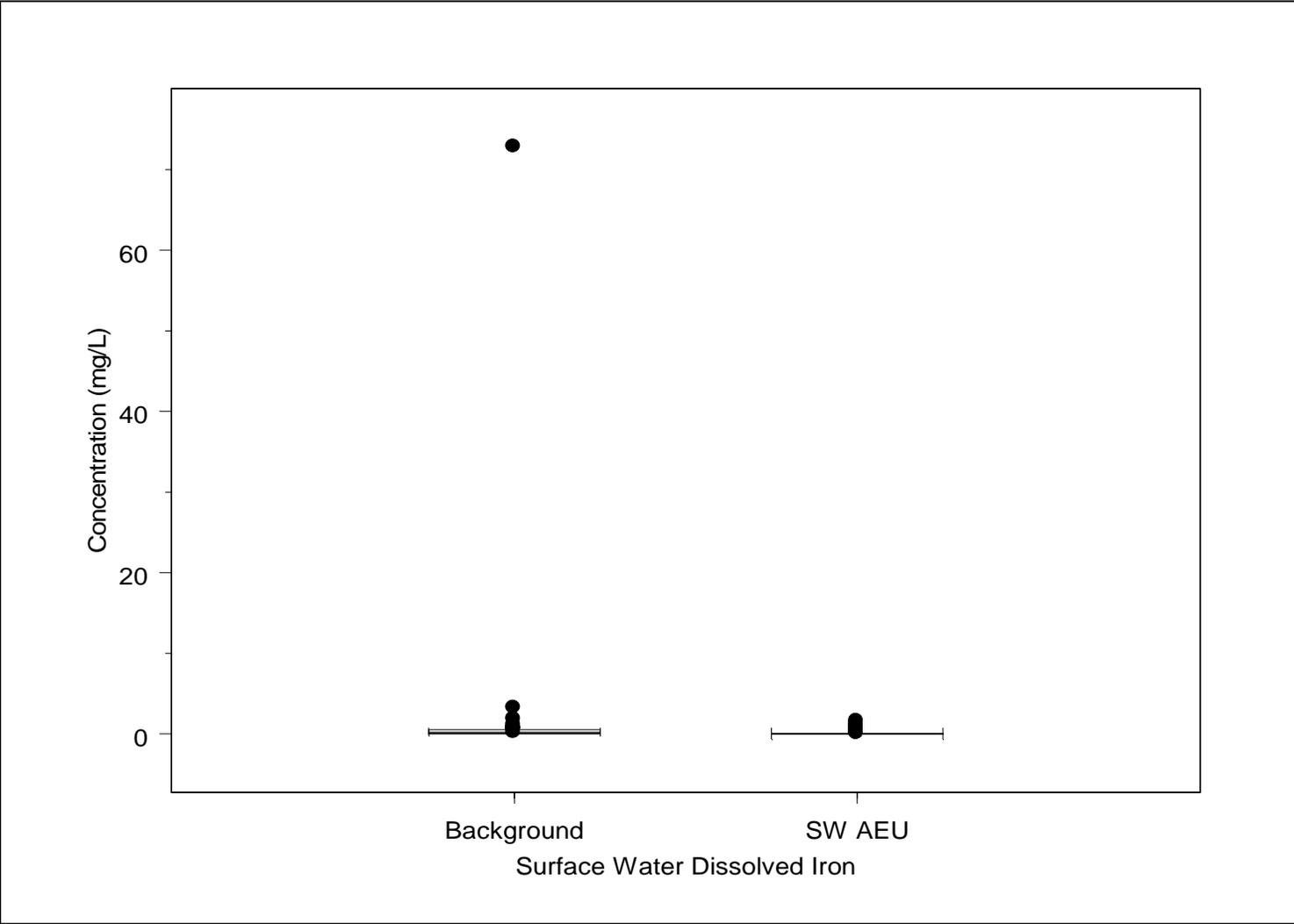
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.27  
SW AEU Surface Water Dissolved Box Plots for Copper



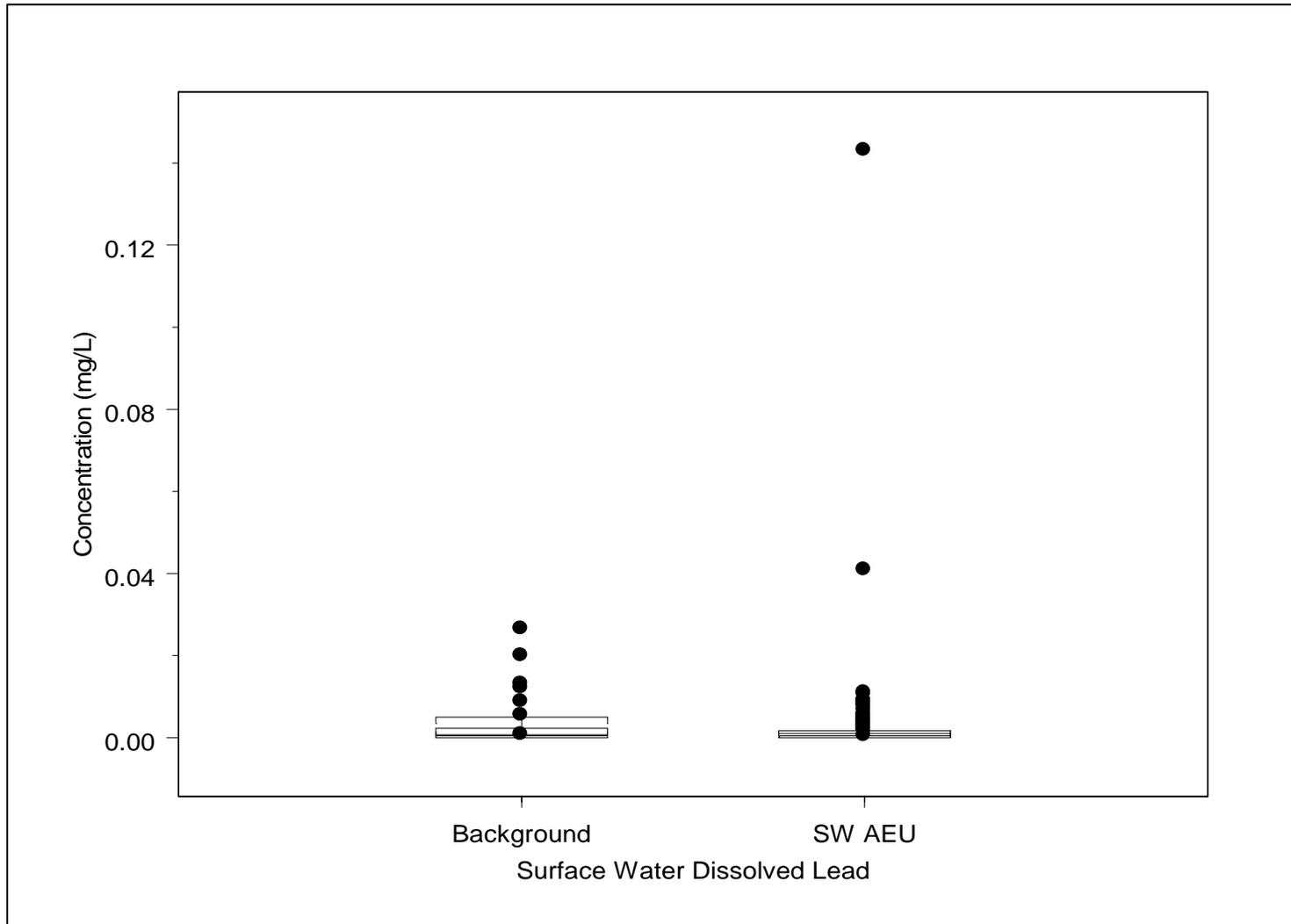
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.28  
SW AEU Surface Water Dissolved Box Plots for Iron



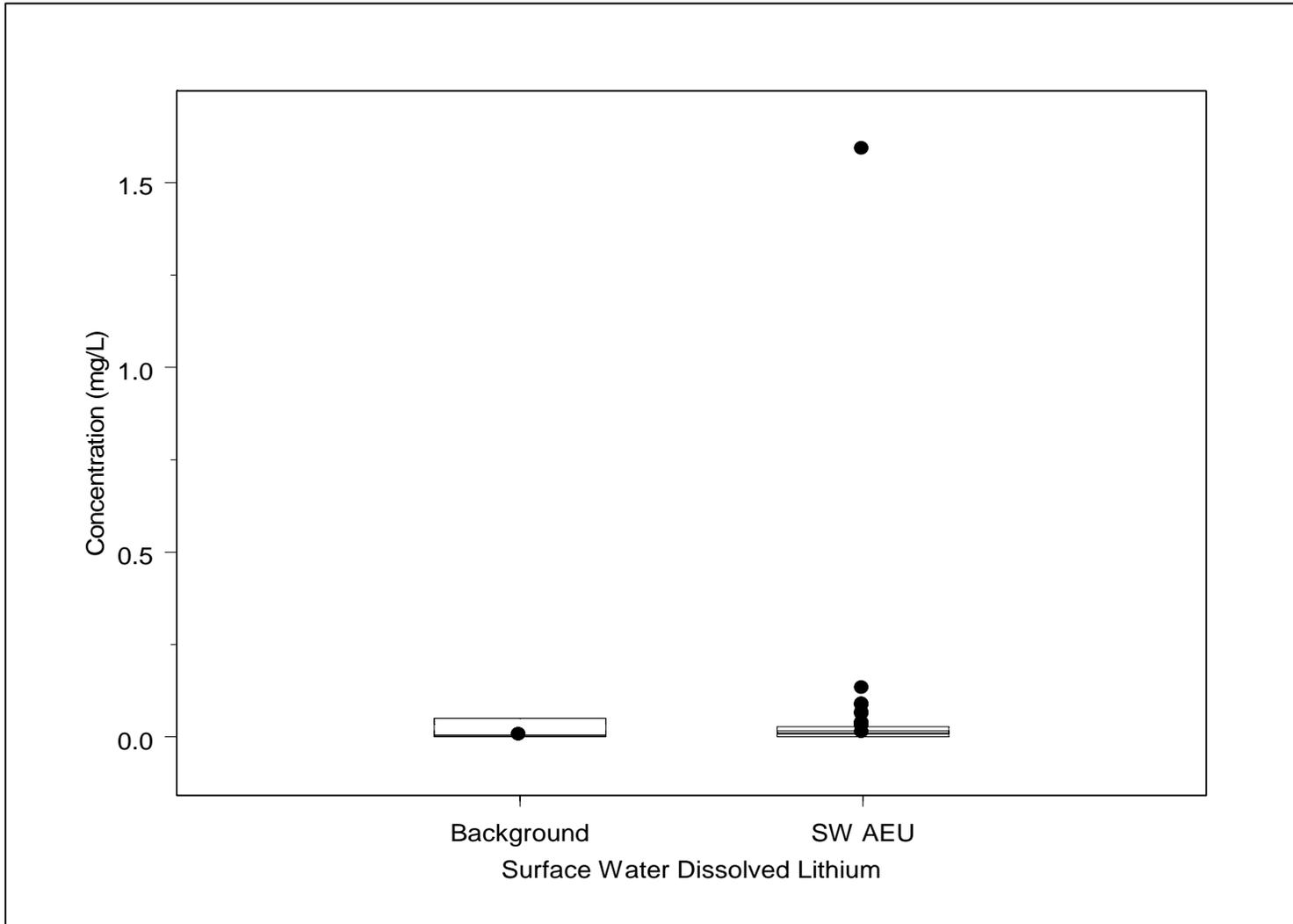
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.29  
SW AEU Surface Water Dissolved Box Plots for Lead



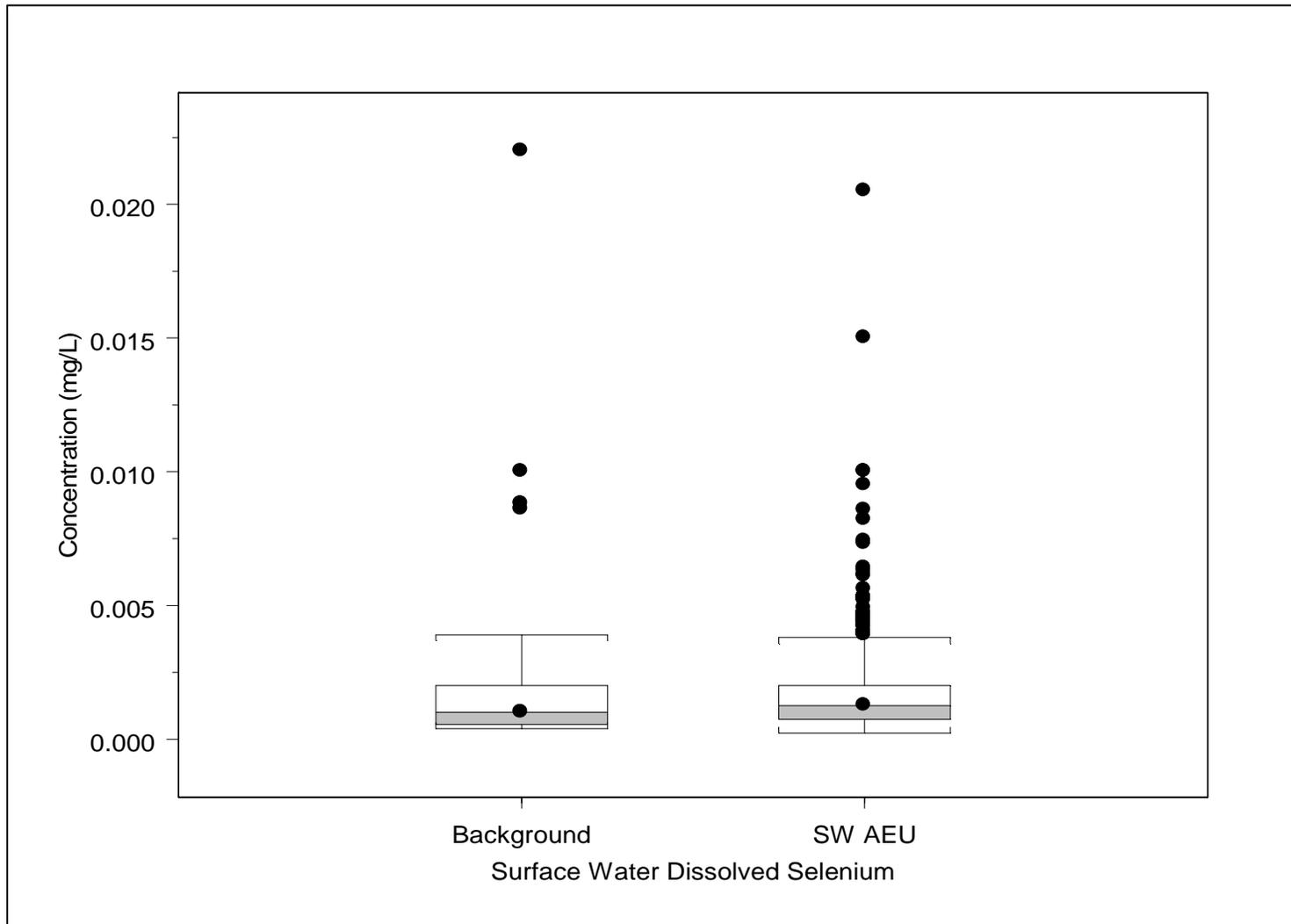
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.30  
SW AEU Surface Water Dissolved Box Plots for Lithium



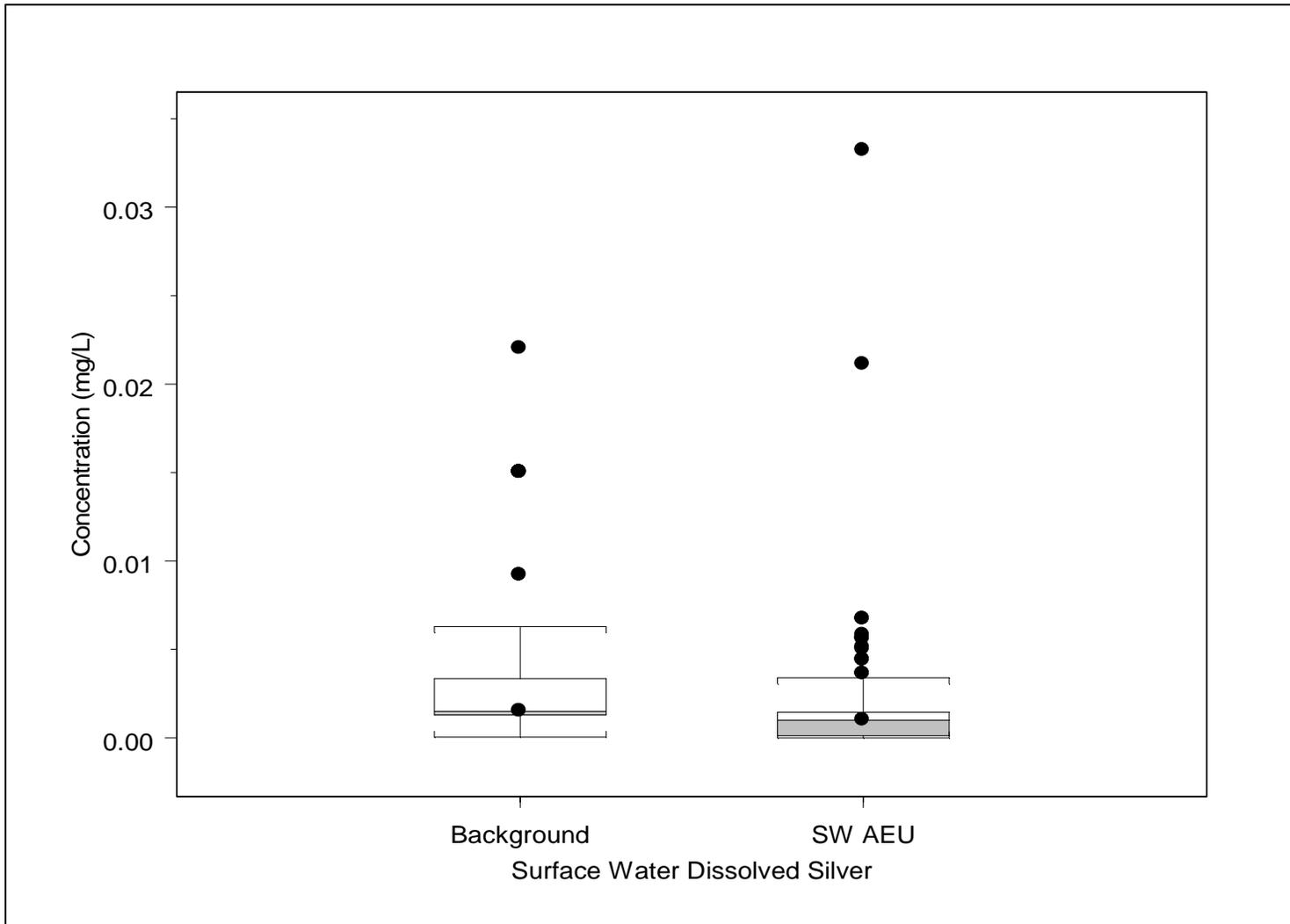
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.31  
SW AEU Surface Water Dissolved Box Plots for Selenium



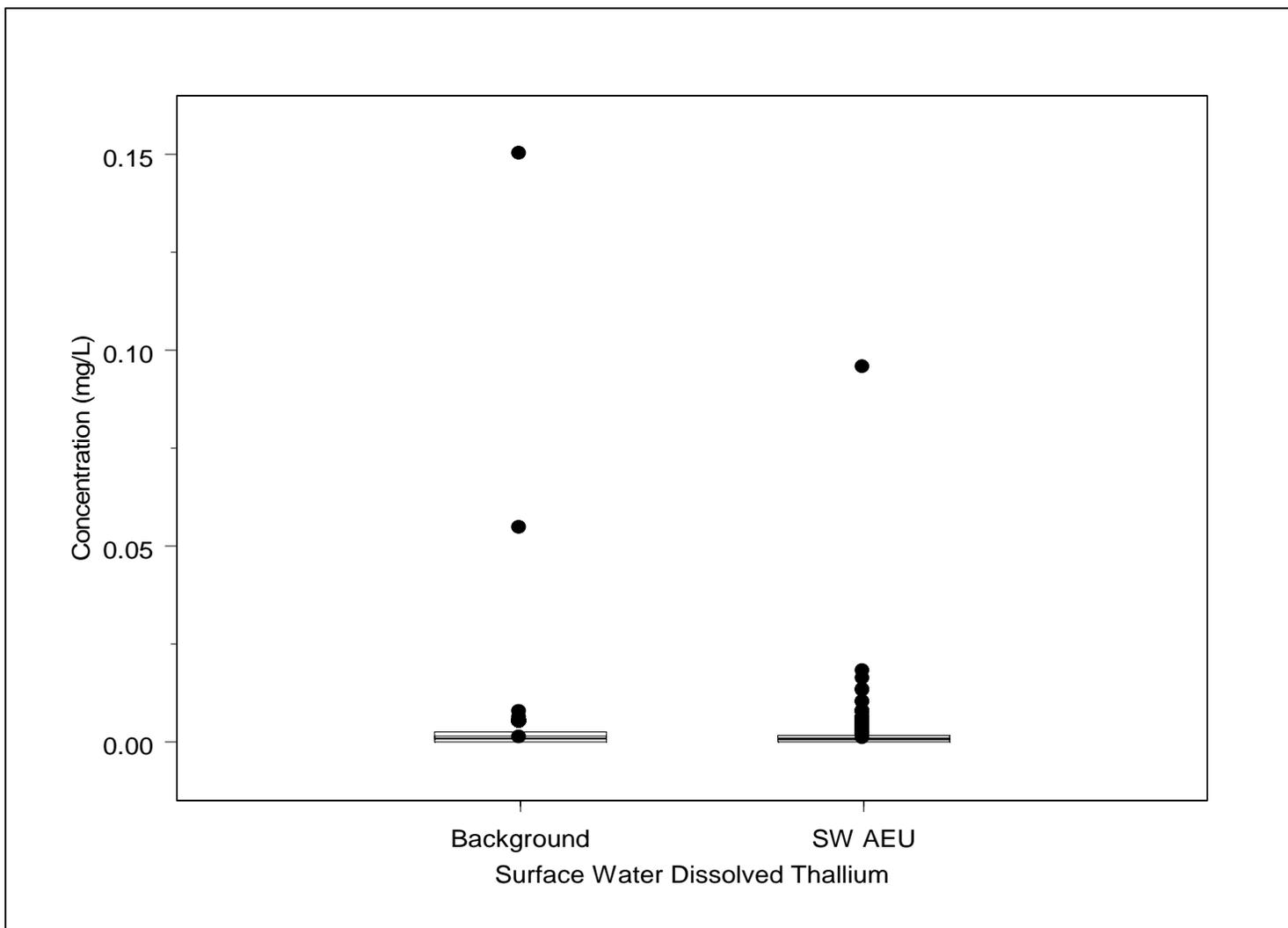
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.32  
SW AEU Surface Water Dissolved Box Plots for Silver



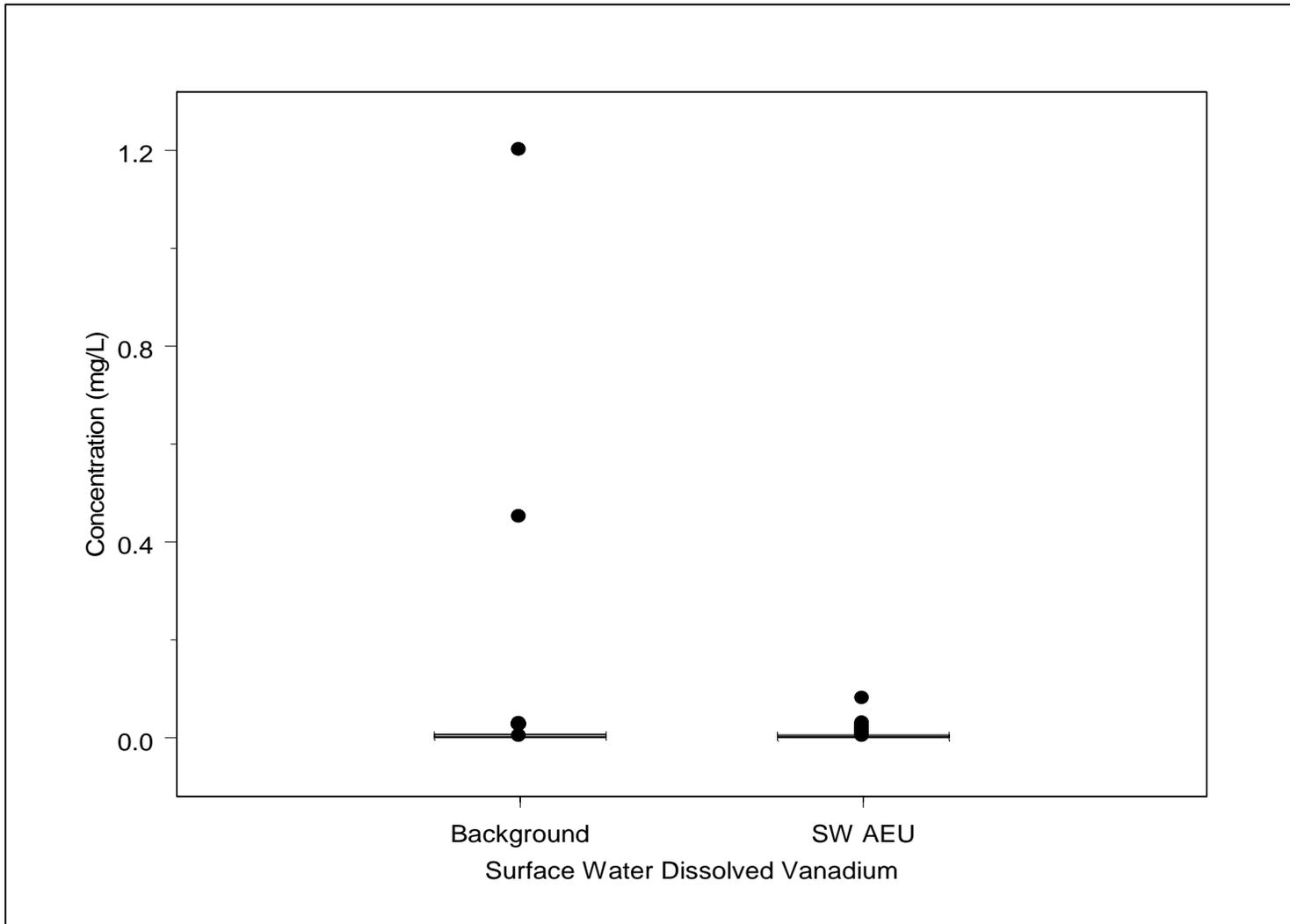
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.33  
SW AEU Surface Water Dissolved Box Plots for Thallium



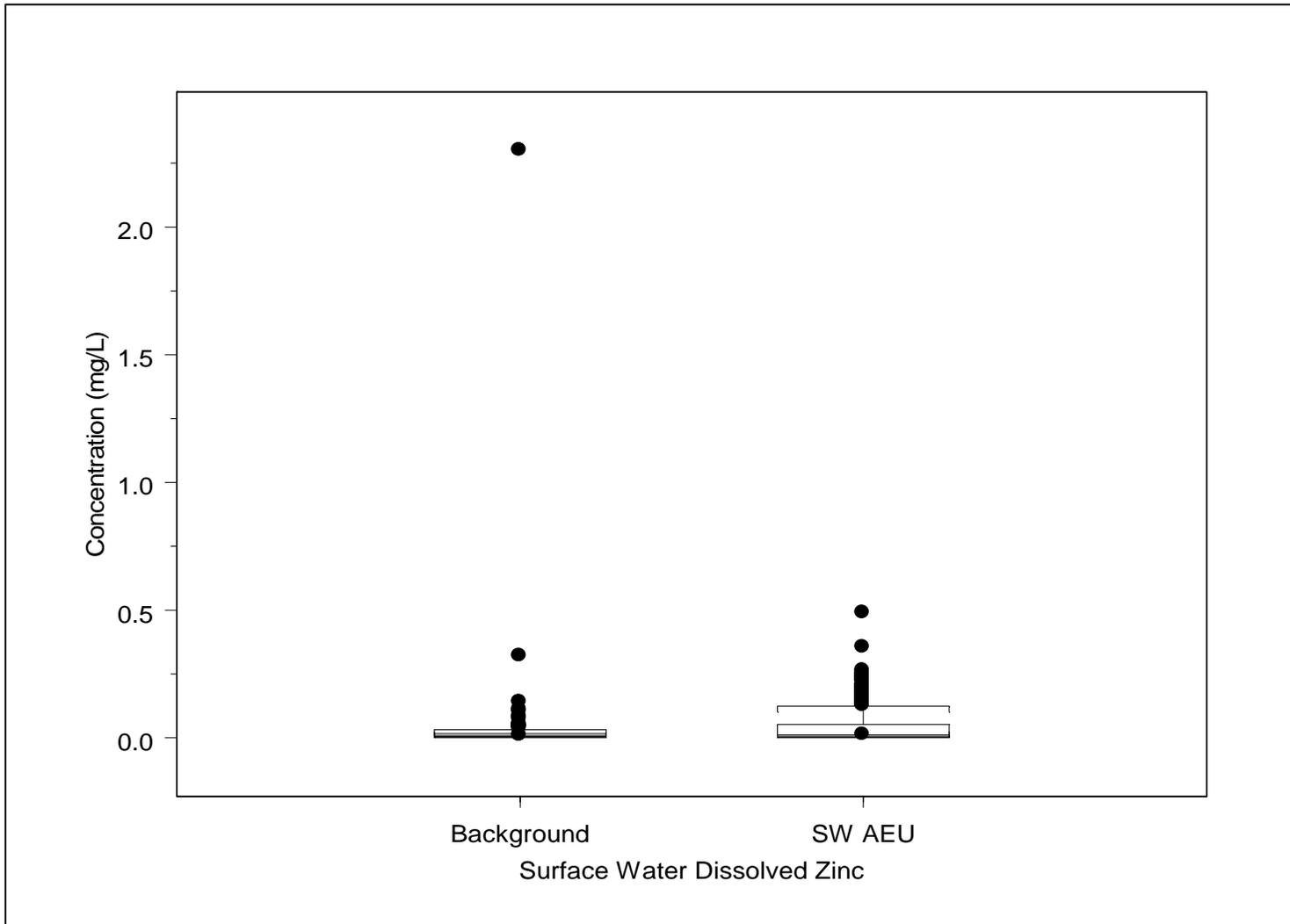
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.34  
SW AEU Surface Water Dissolved Box Plots for Vanadium



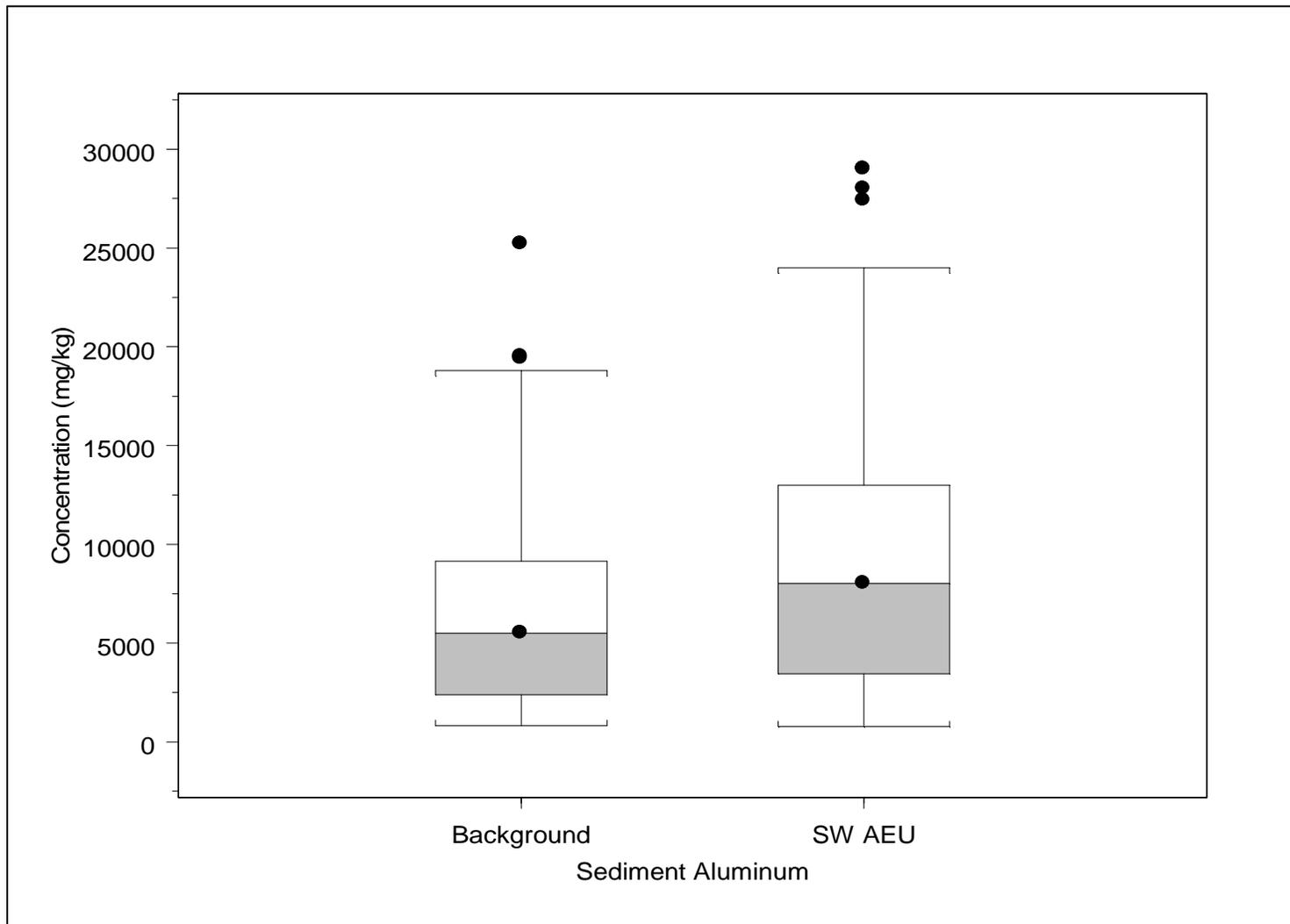
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.35  
SW AEU Surface Water Dissolved Box Plots for Zinc



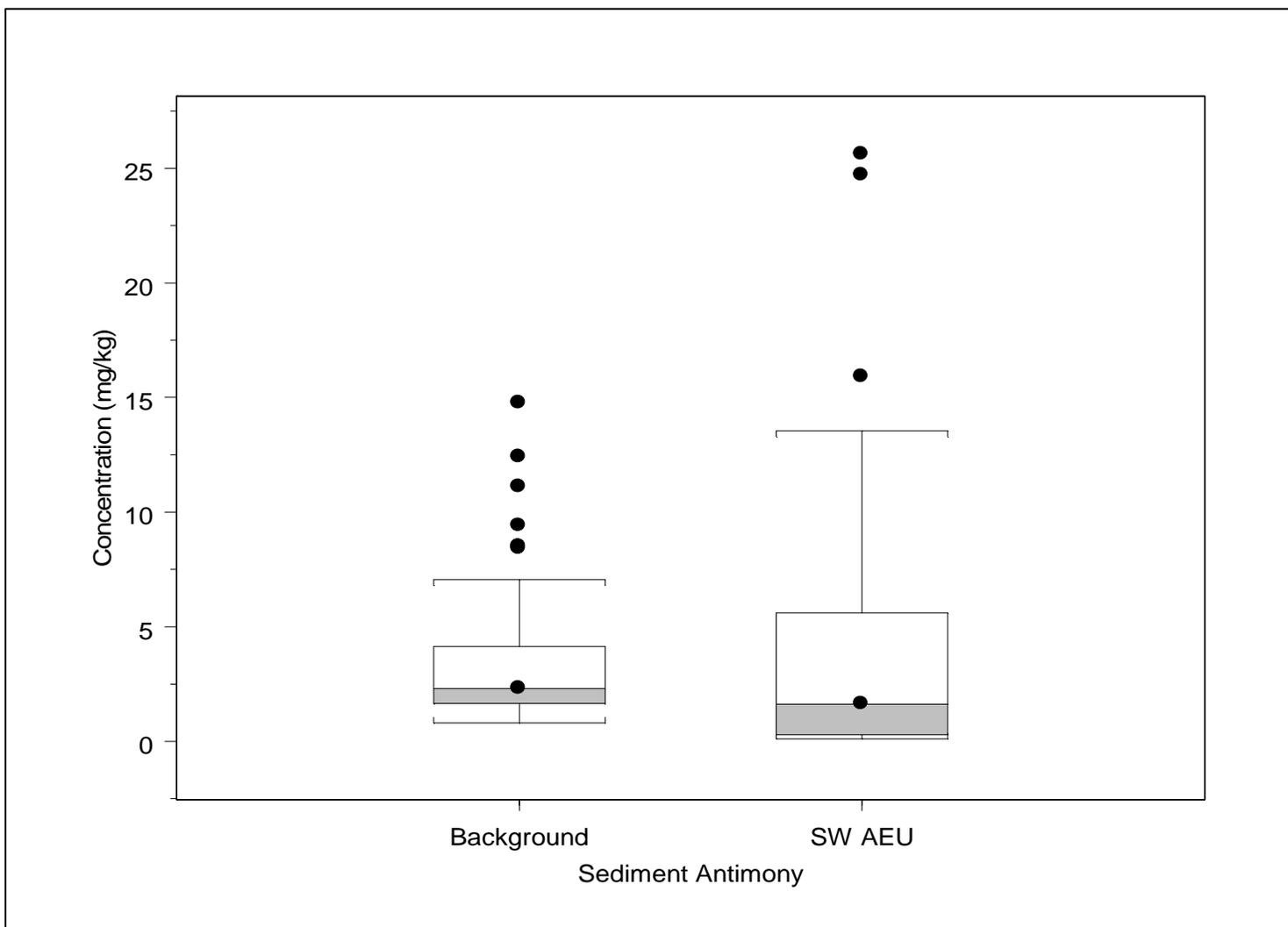
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.36  
SW AEU Sediment Box Plots for Aluminum



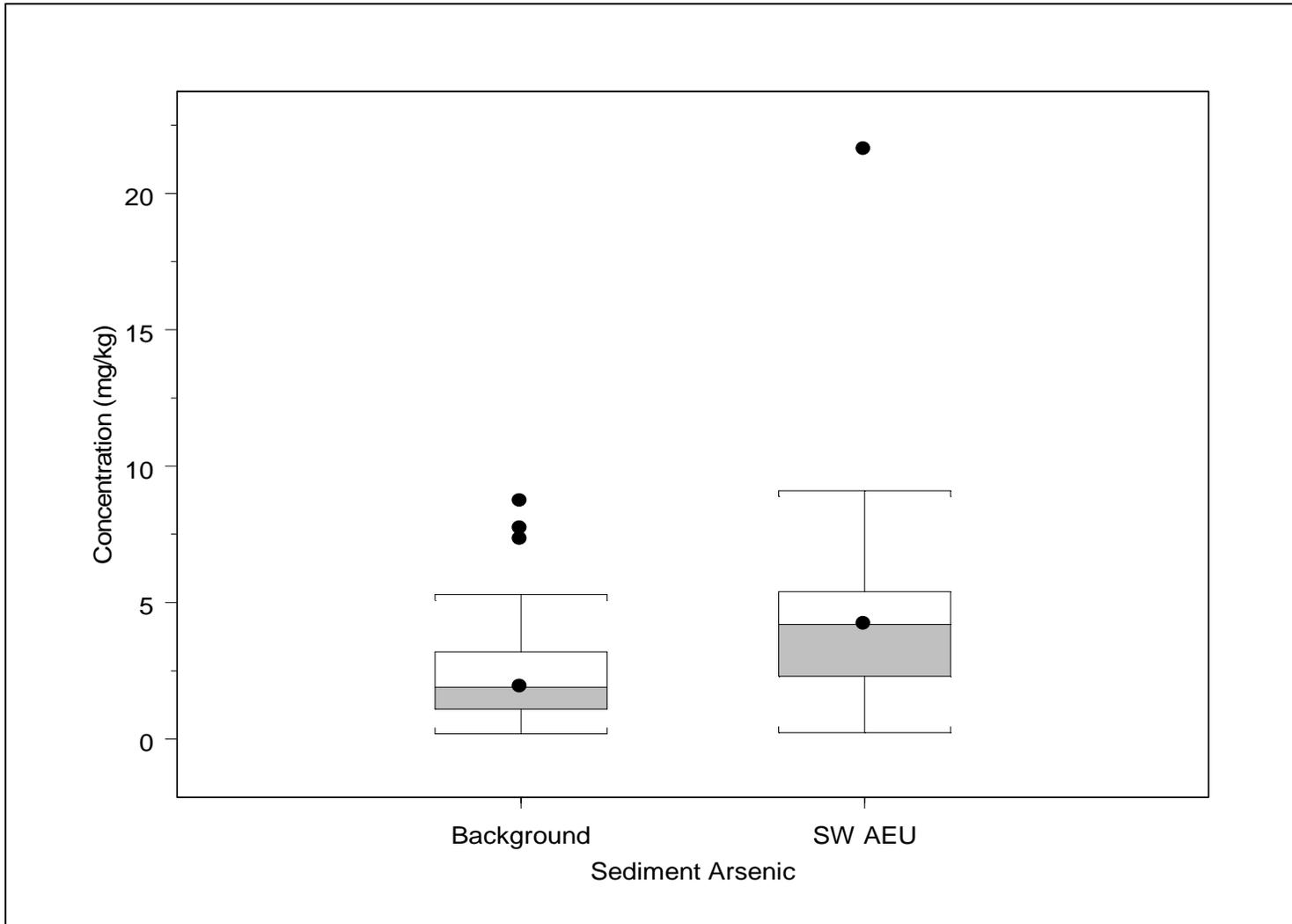
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.37  
SW AEU Sediment Box Plots for Antimony



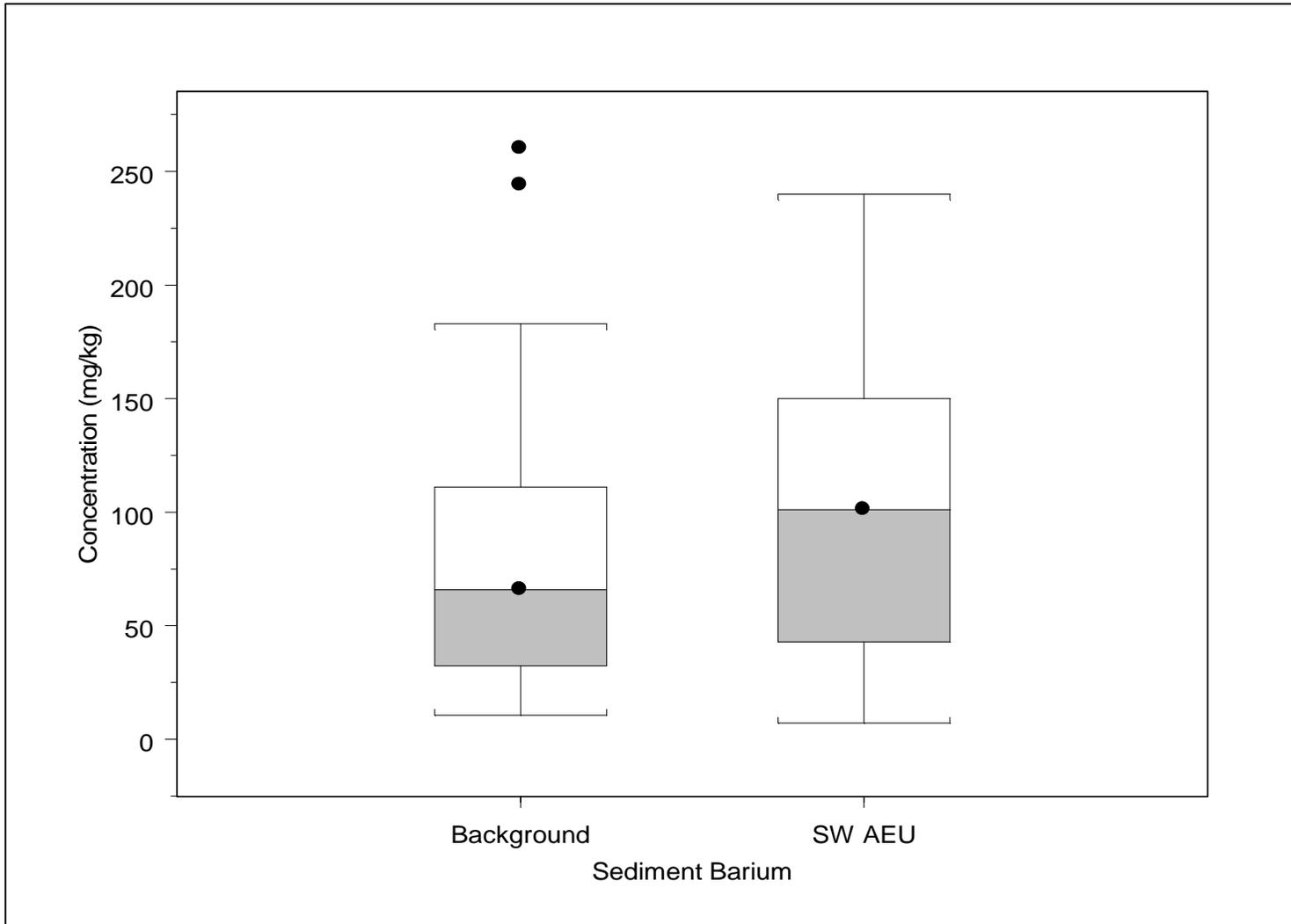
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.38  
SW AEU Sediment Box Plots for Arsenic



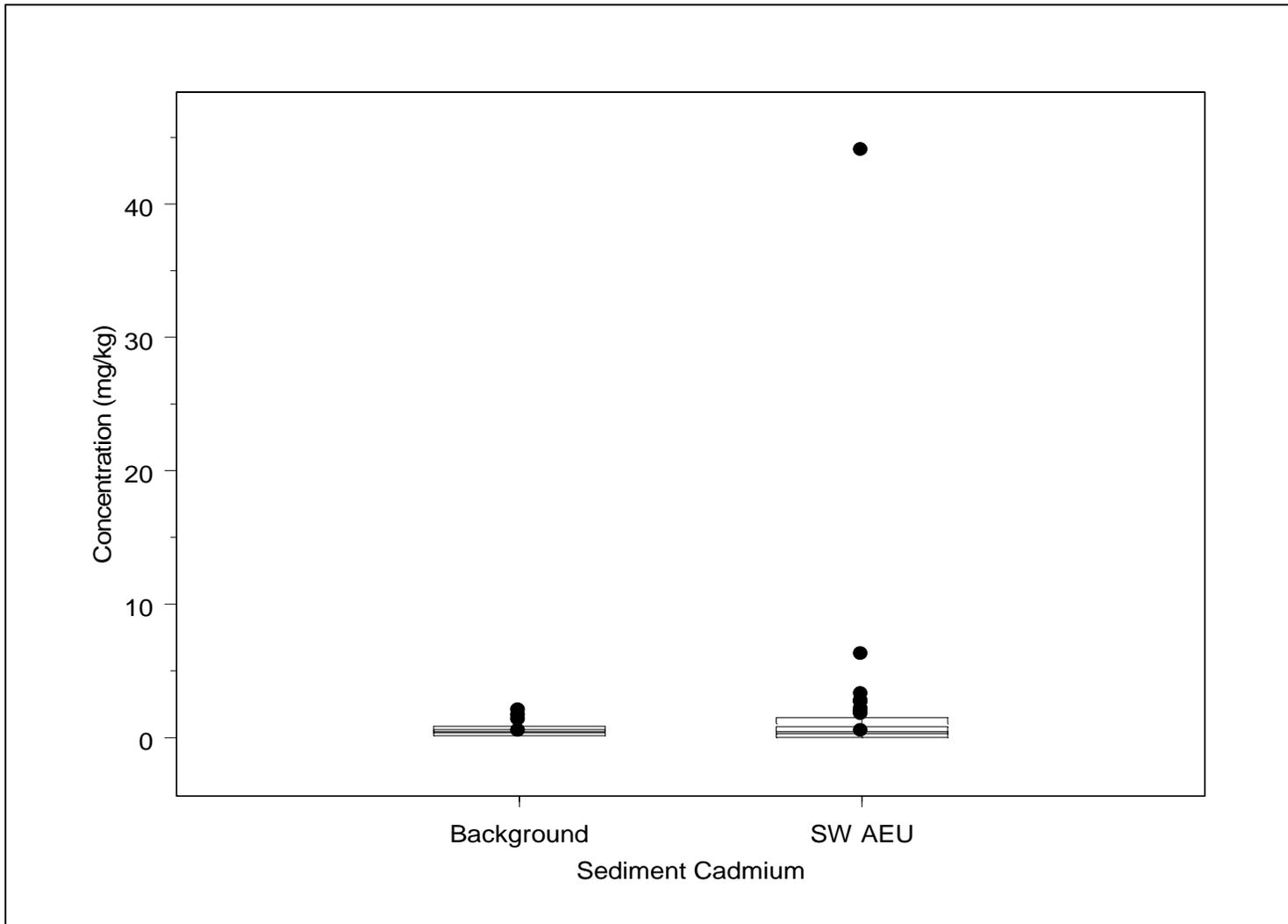
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.39  
SW AEU Sediment Box Plots for Barium



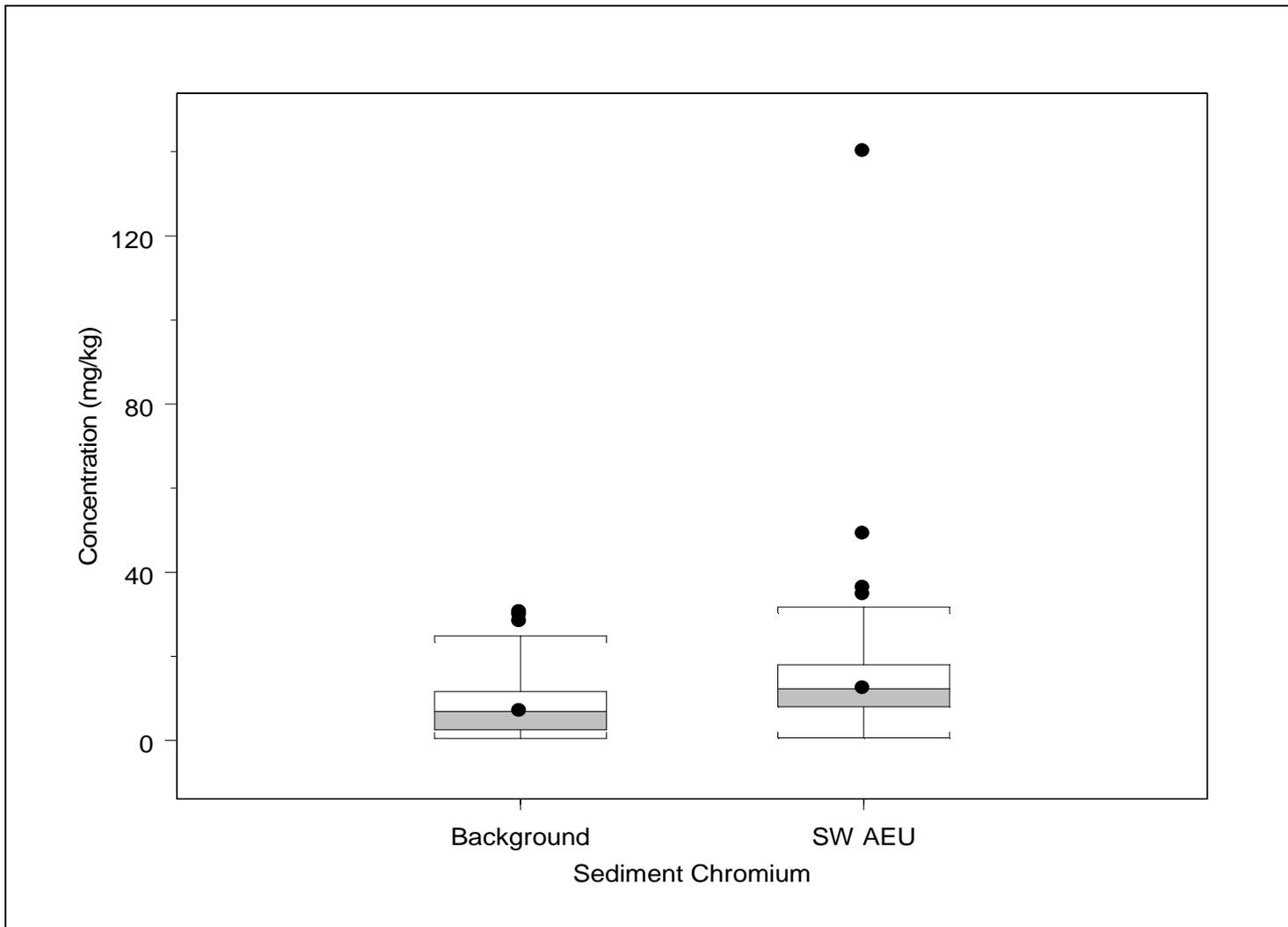
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.40  
SW AEU Sediment Box Plots for Cadmium



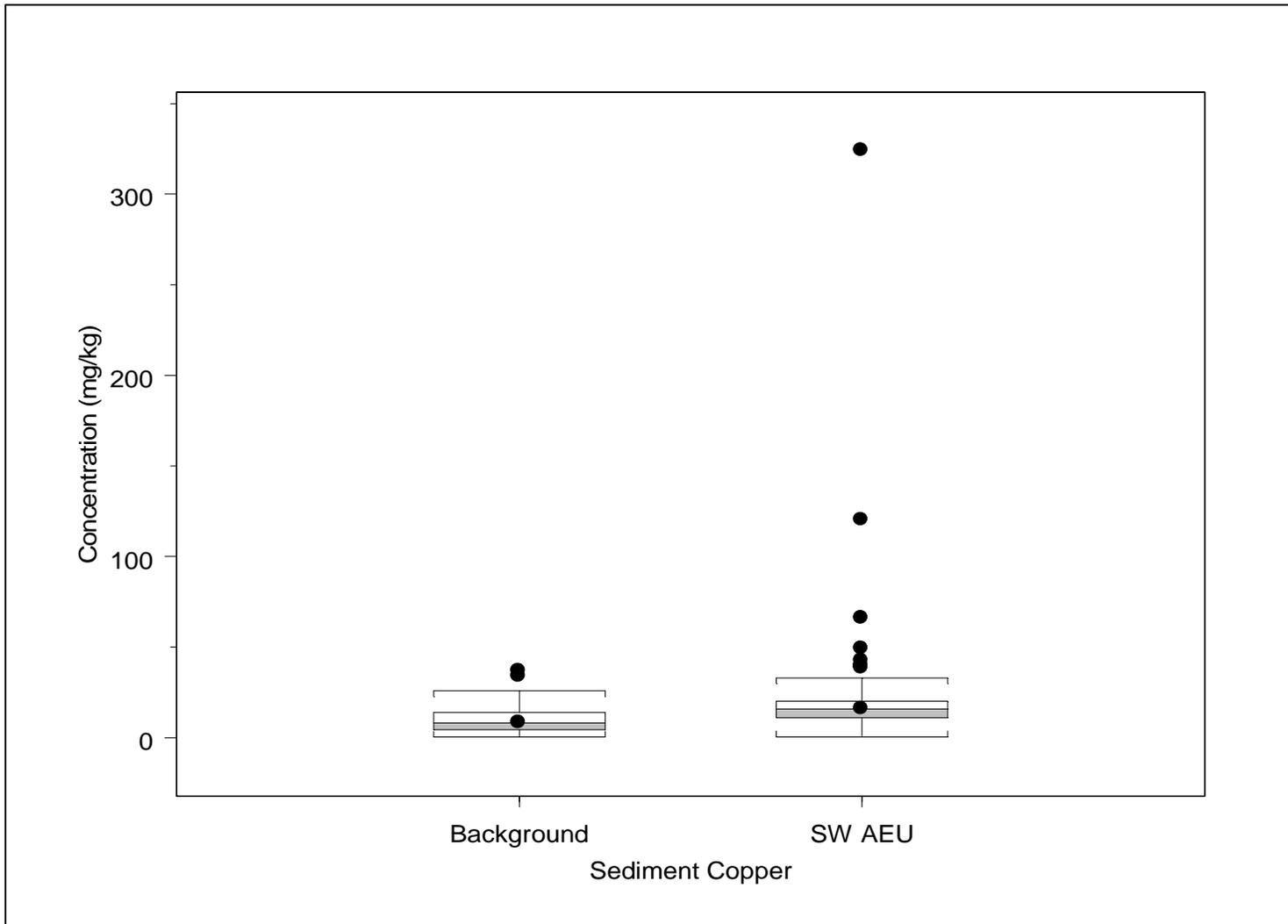
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.41  
SW AEU Sediment Box Plots for Chromium



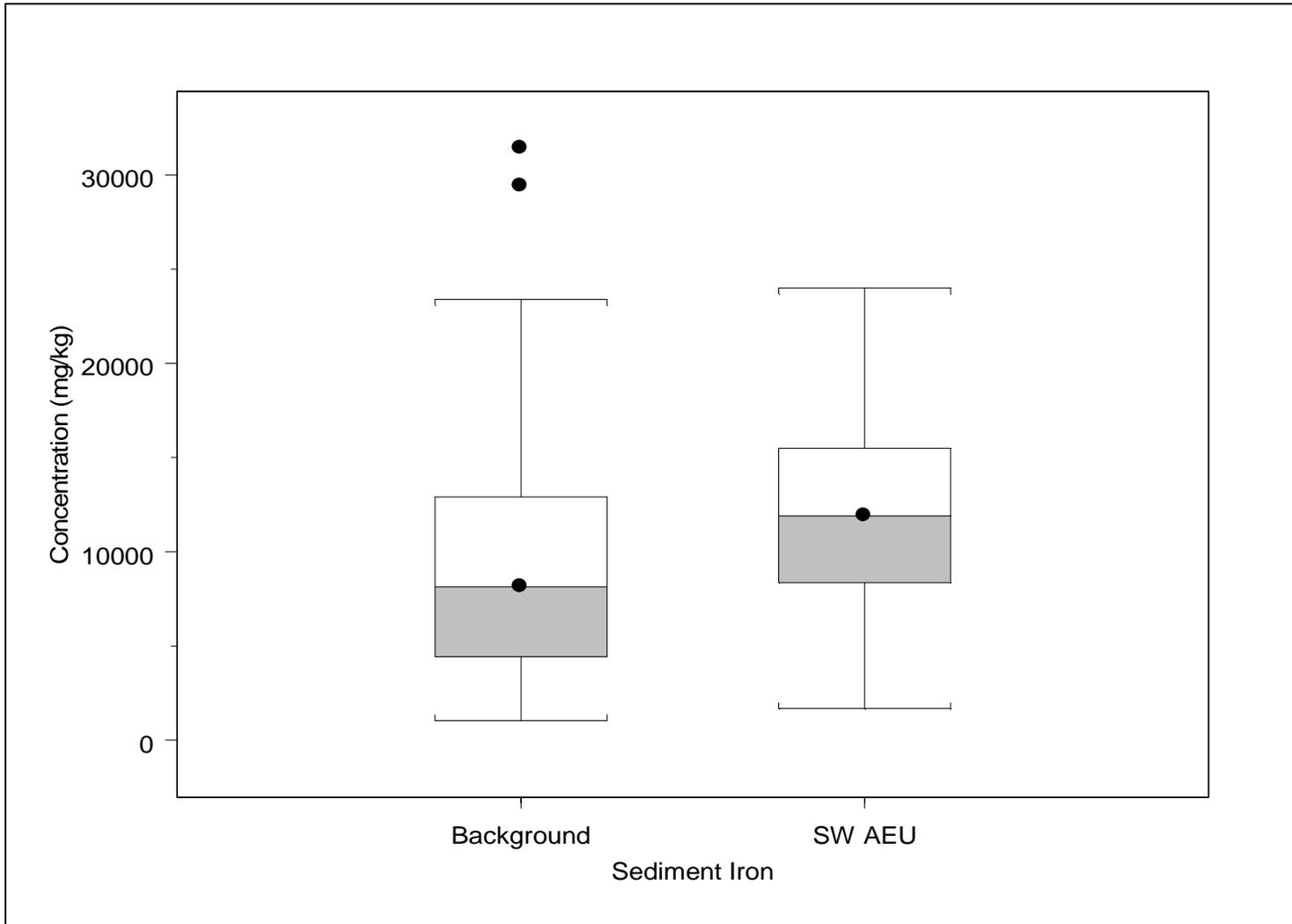
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.42  
SW AEU Sediment Box Plots for Copper



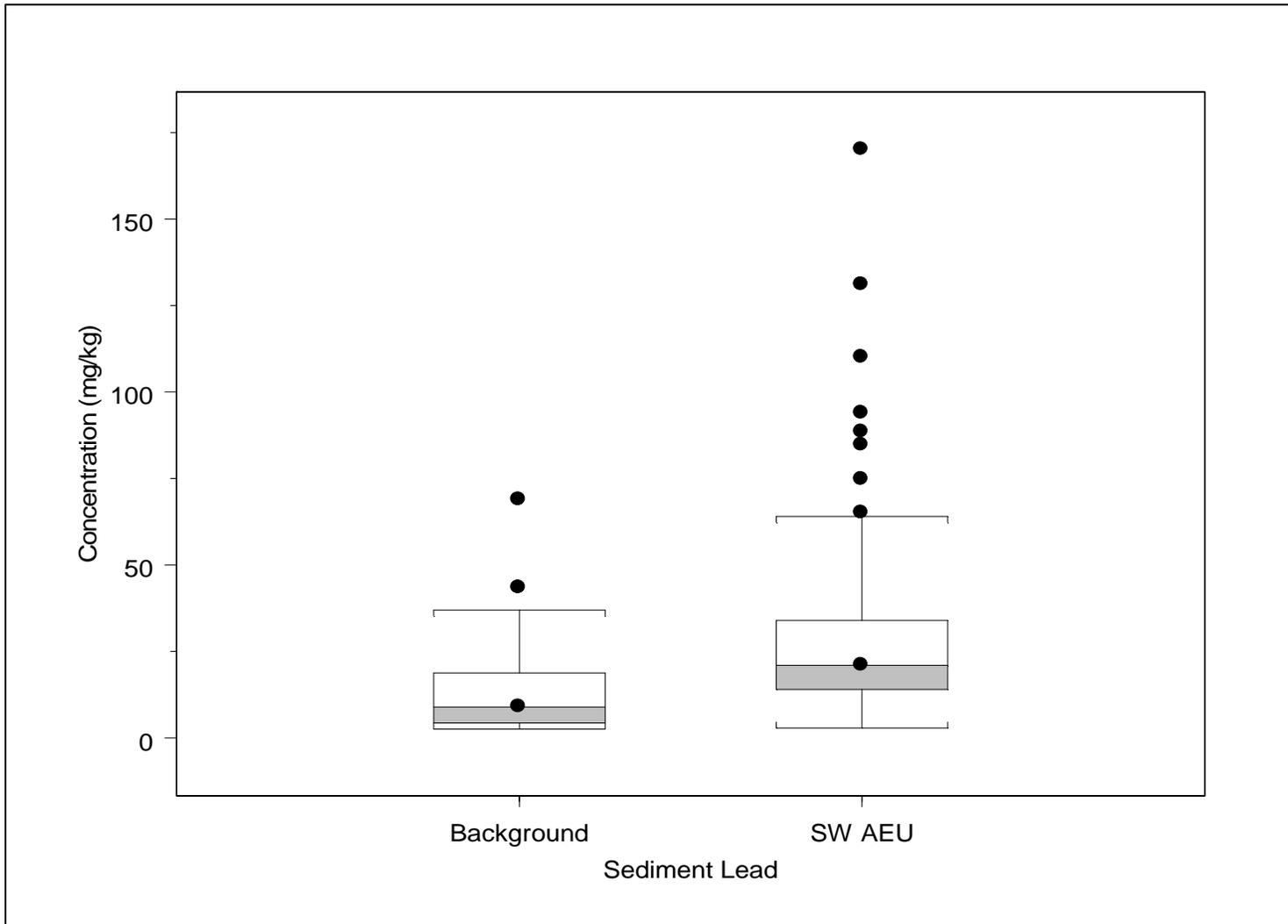
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.43  
SW AEU Sediment Box Plots for Iron



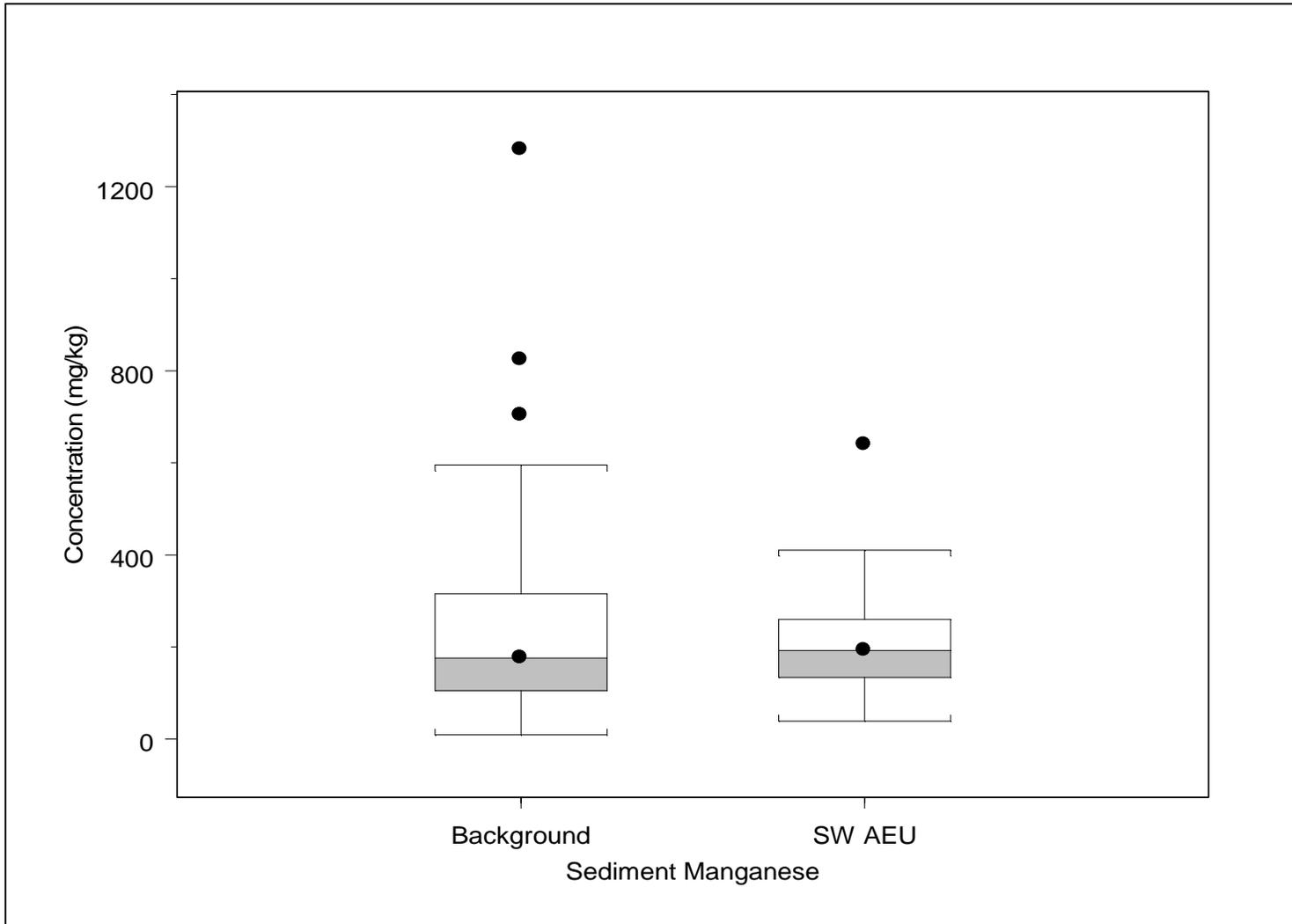
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.44  
SW AEU Sediment Box Plots for Lead



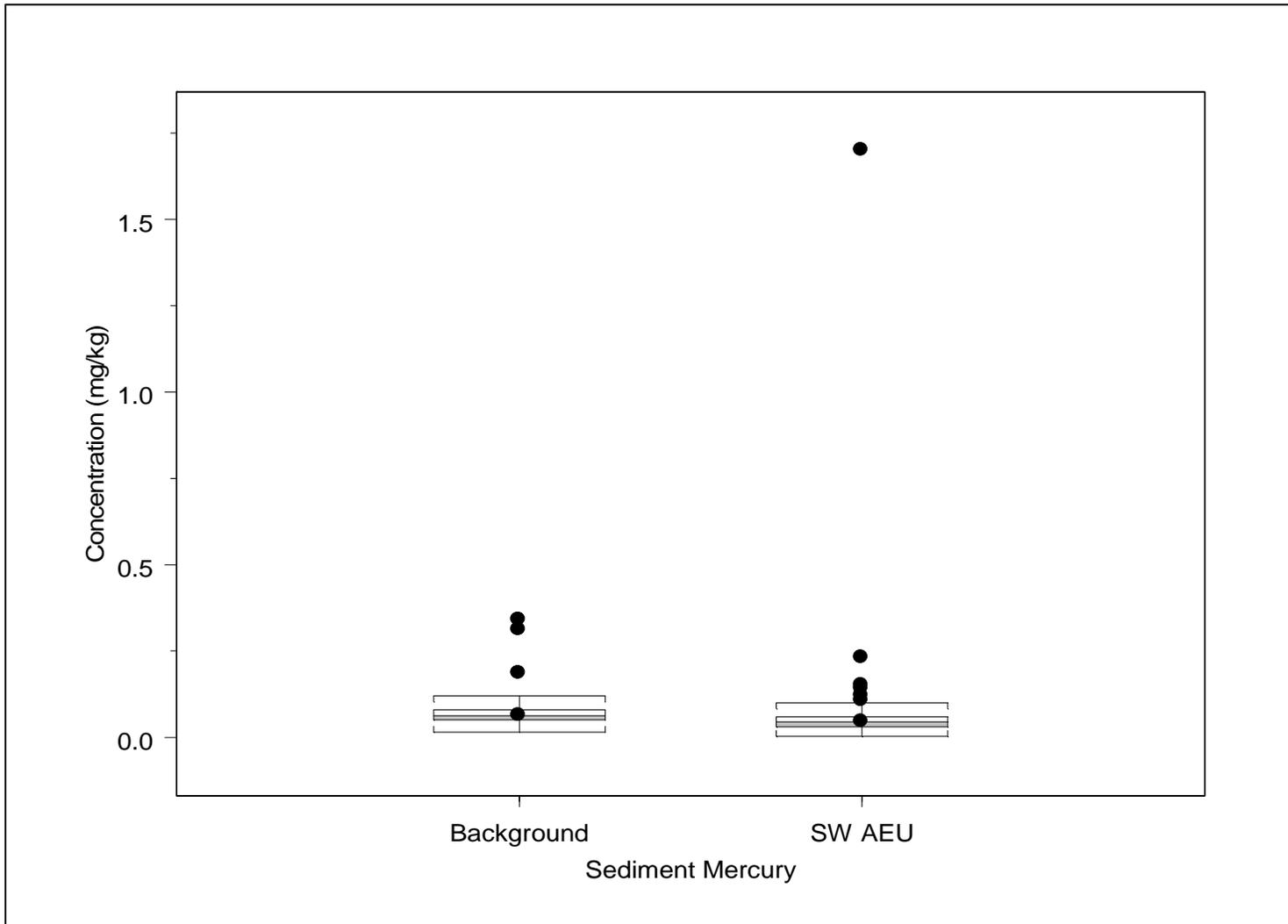
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.45  
SW AEU Sediment Box Plots for Manganese



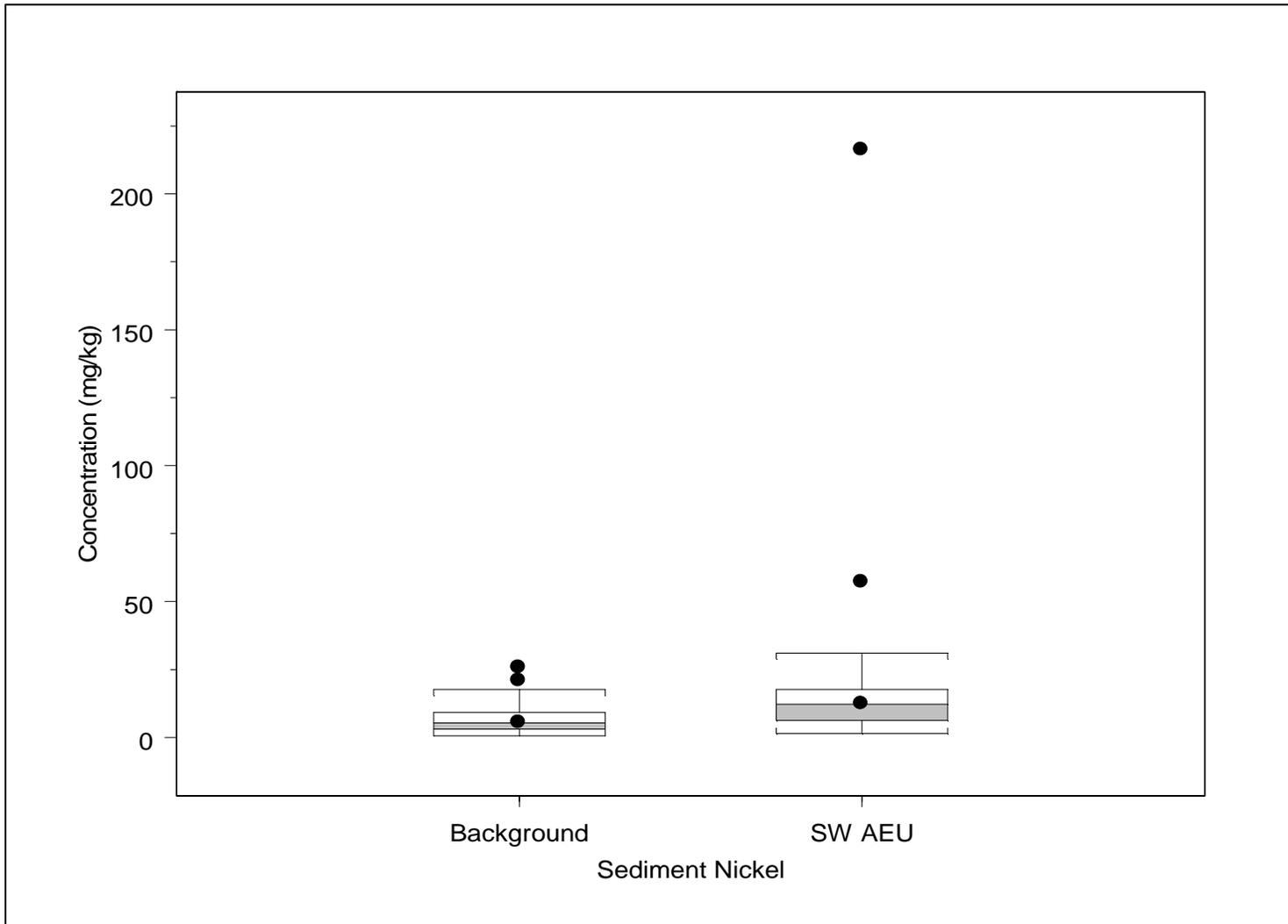
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.46  
SW AEU Sediment Box Plots for Mercury



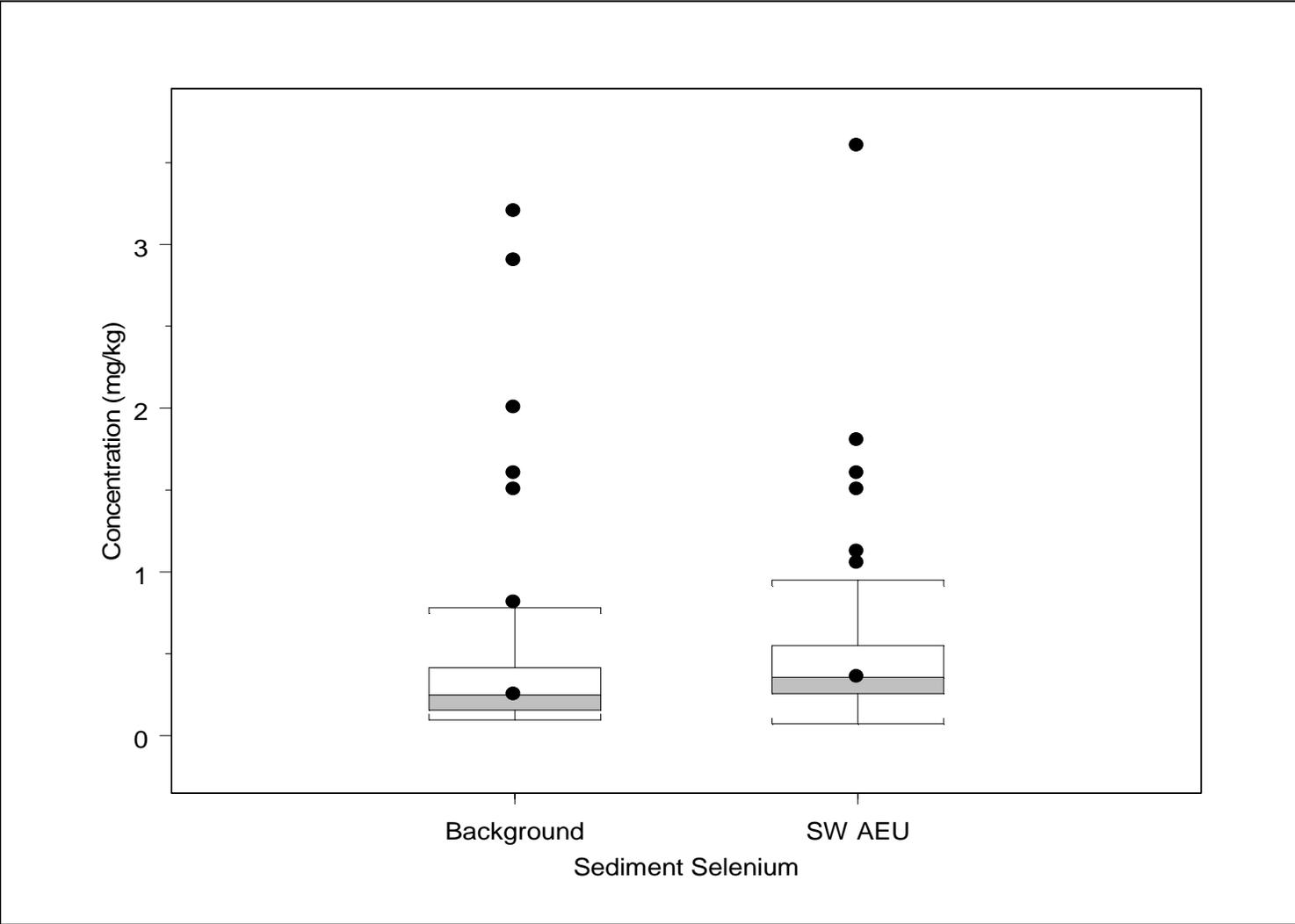
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.47  
SW AEU Sediment Box Plots for Nickel



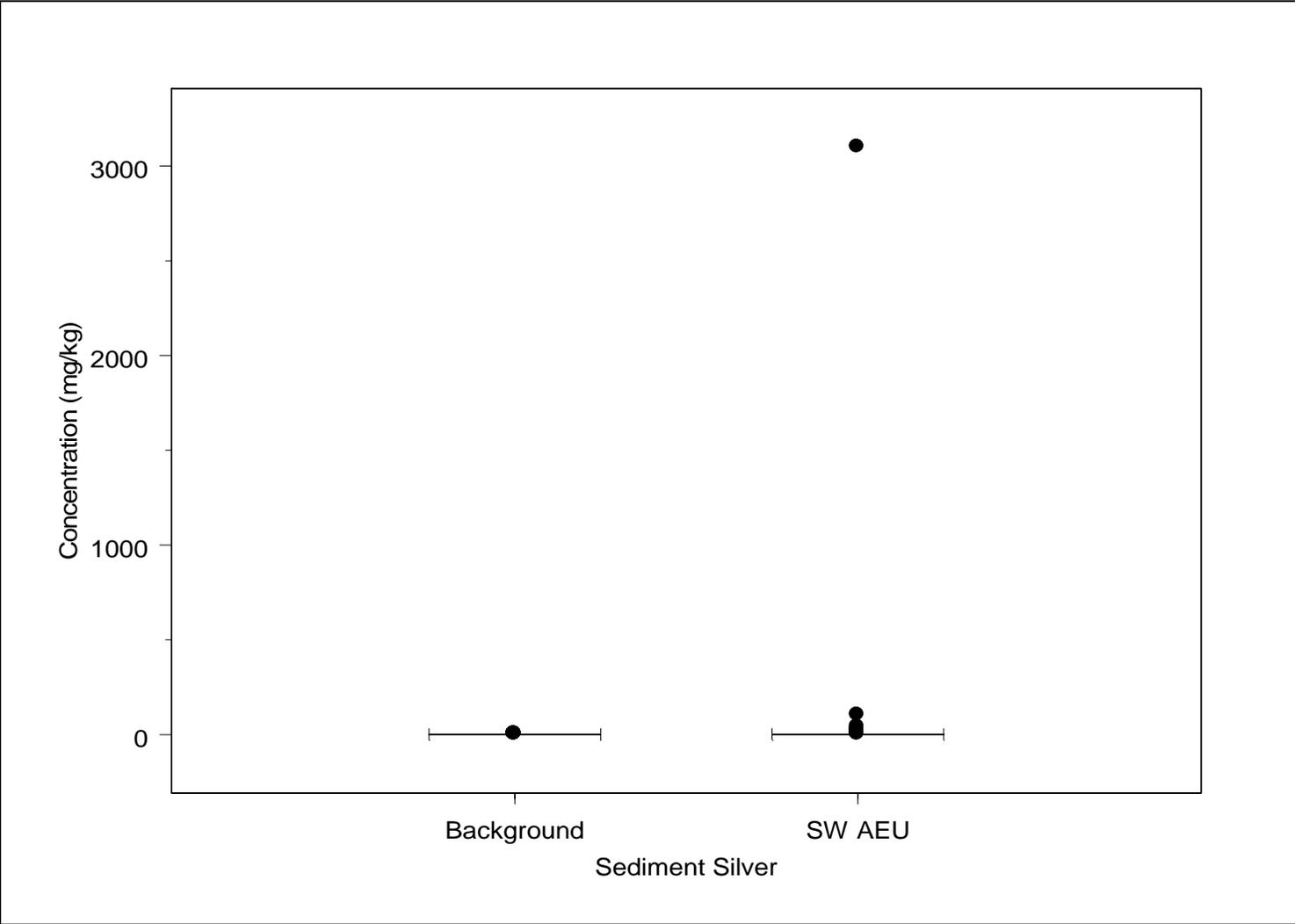
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.48  
SW AEU Sediment Box Plots for Selenium



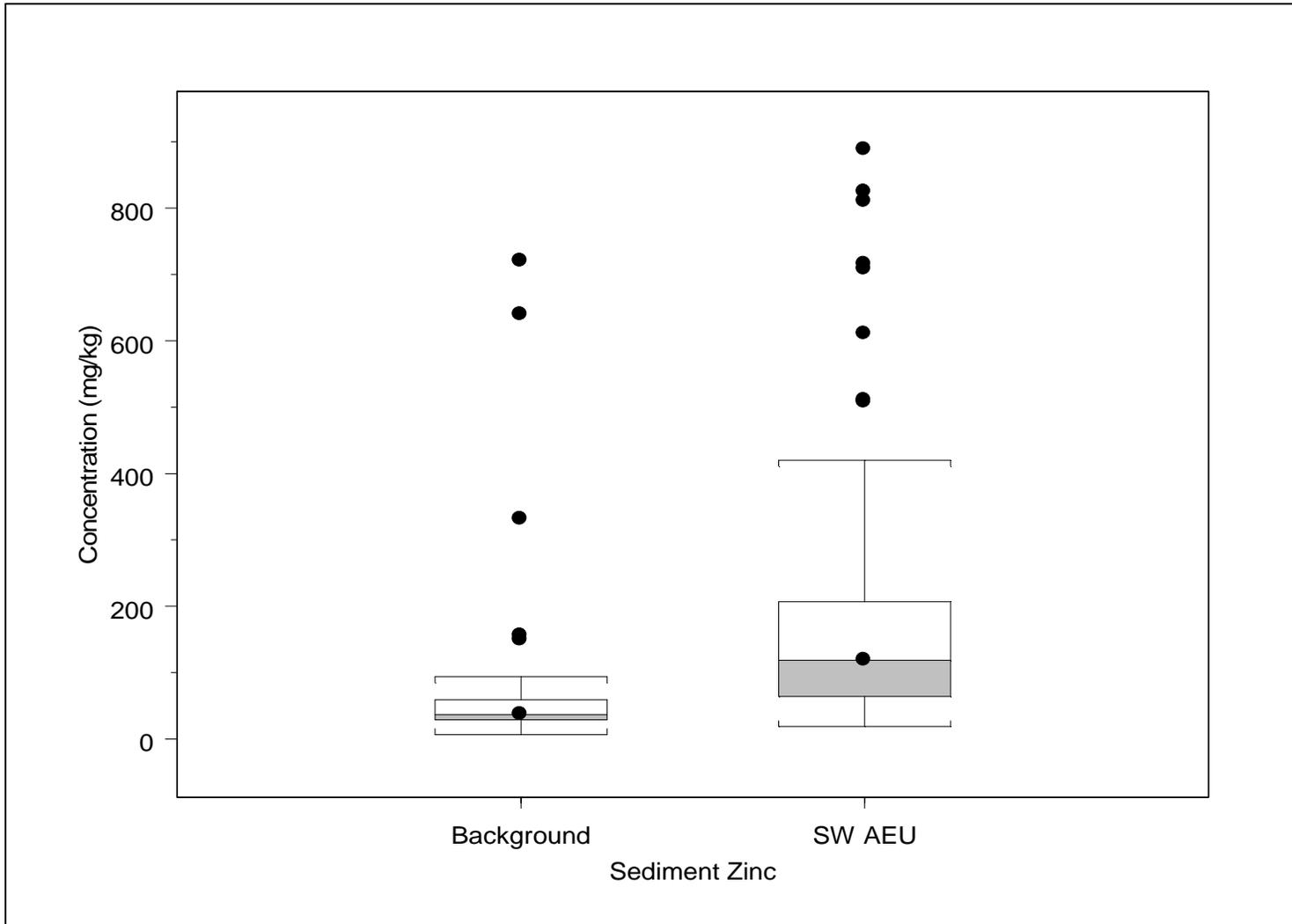
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.49  
SW AEU Sediment Box Plots for Silver



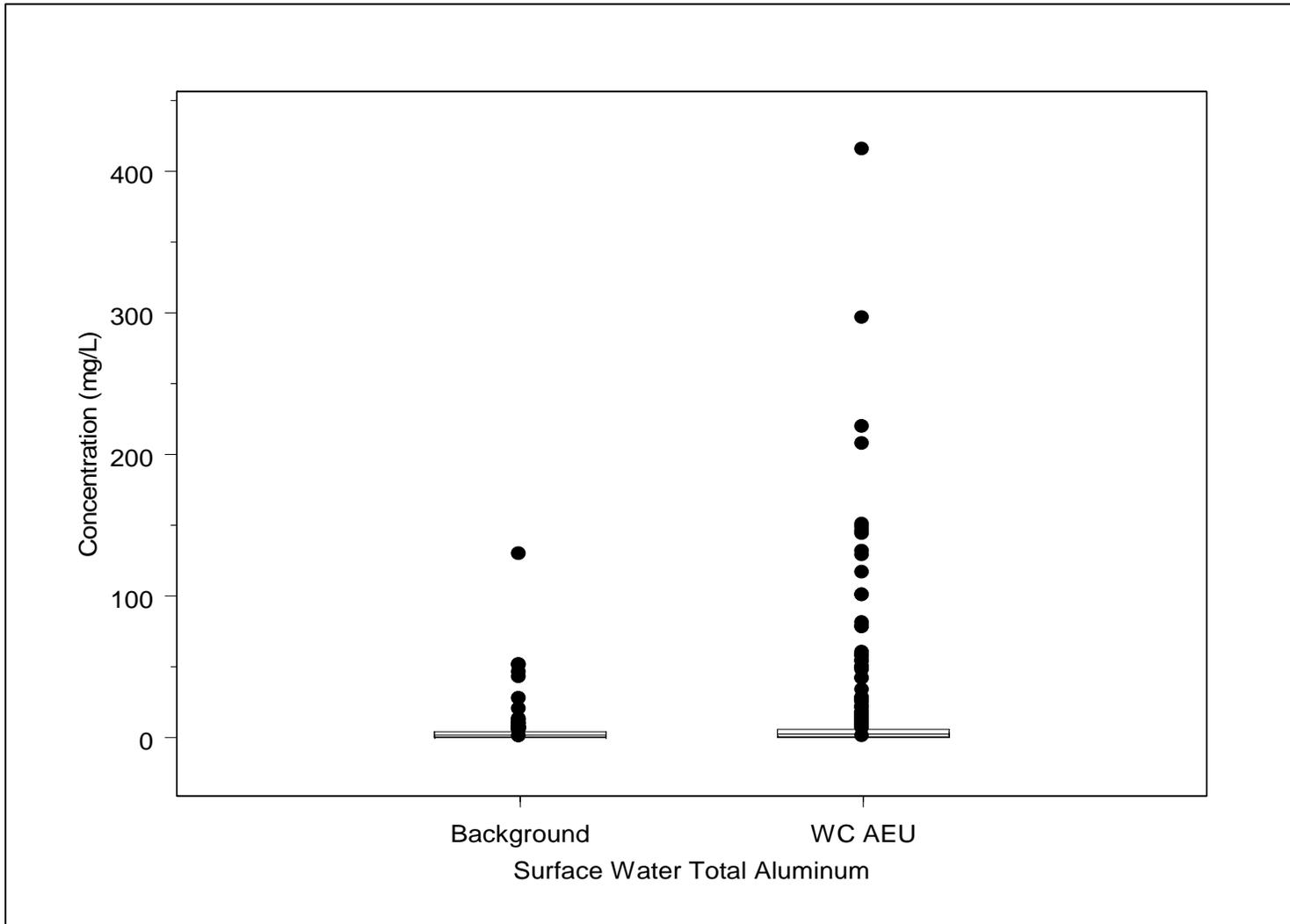
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.SW AEU.50  
SW AEU Sediment Box Plots for Zinc



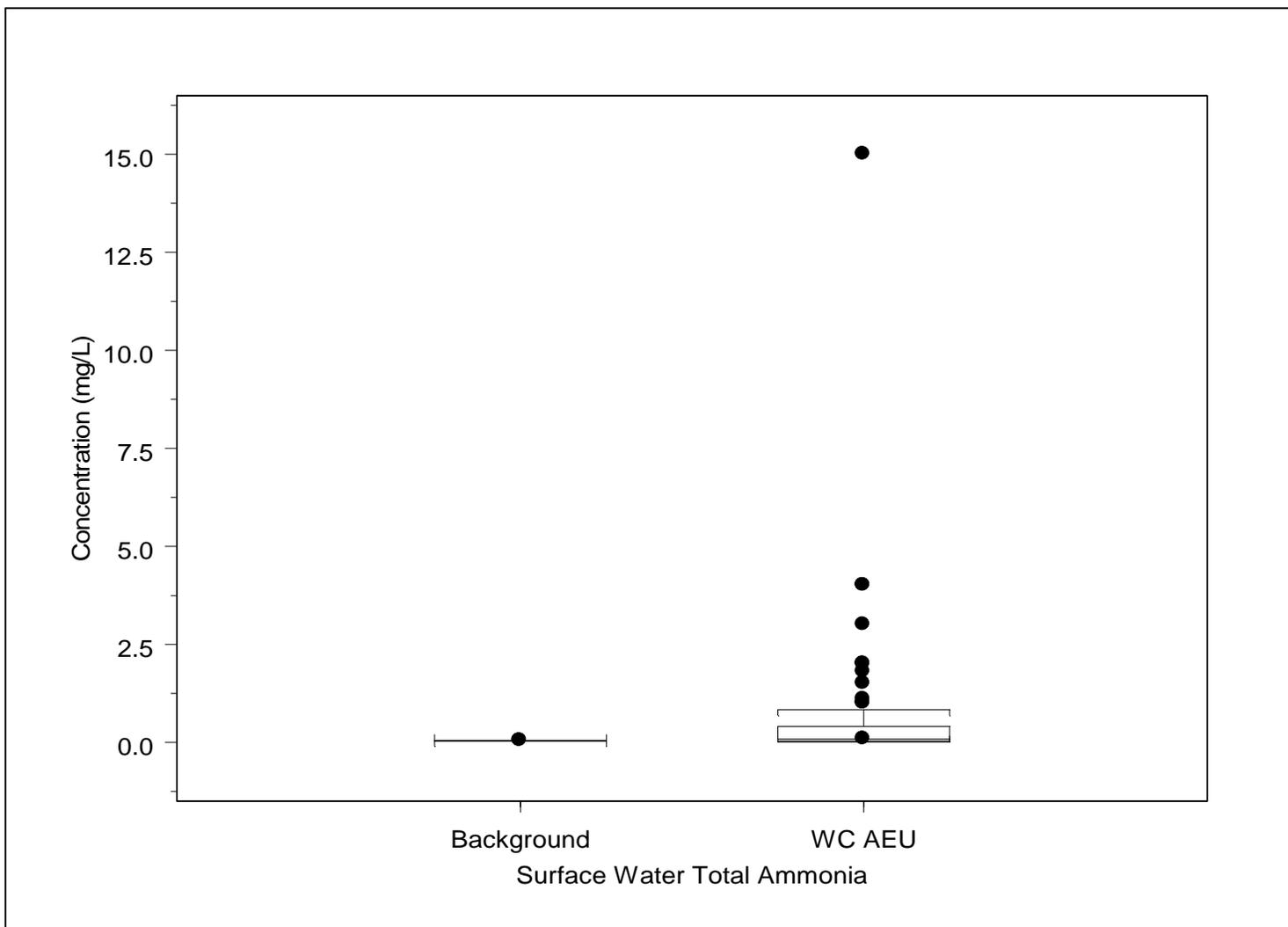
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



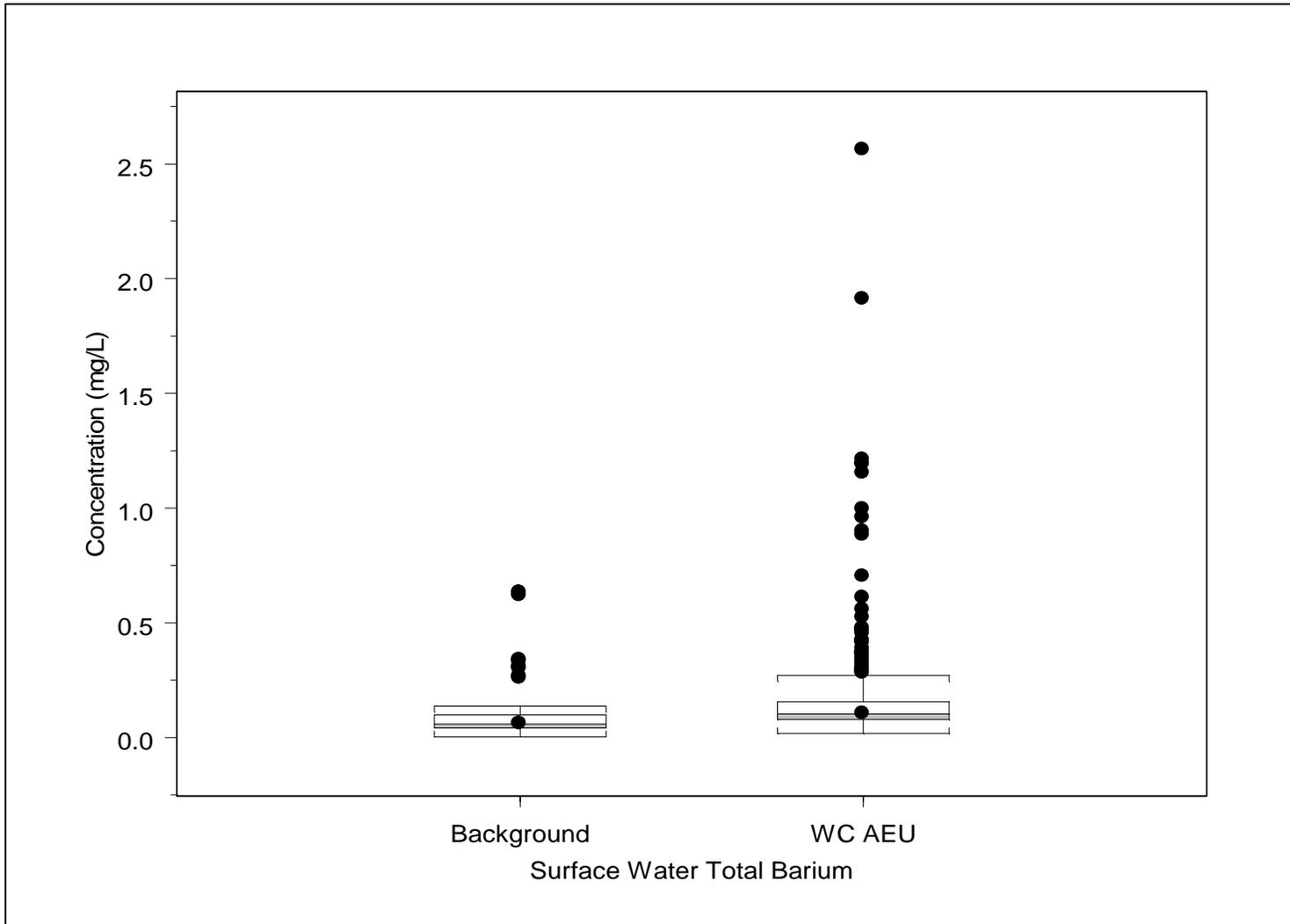
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



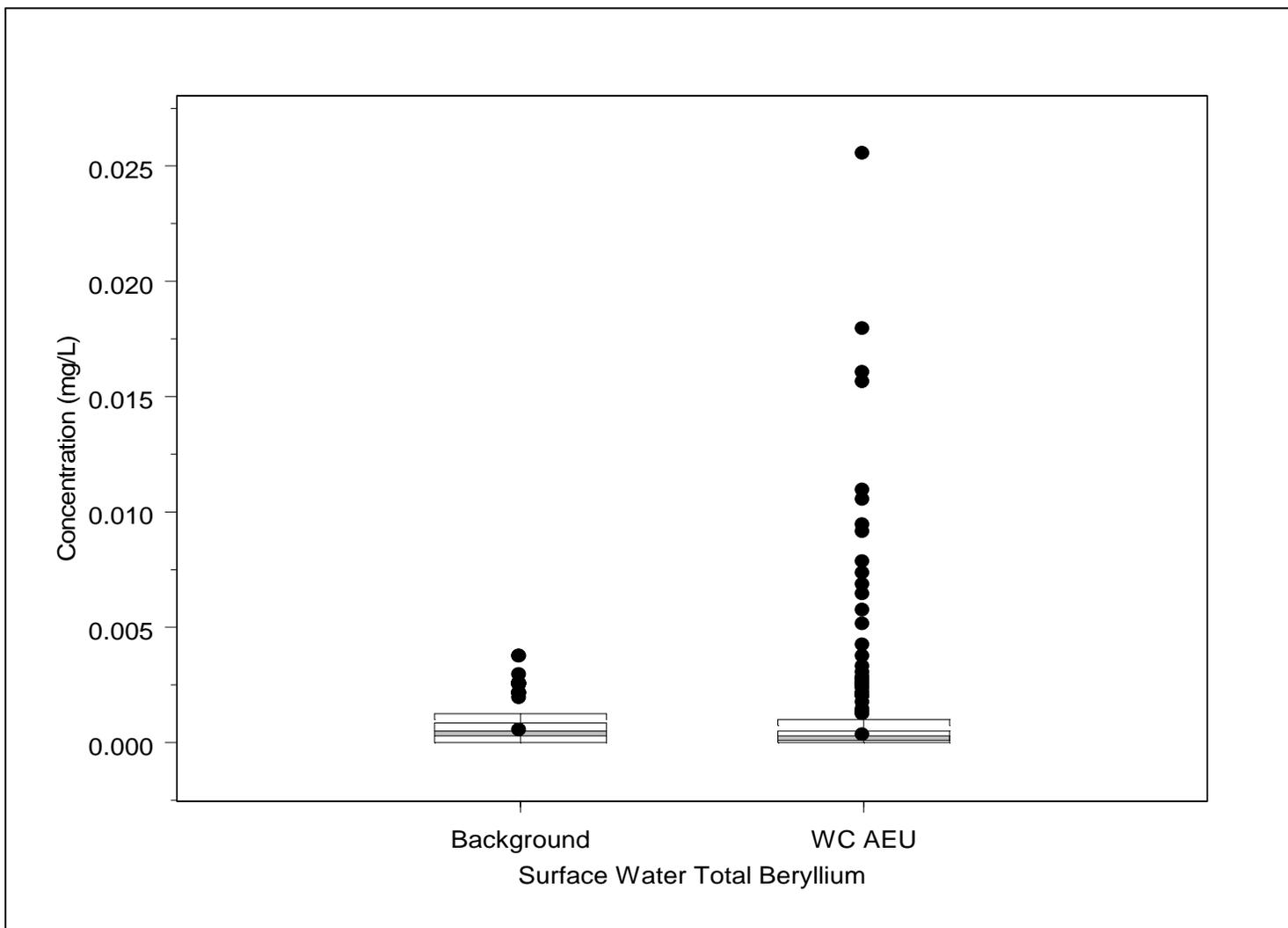
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



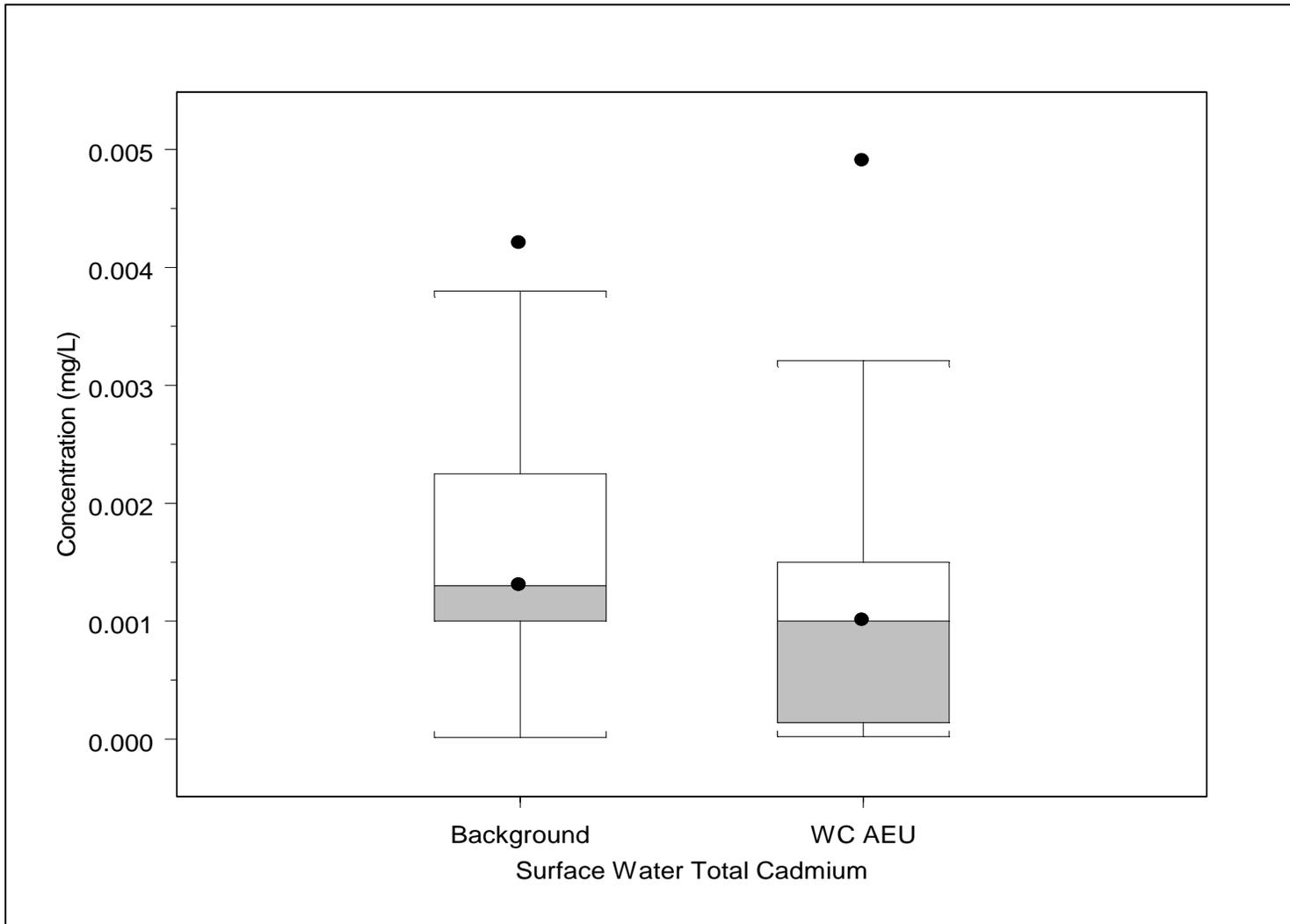
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



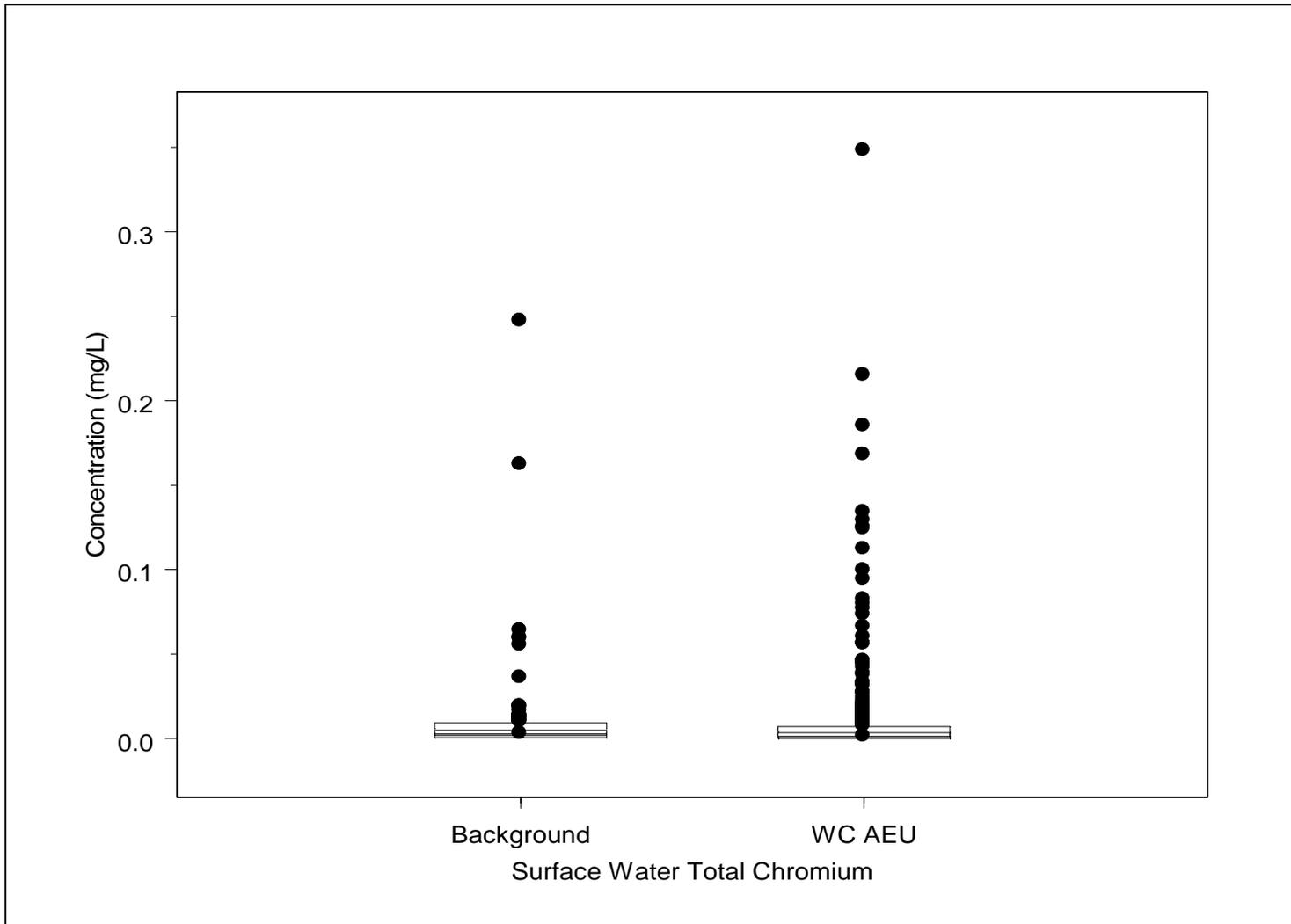
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



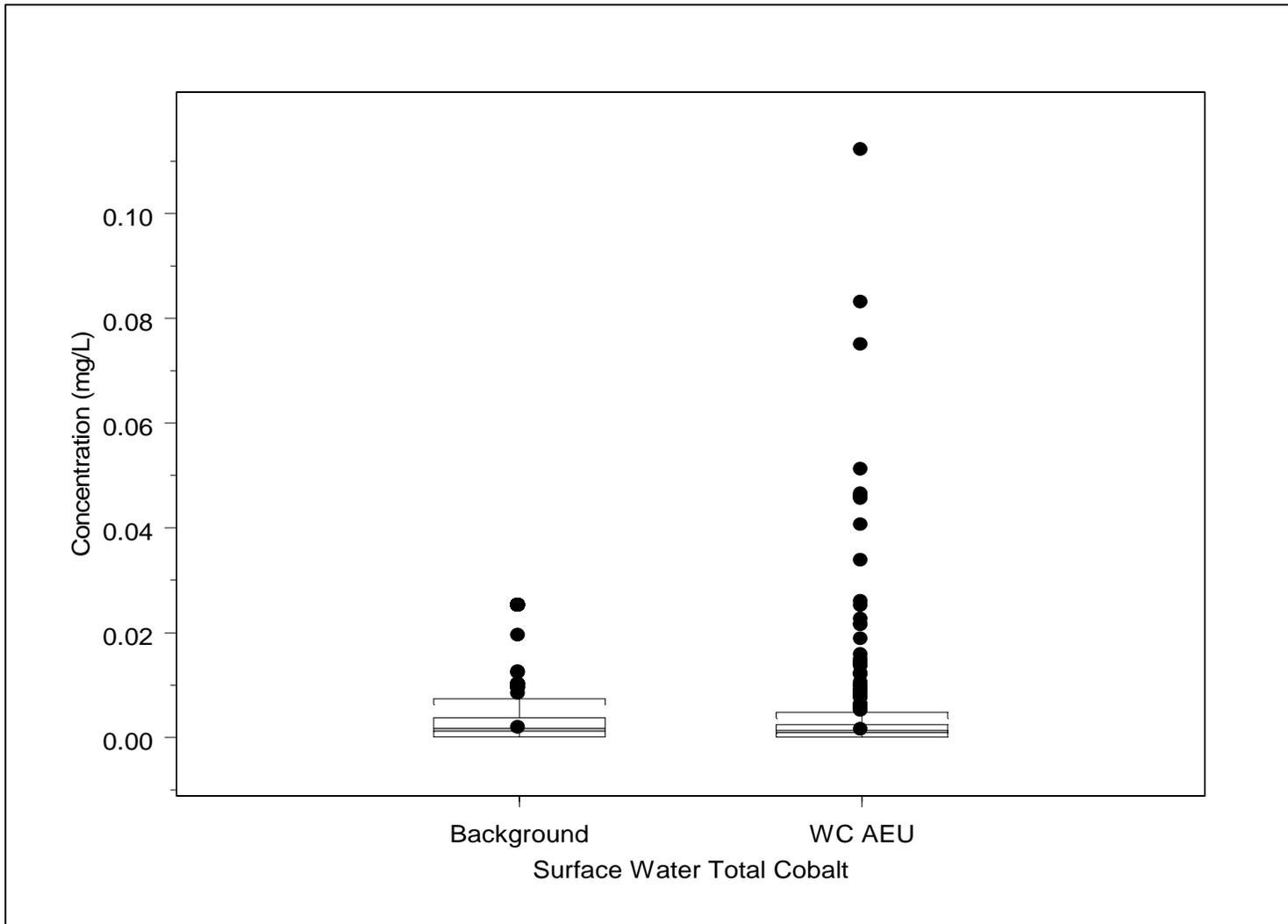
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.6  
WC AEU Surface Water Total Box Plots for Chromium



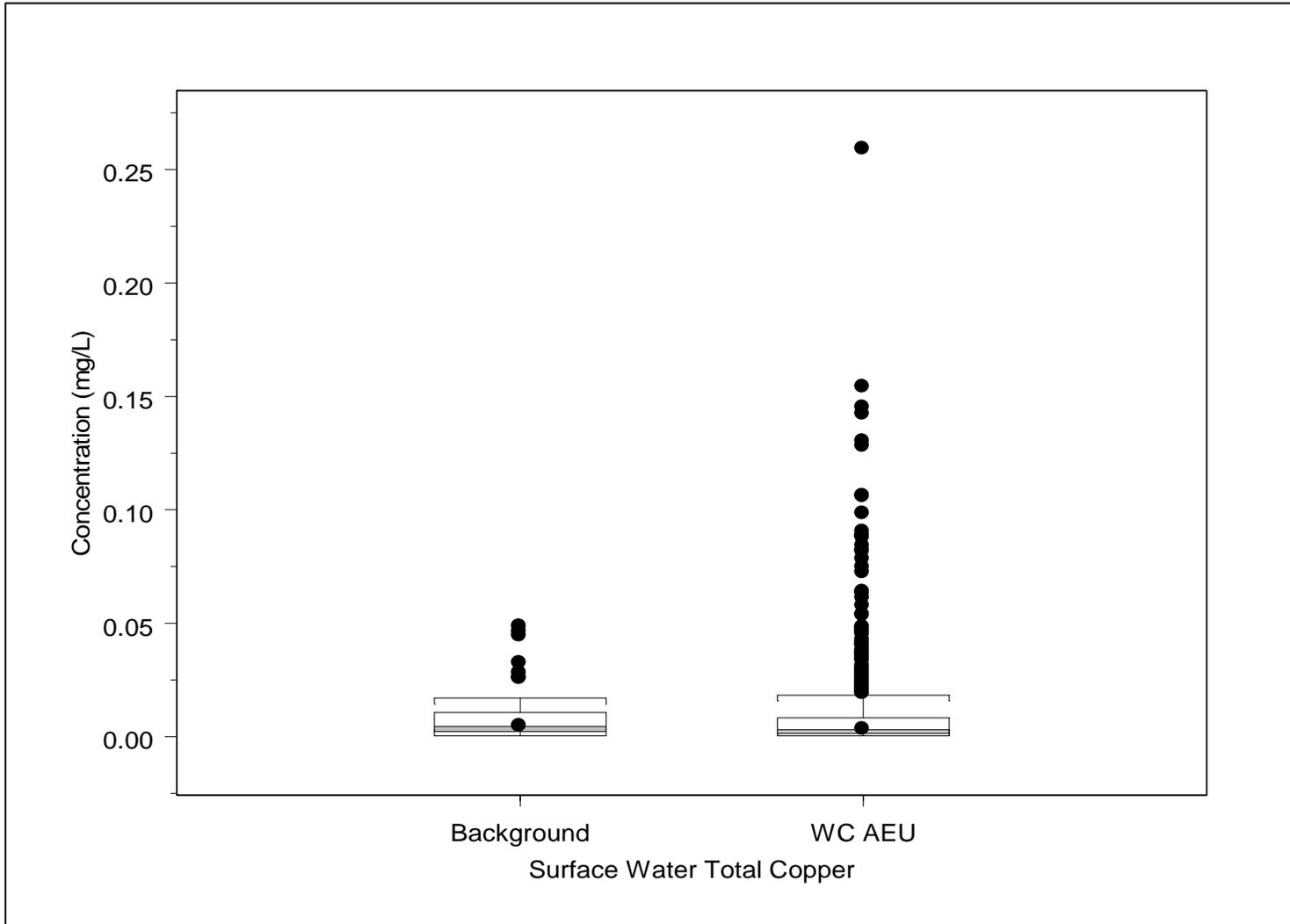
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.7  
WC AEU Surface Water Total Box Plots for Cobalt



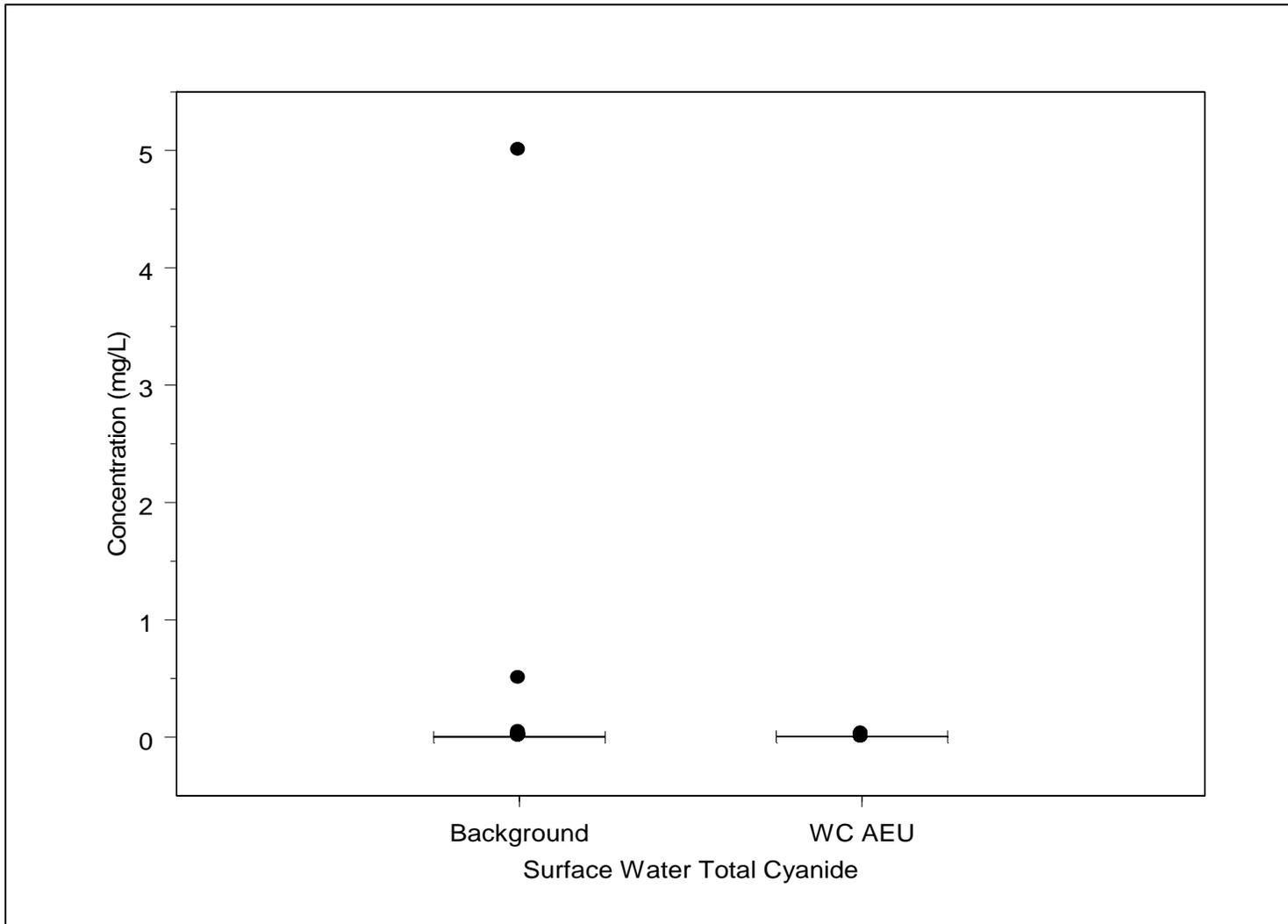
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



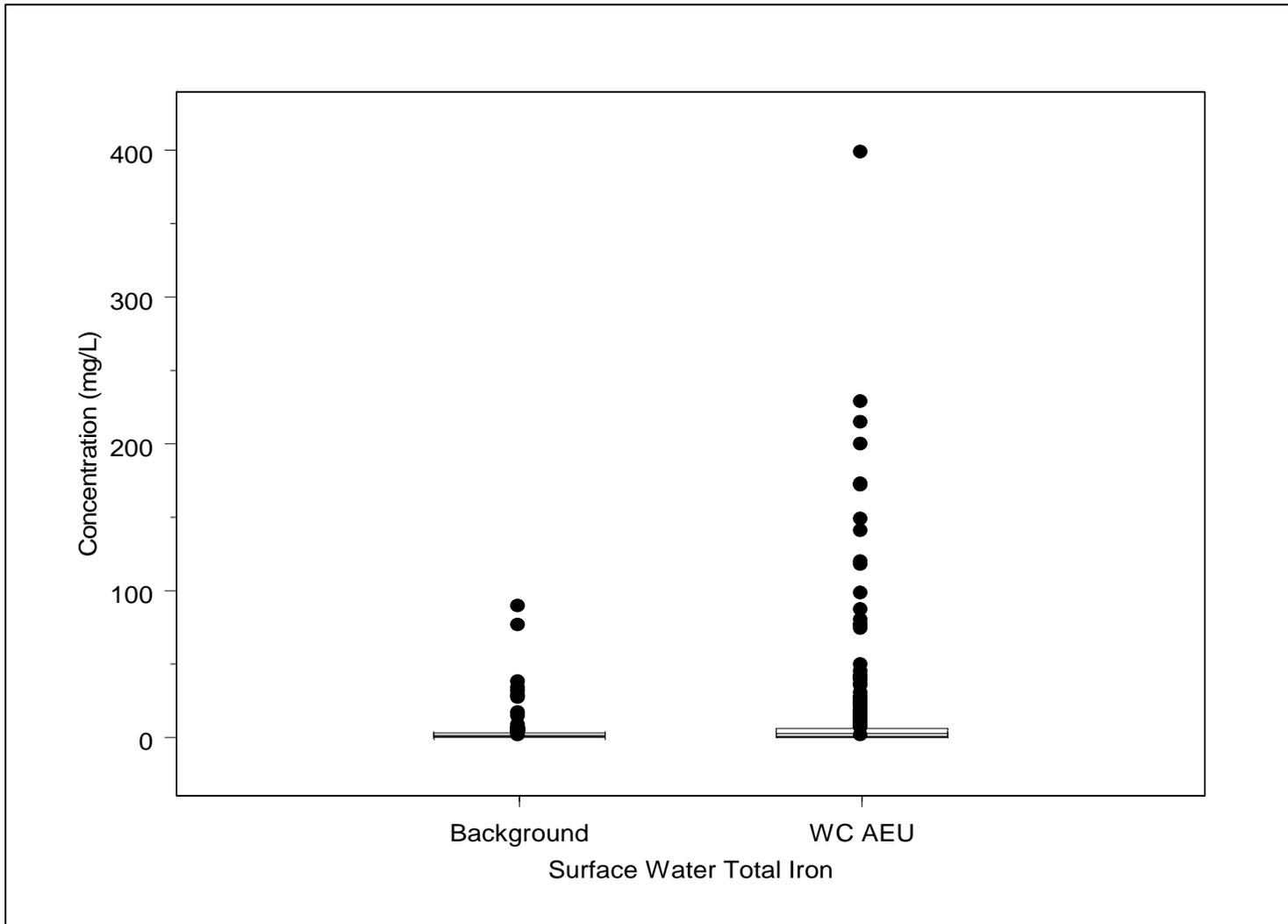
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.9  
WC AEU Surface Water Total Box Plots for Cyanide



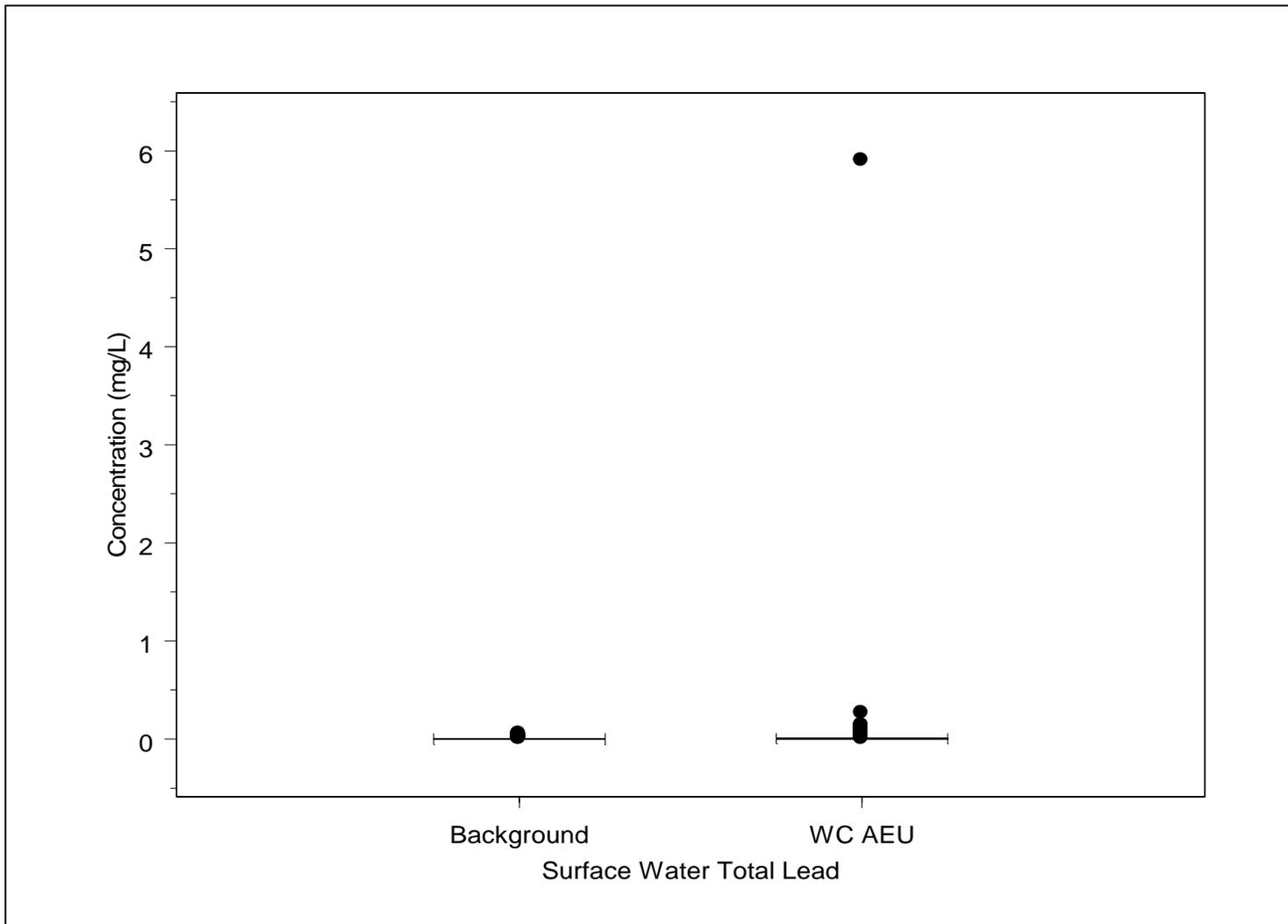
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.10  
WC AEU Surface Water Total Box Plots for Iron



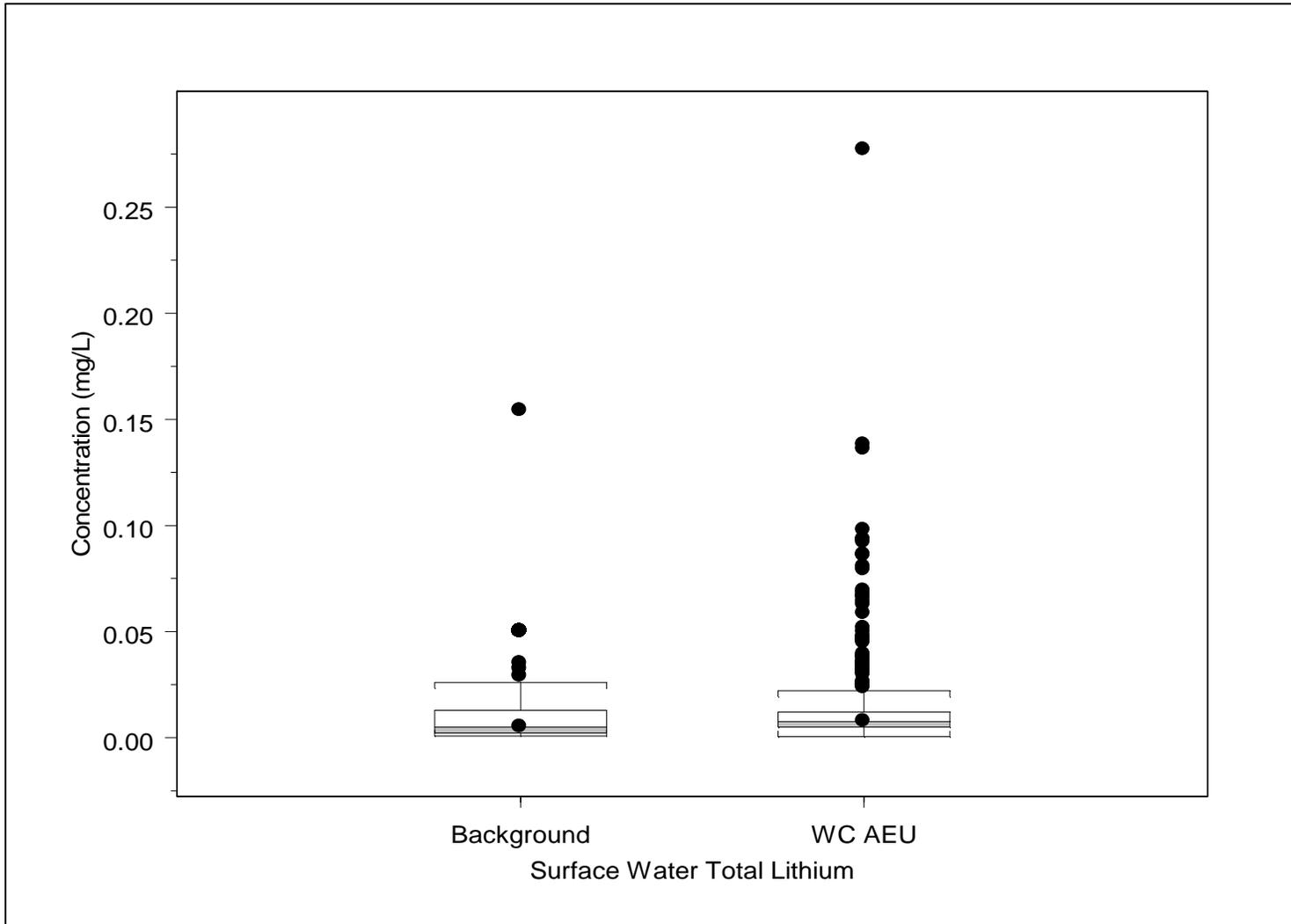
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.11  
WC AEU Surface Water Total Box Plots for Lead



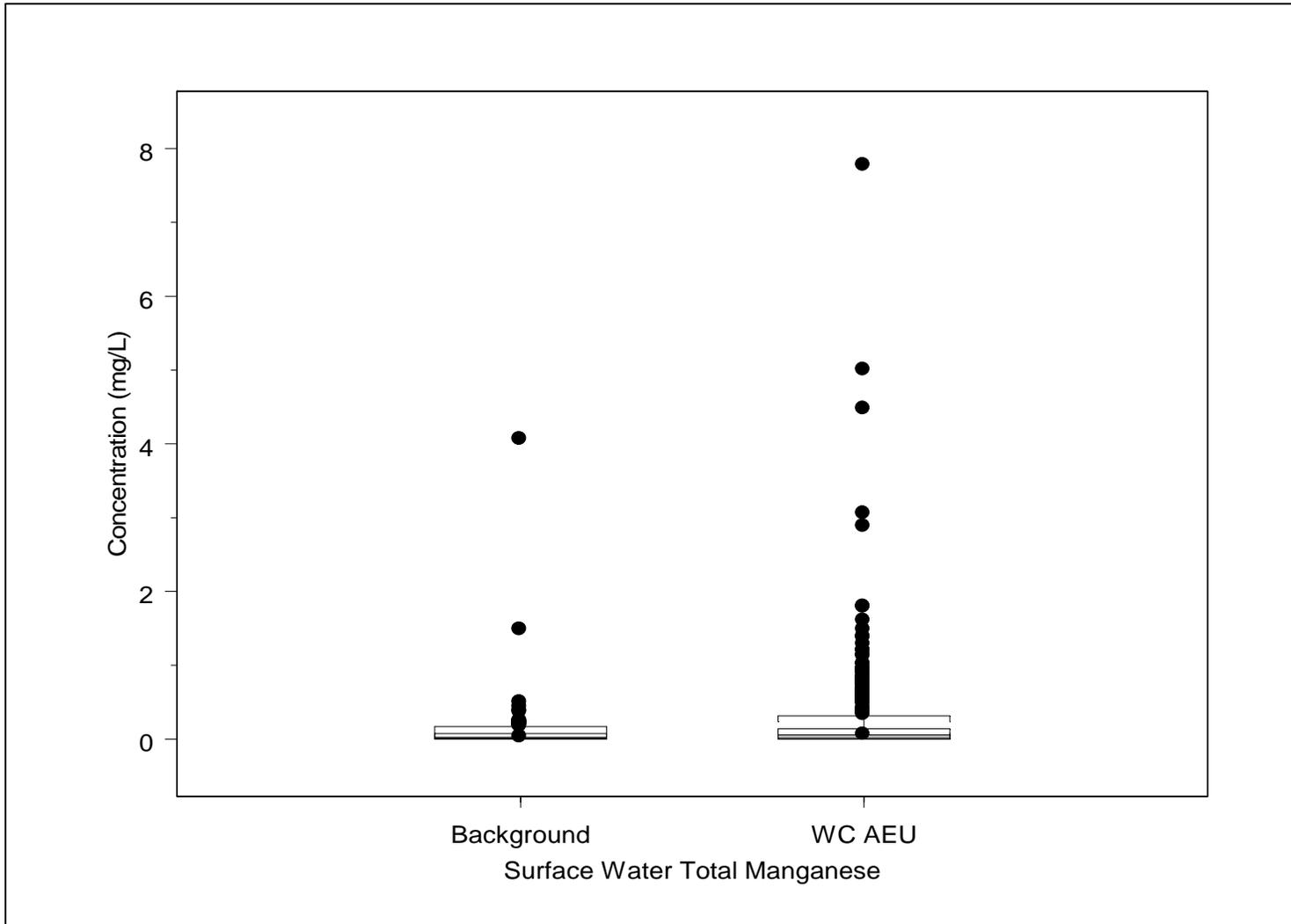
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.12  
WC AEU Surface Water Total Box Plots for Lithium



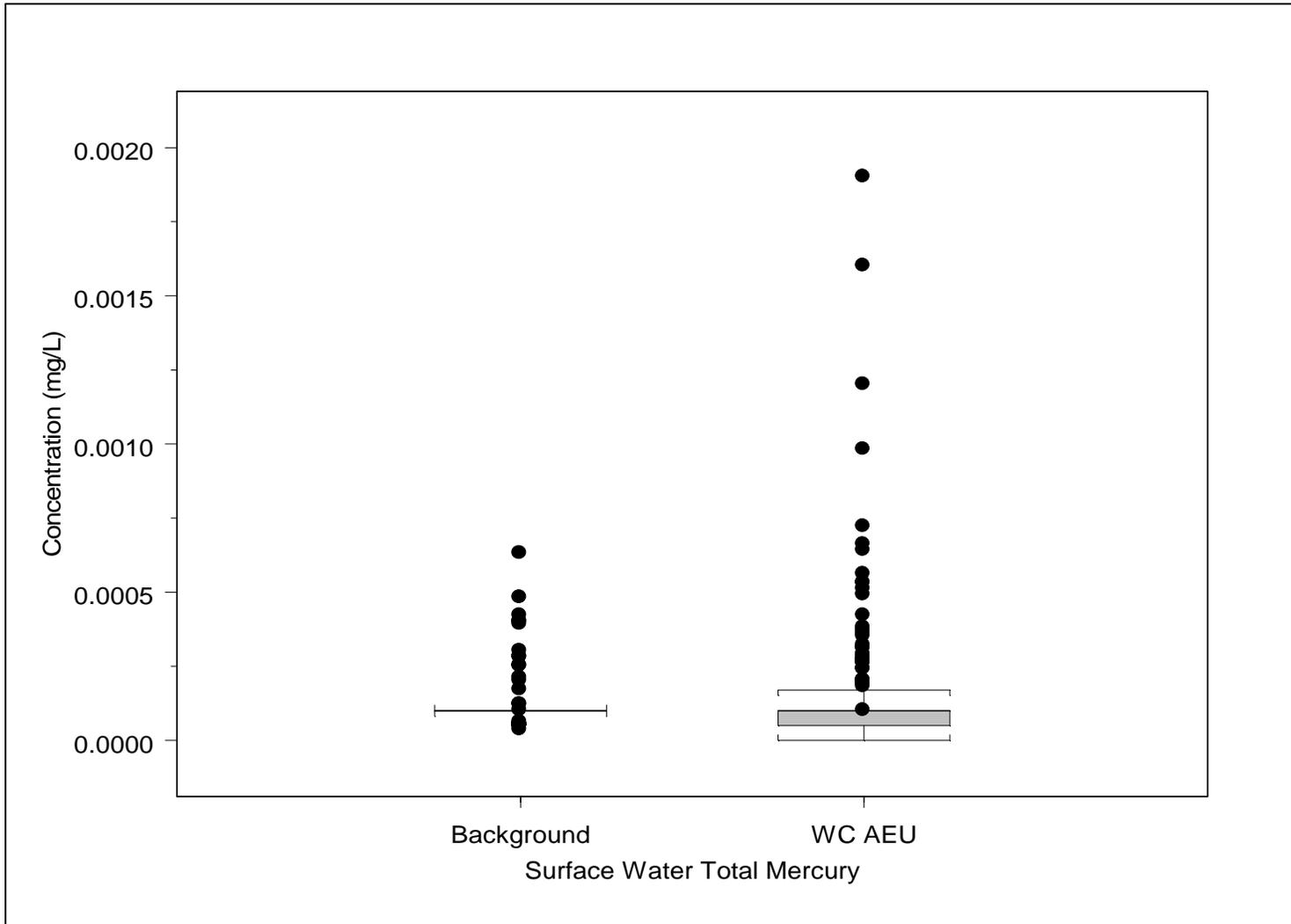
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.13  
WC AEU Surface Water Total Box Plots for Manganese



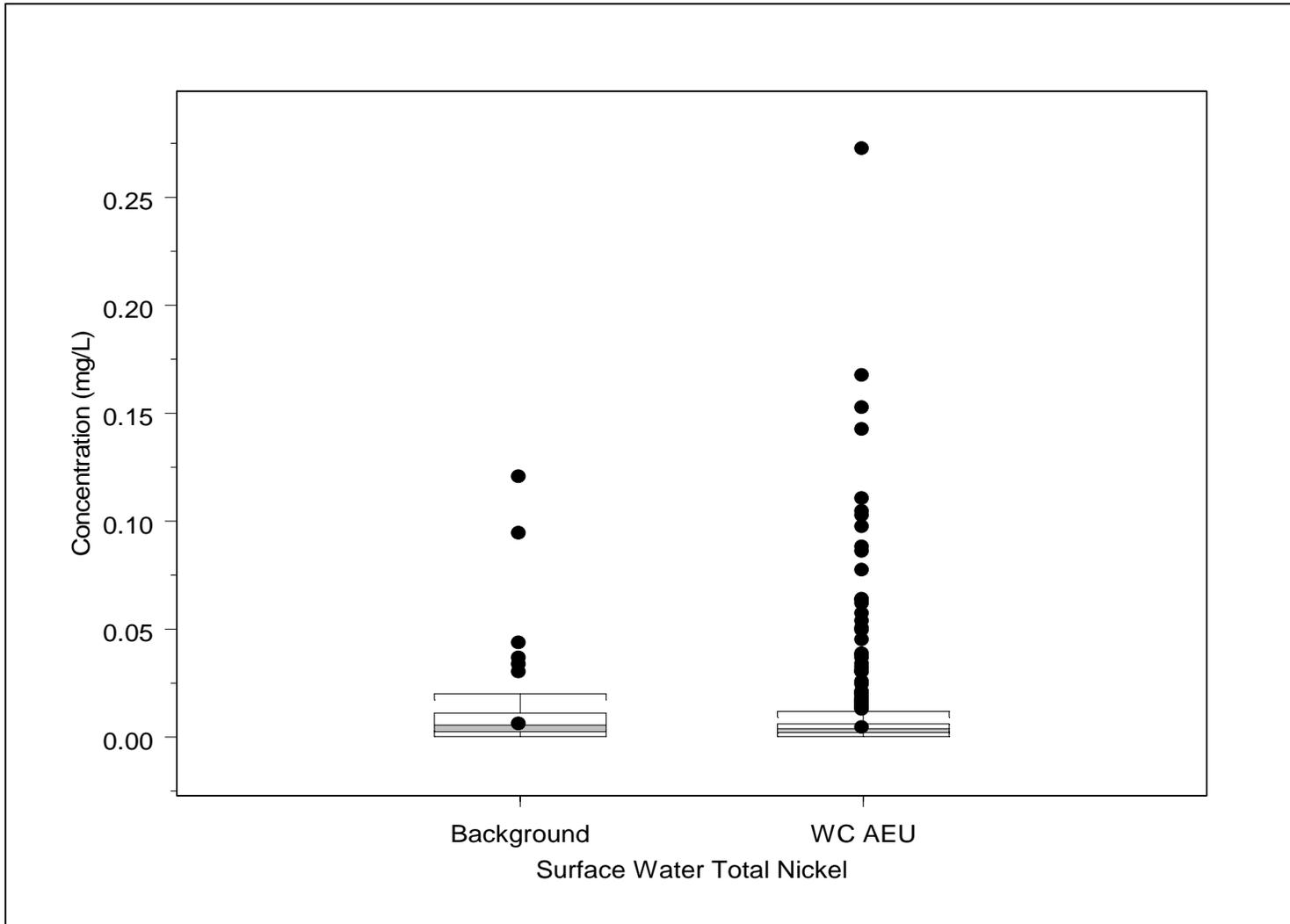
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.14  
WC AEU Surface Water Total Box Plots for Mercury



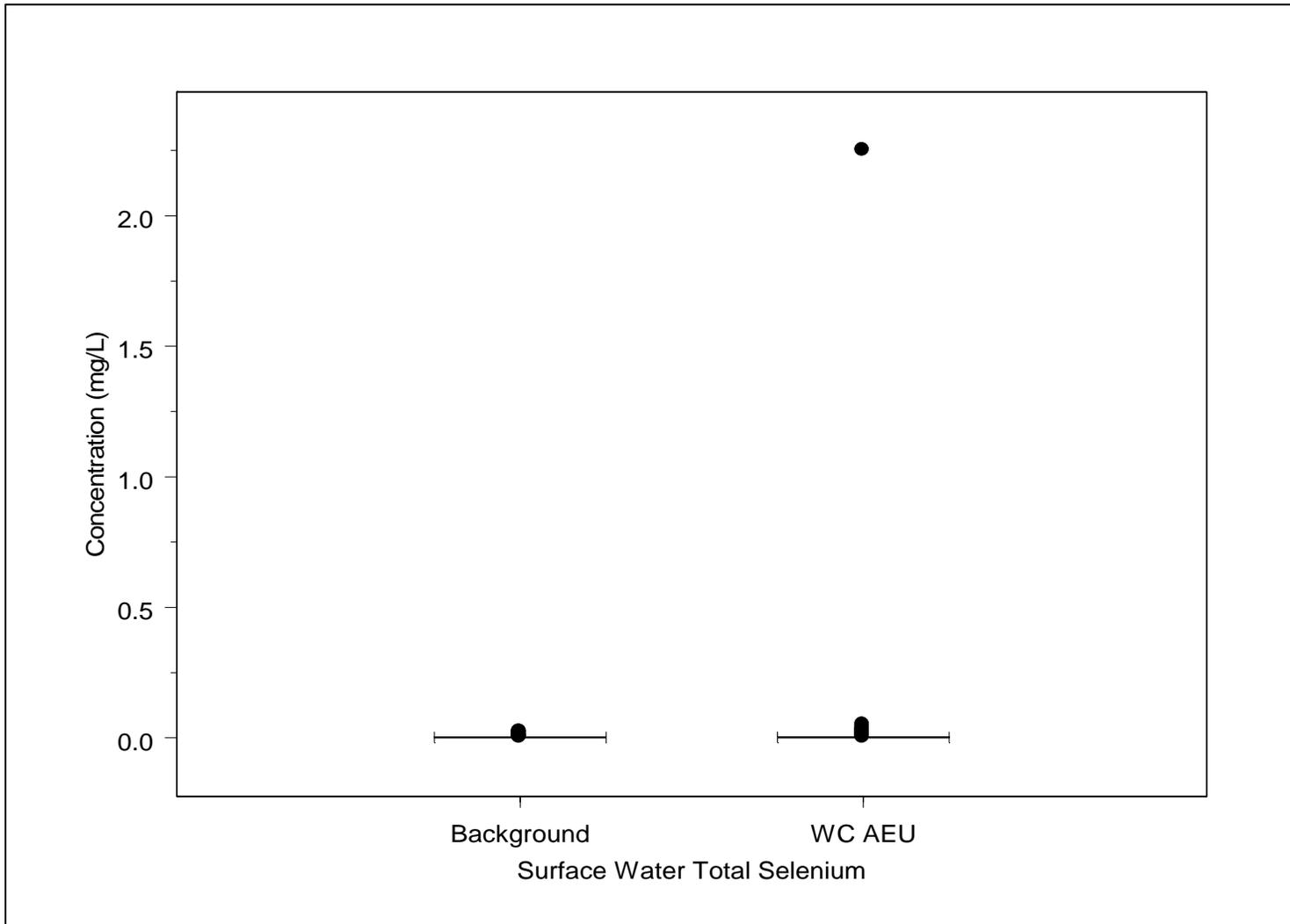
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.15  
WC AEU Surface Water Total Box Plots for Nickel



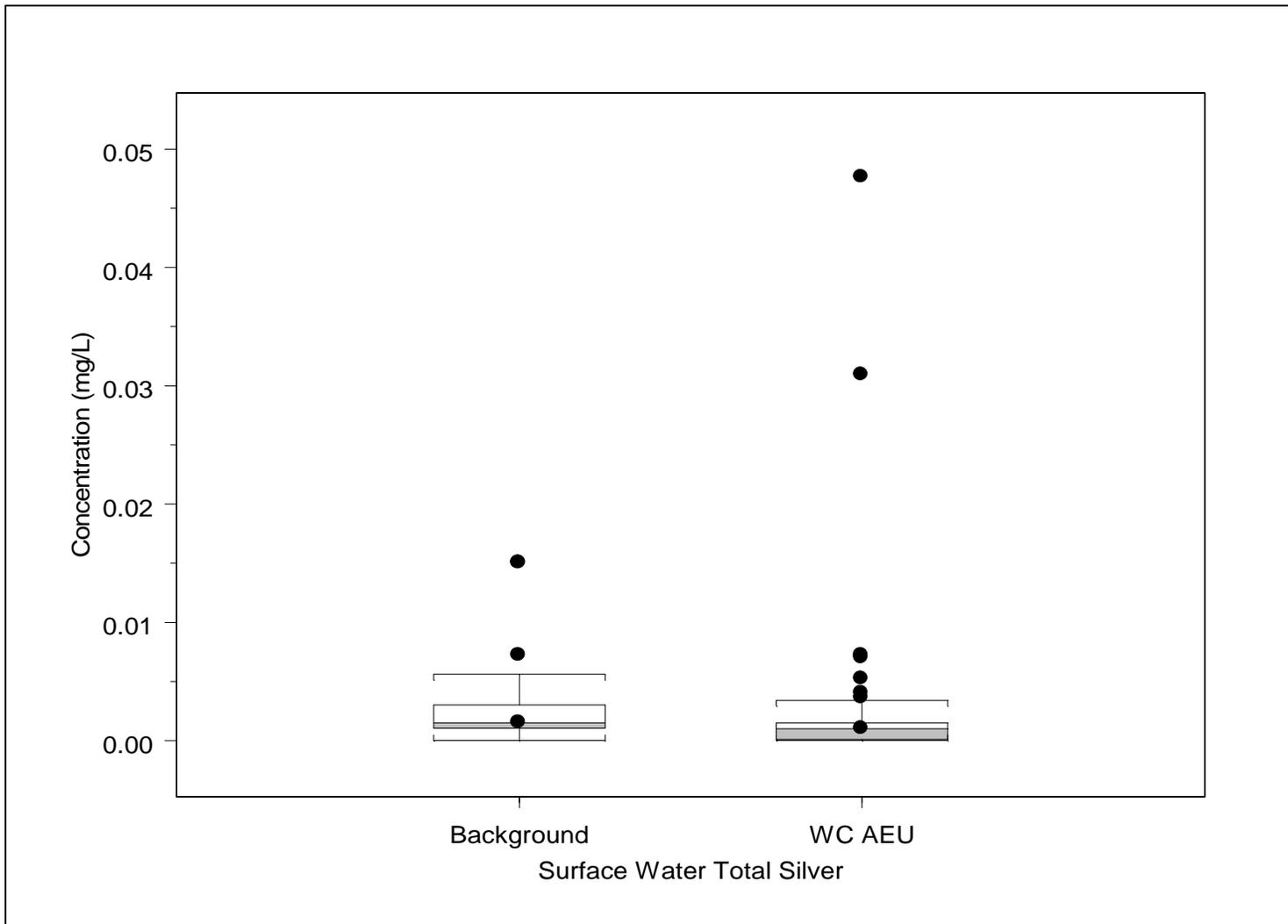
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.16  
WC AEU Surface Water Total Box Plots for Selenium



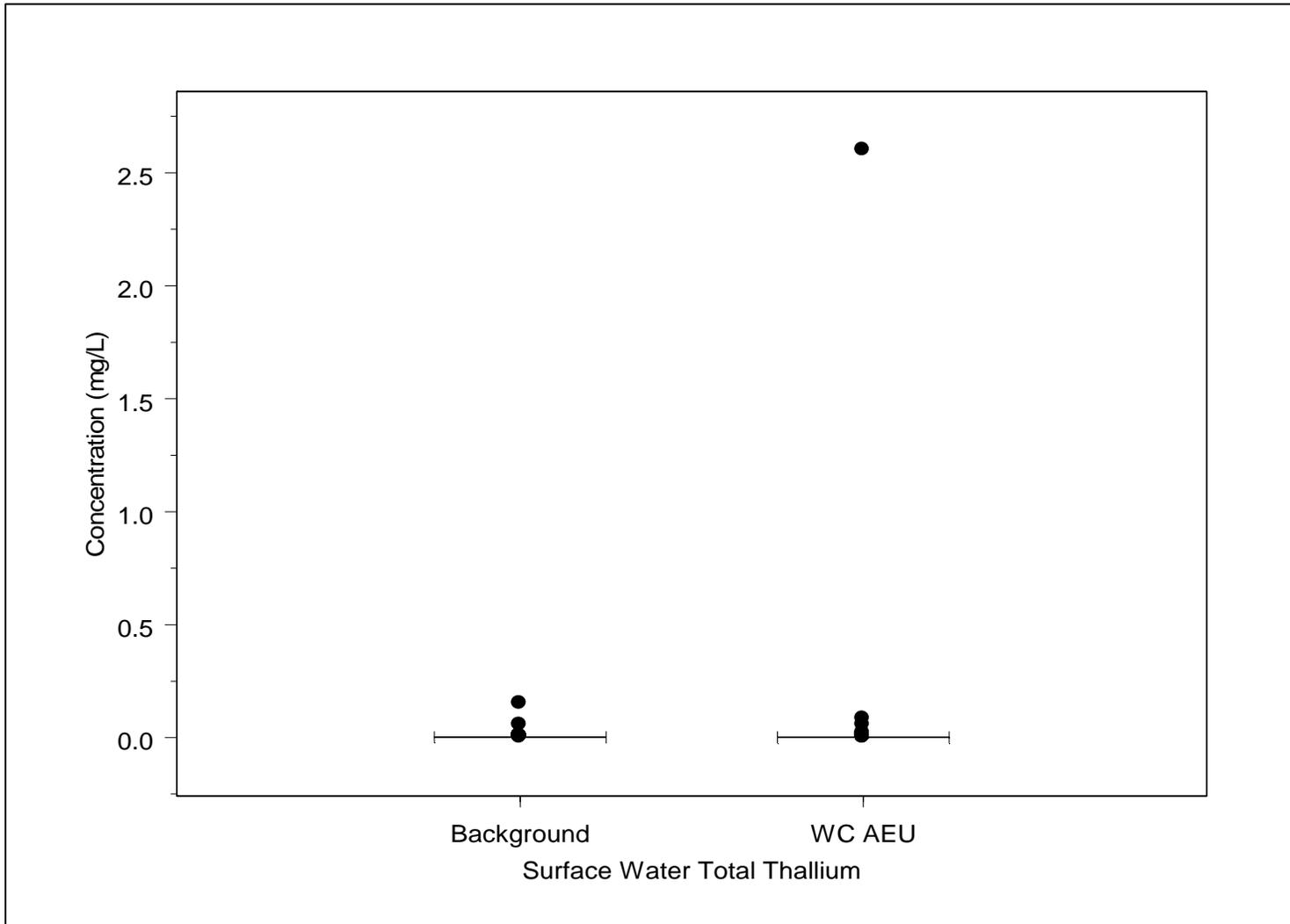
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.17  
WC AEU Surface Water Total Box Plots for Silver



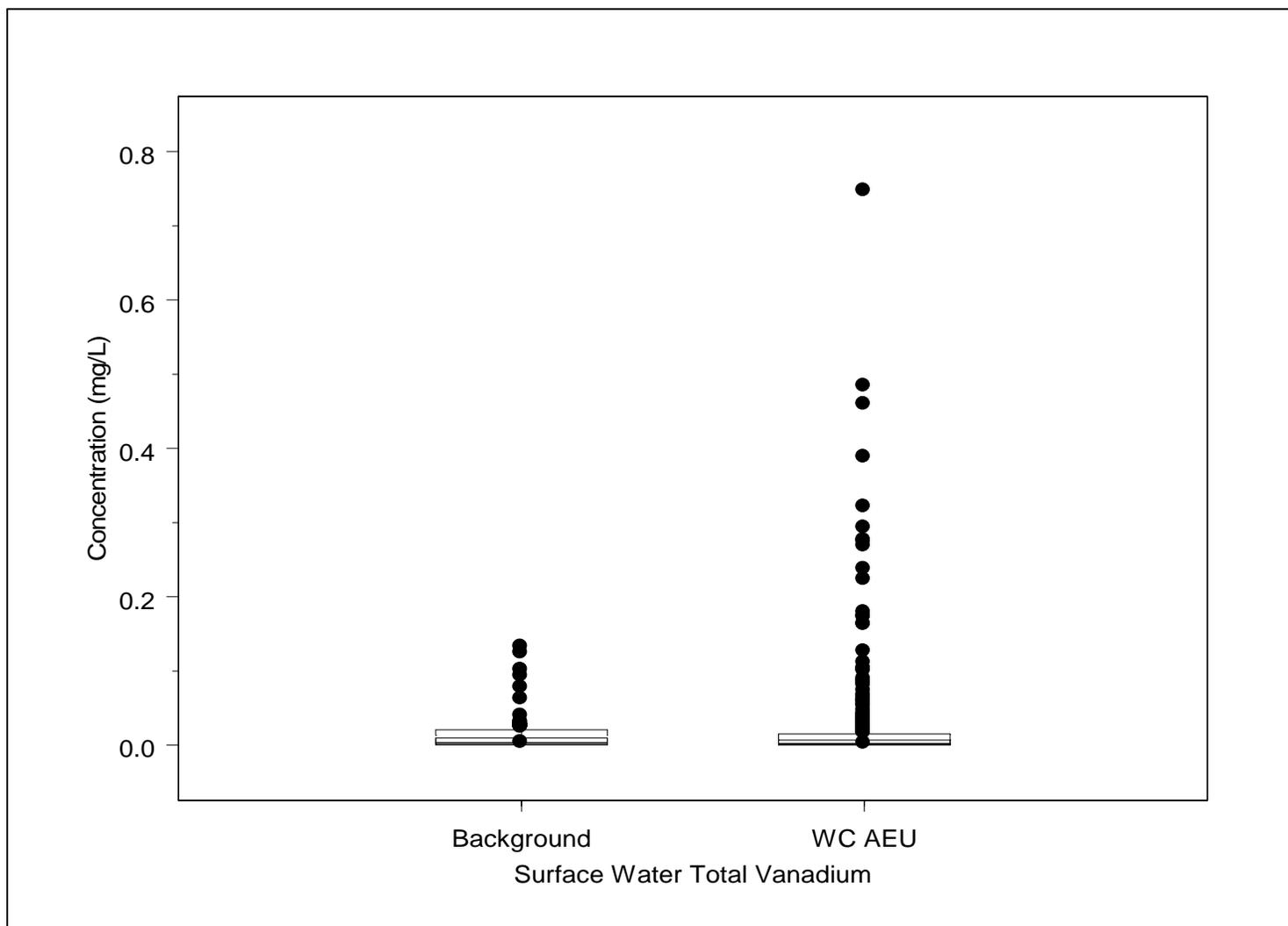
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.18  
WC AEU Surface Water Total Box Plots for Thallium



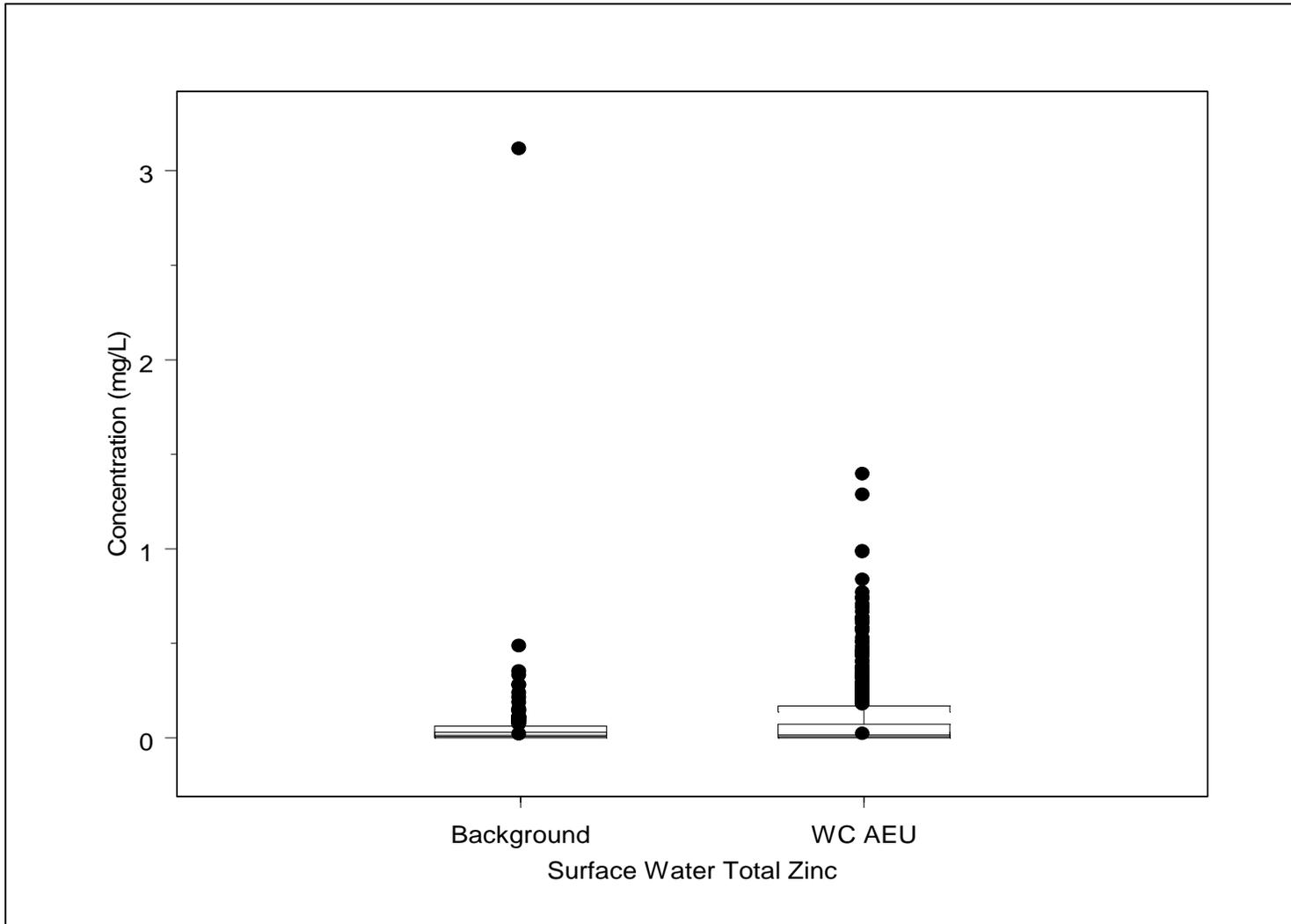
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.19  
WC AEU Surface Water Total Box Plots for Vanadium



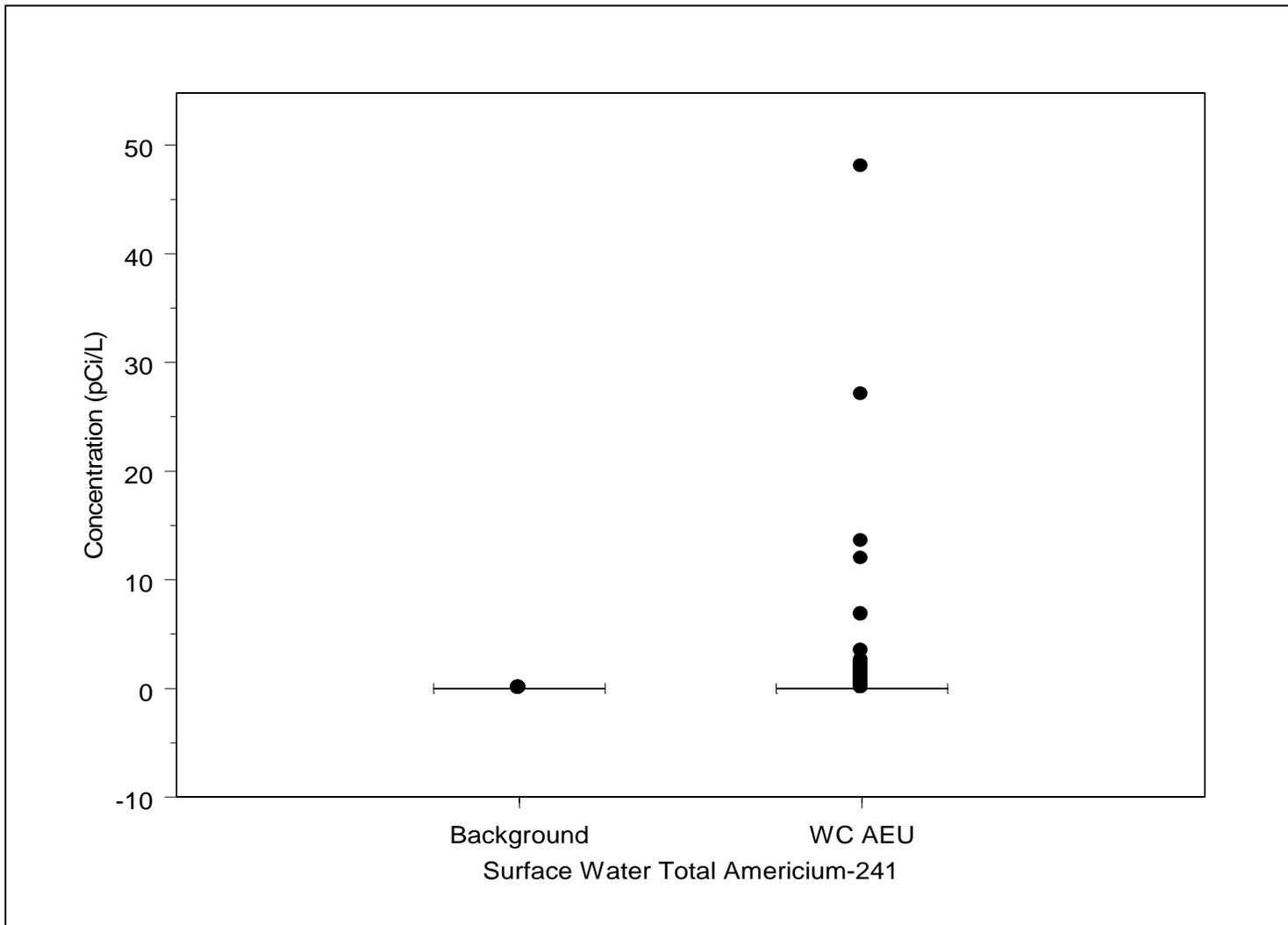
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

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



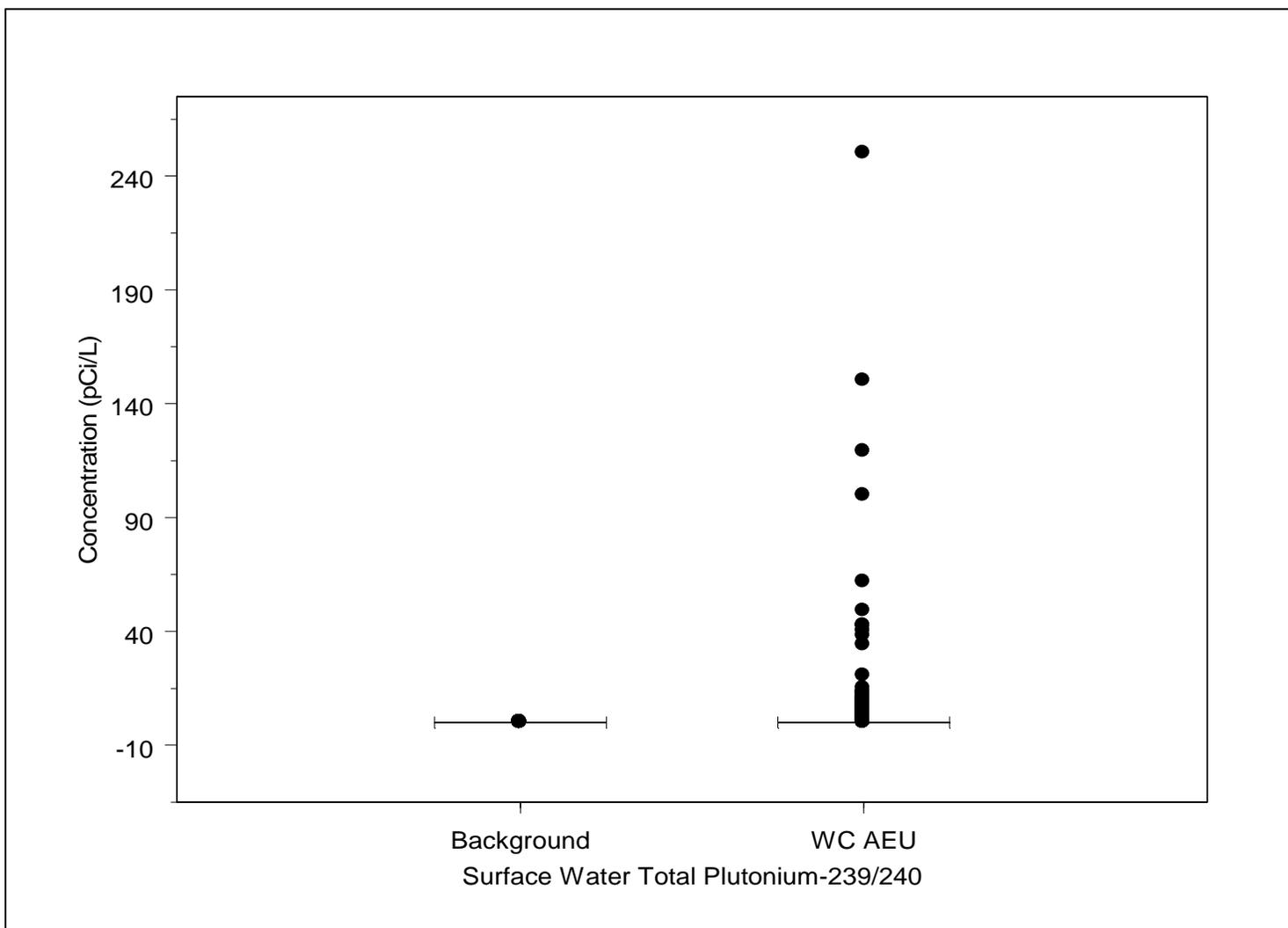
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.21  
WC AEU Surface Water Total Box Plots for Americium-241



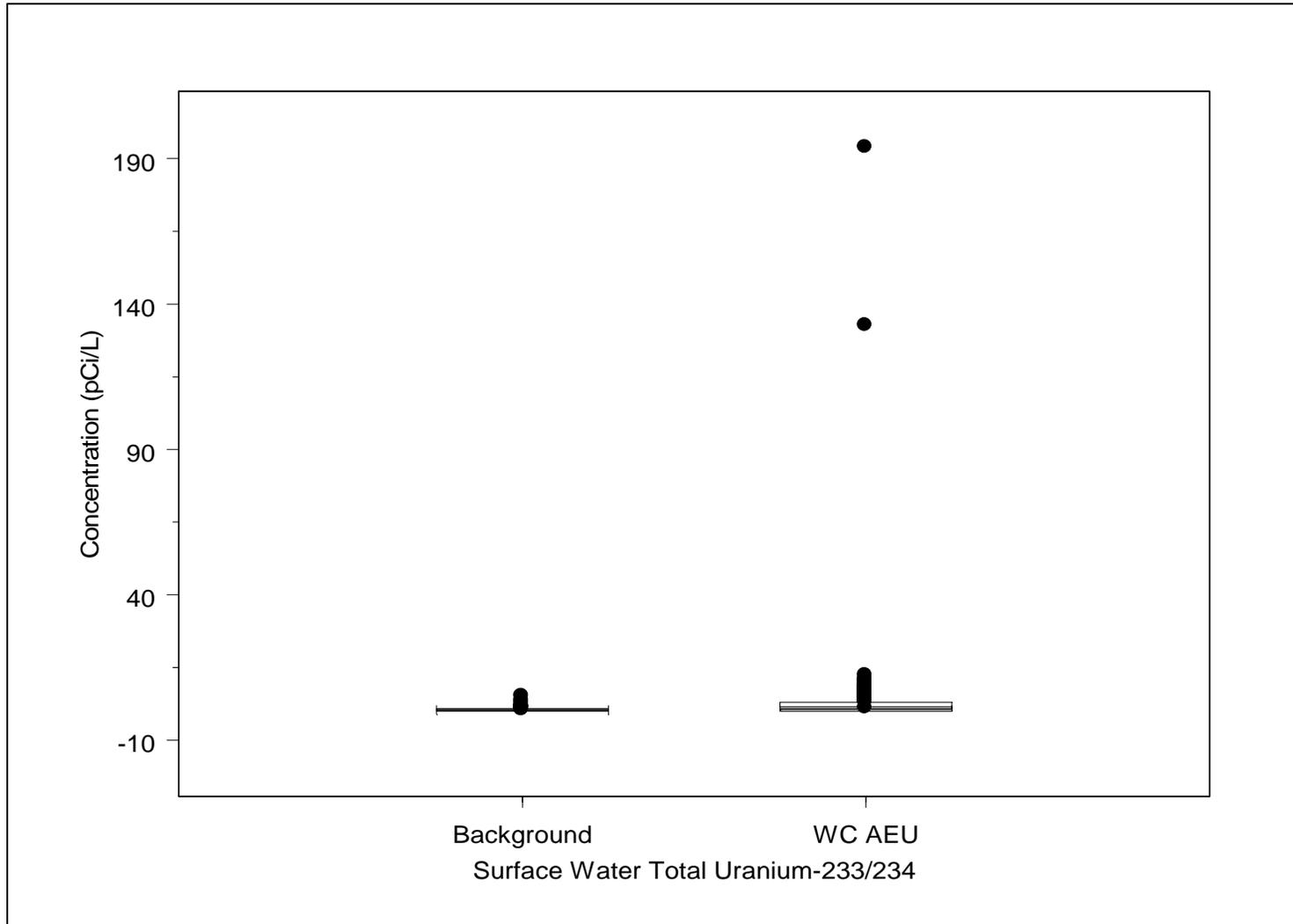
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.22  
WC AEU Surface Water Total Box Plots for Plutonium-239/240



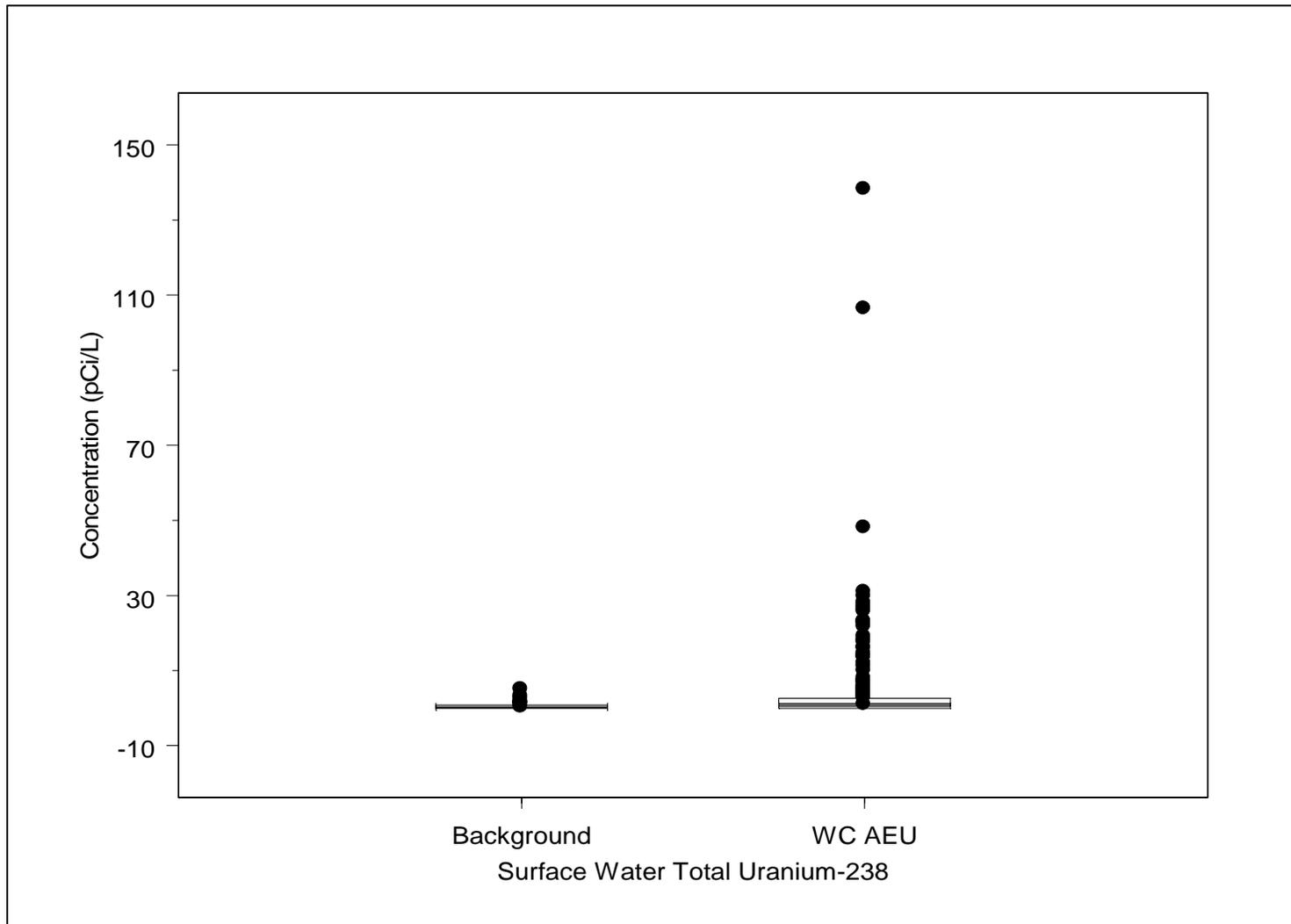
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.23  
WC AEU Surface Water Total Box Plots for Uranium-233/234



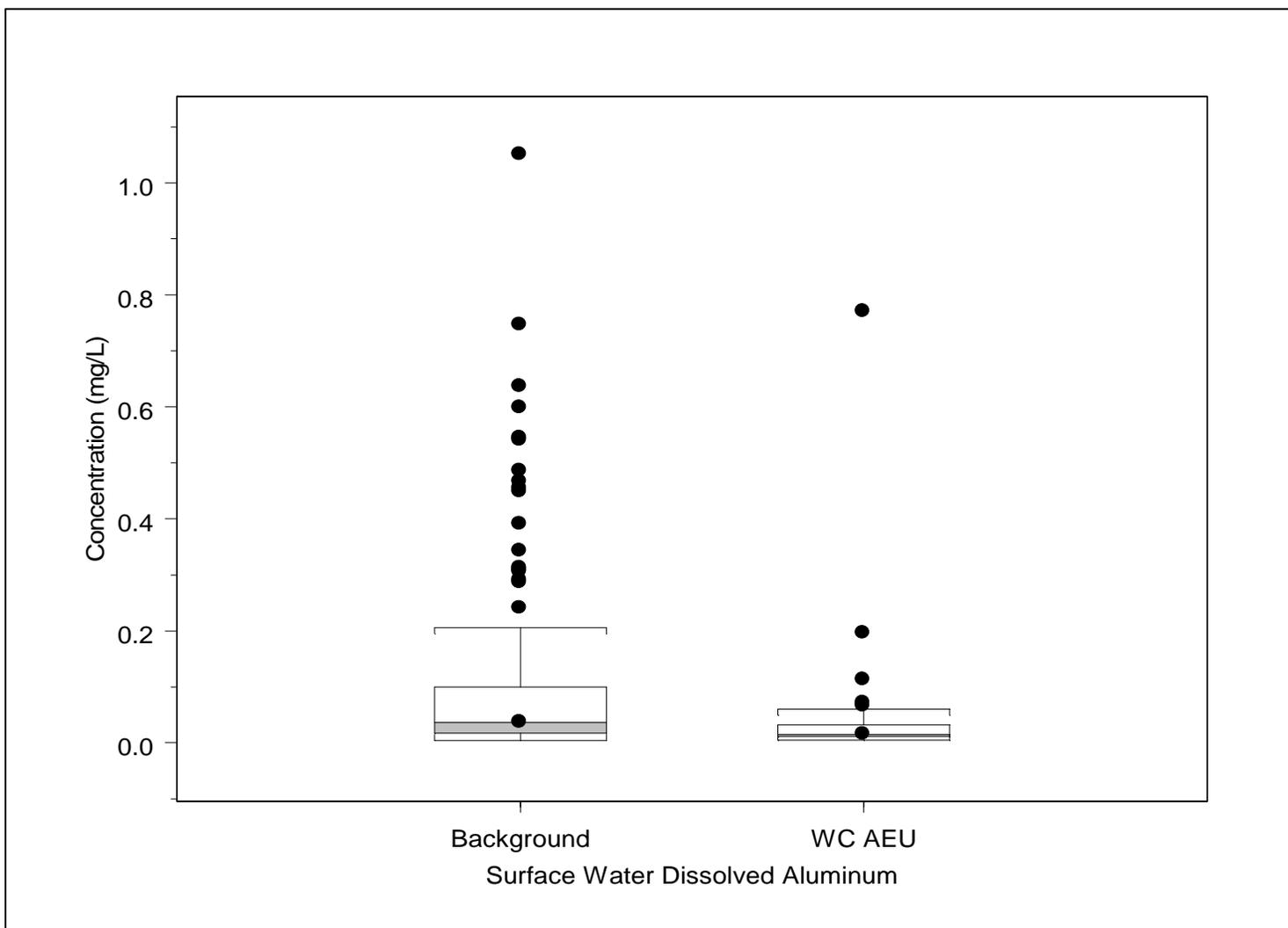
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.24  
WC AEU Surface Water Total Box Plots for Uranium-238



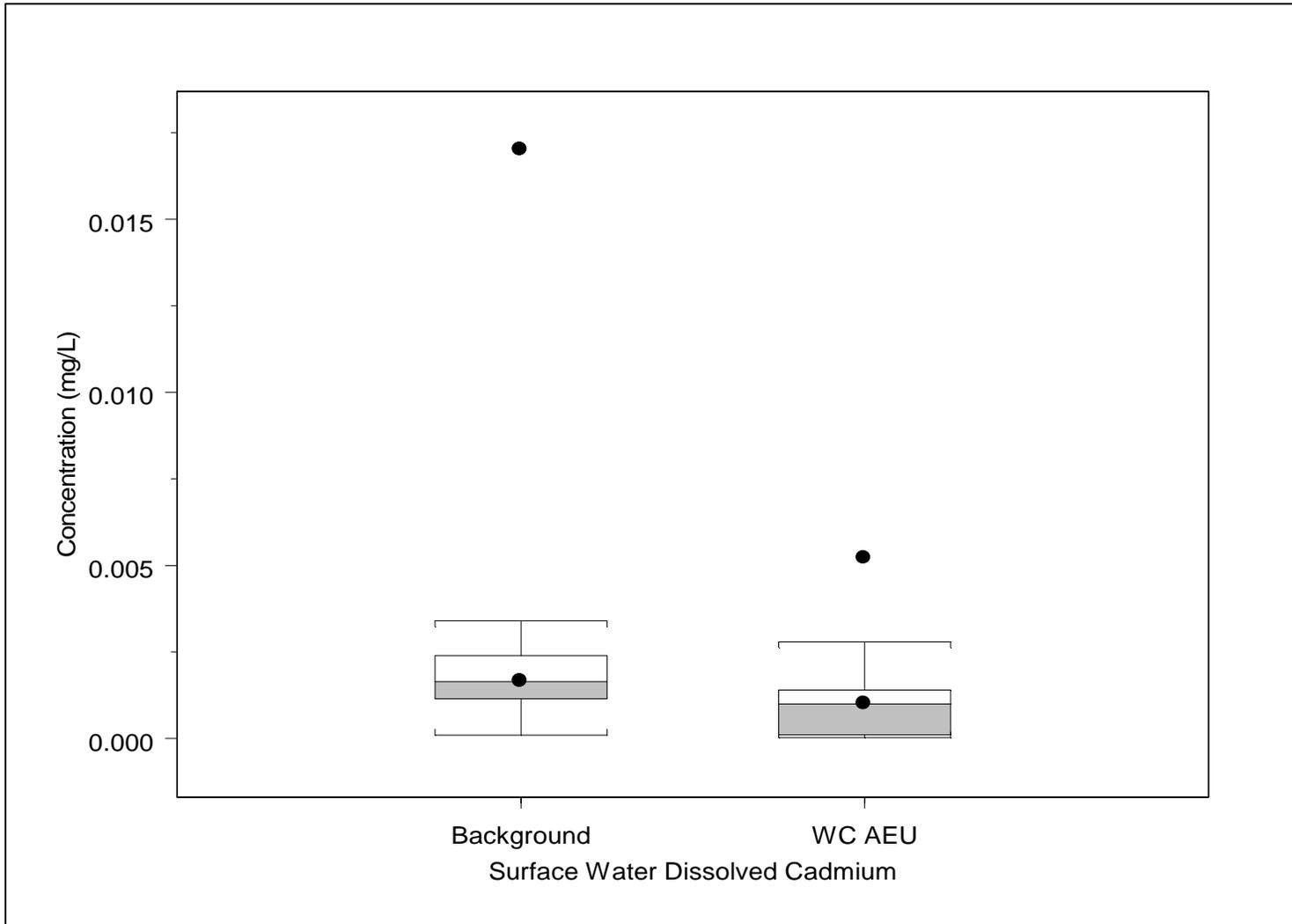
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.25  
WC AEU Surface Water Dissolved Box Plots for Aluminum



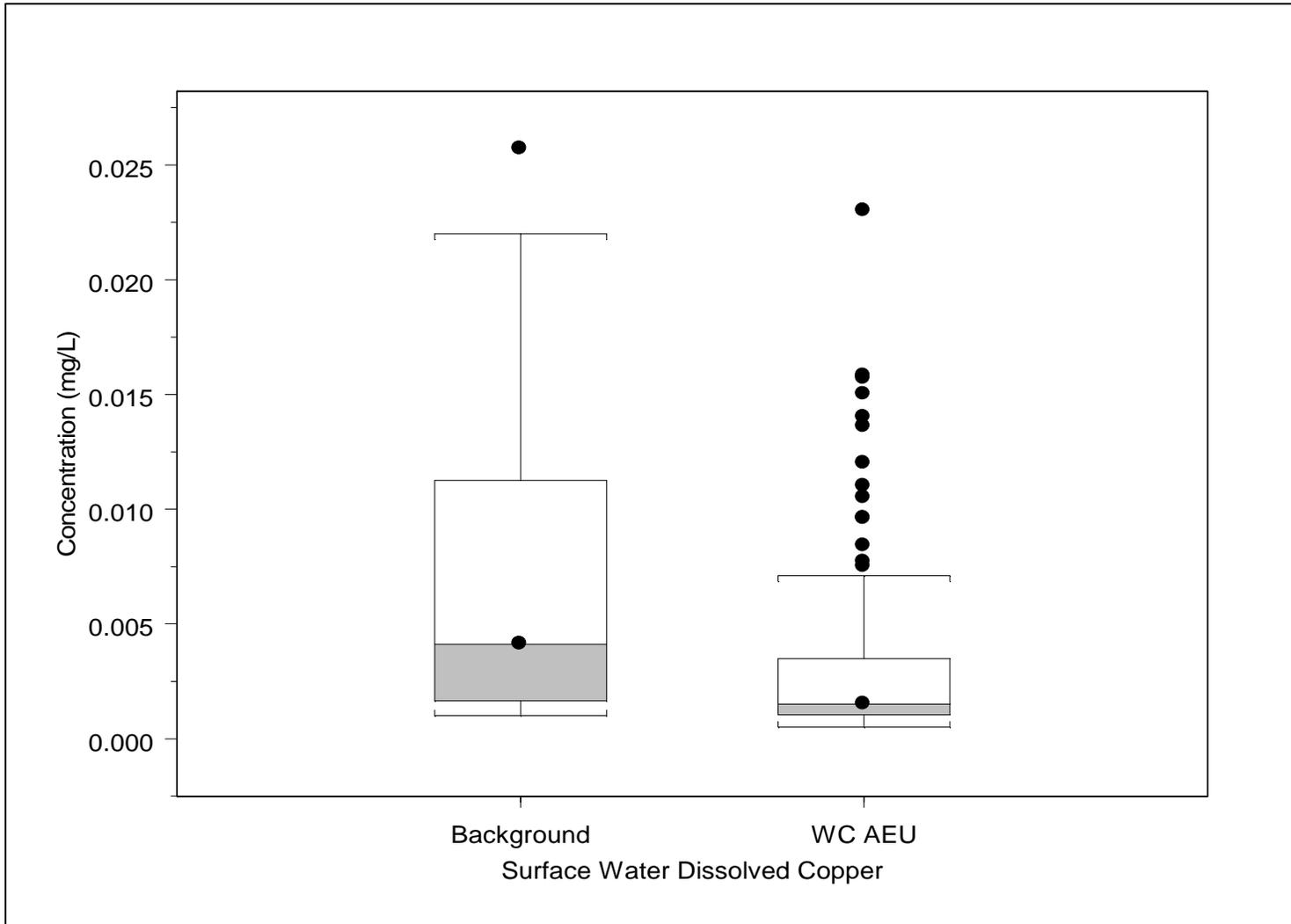
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.26  
WC AEU Surface Water Dissolved Box Plots for Cadmium



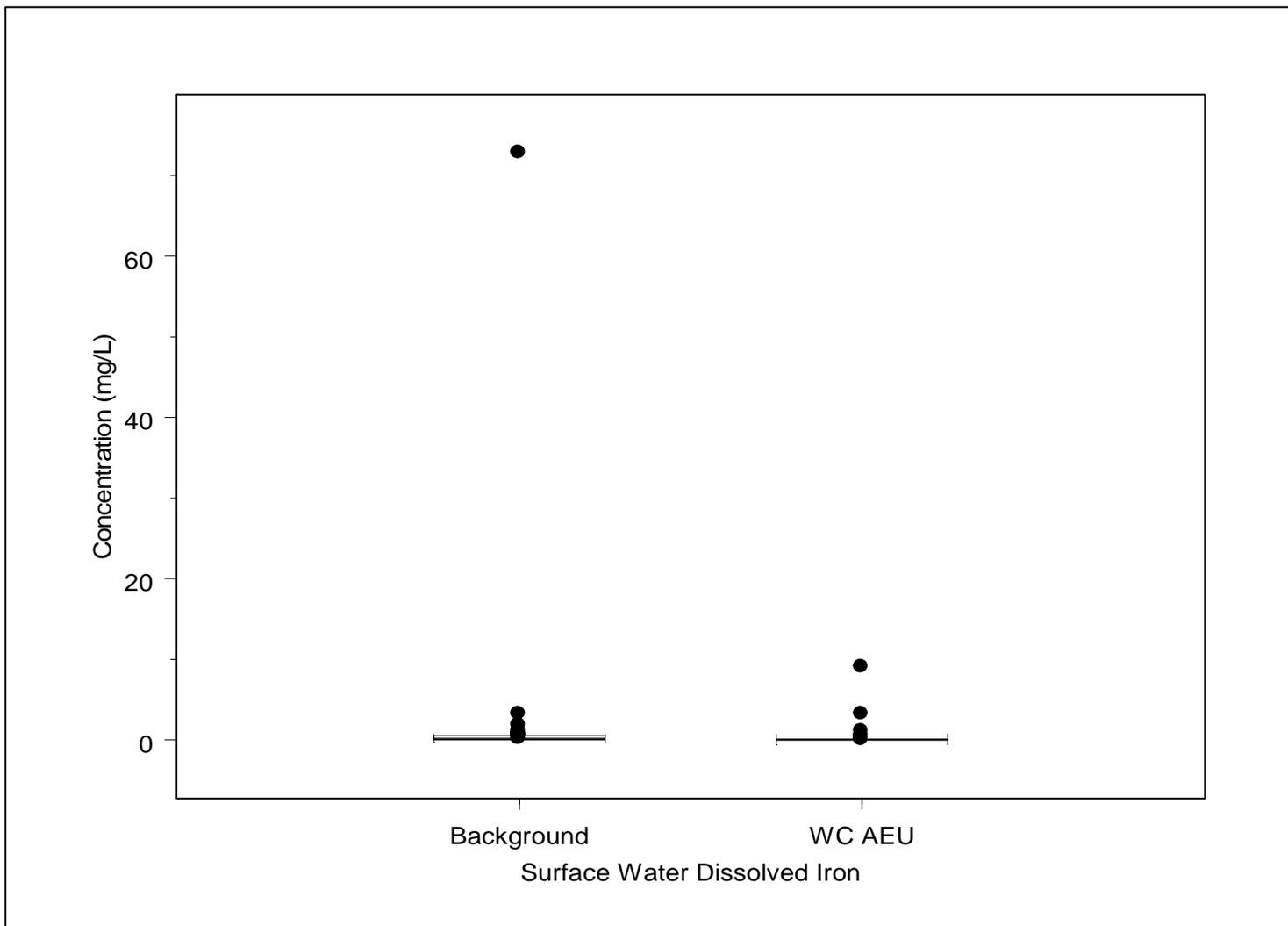
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.27  
WC AEU Surface Water Dissolved Box Plots for Copper



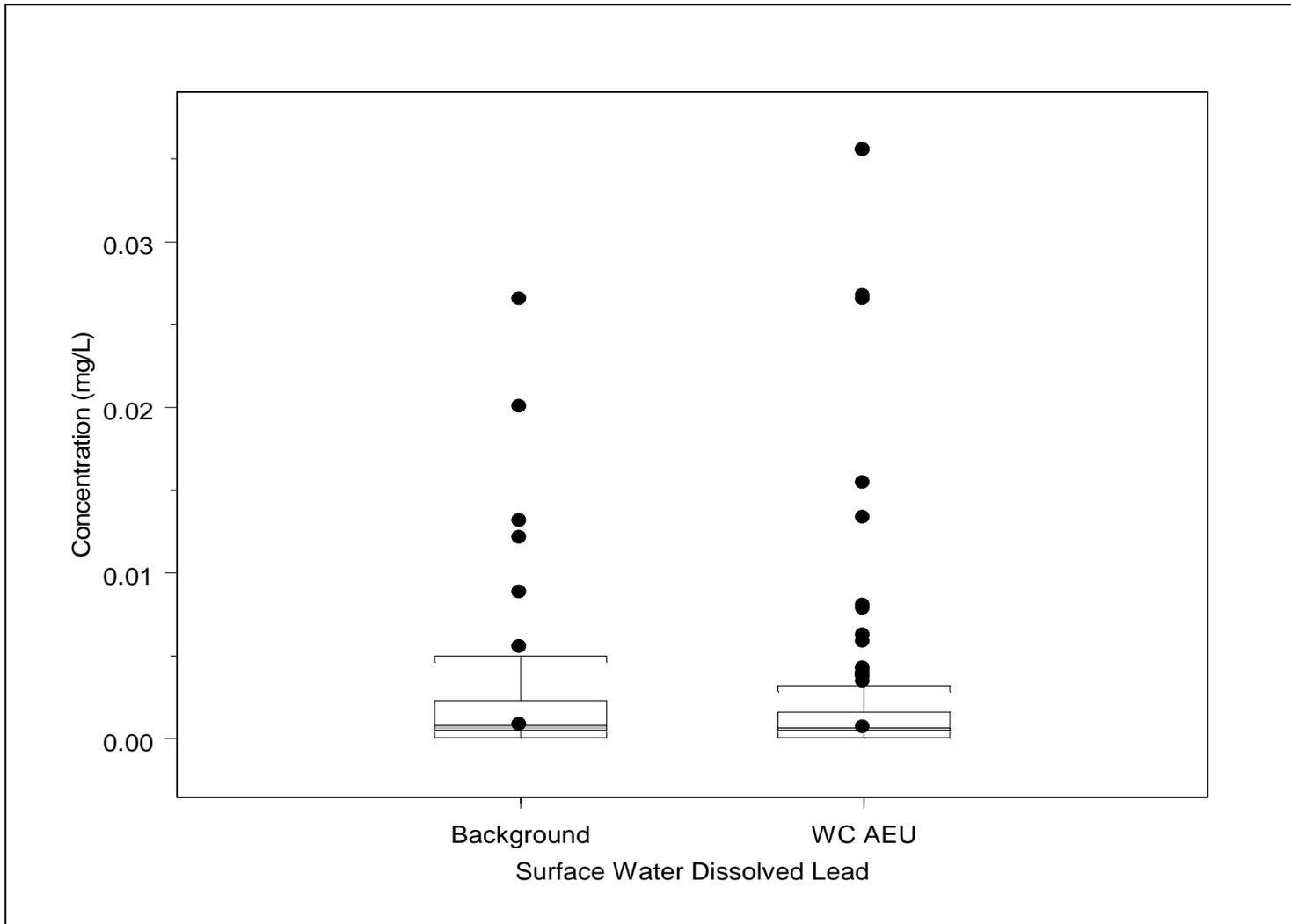
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.28  
WC AEU Surface Water Dissolved Box Plots for Iron



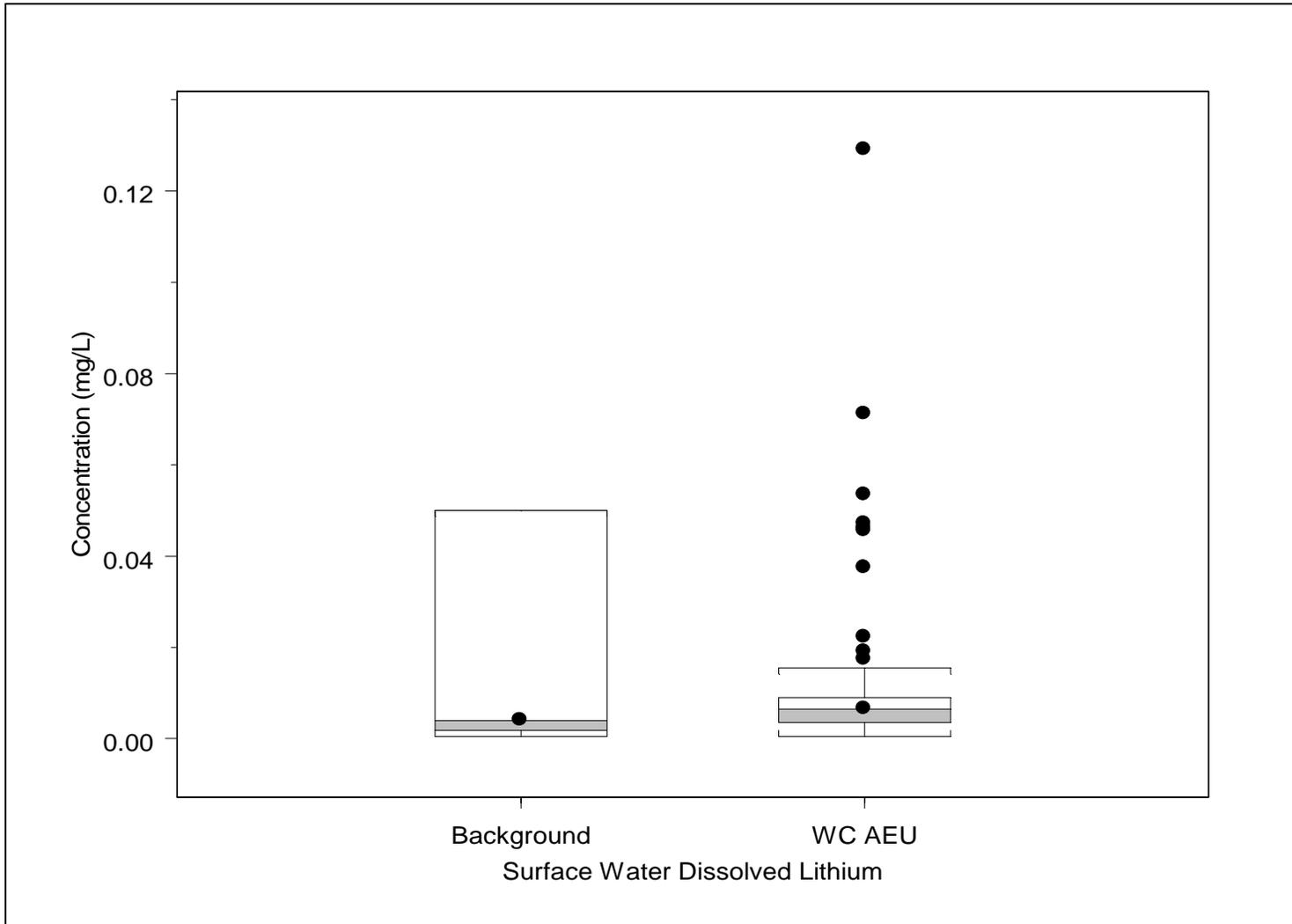
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.29  
WC AEU Surface Water Dissolved Box Plots for Lead



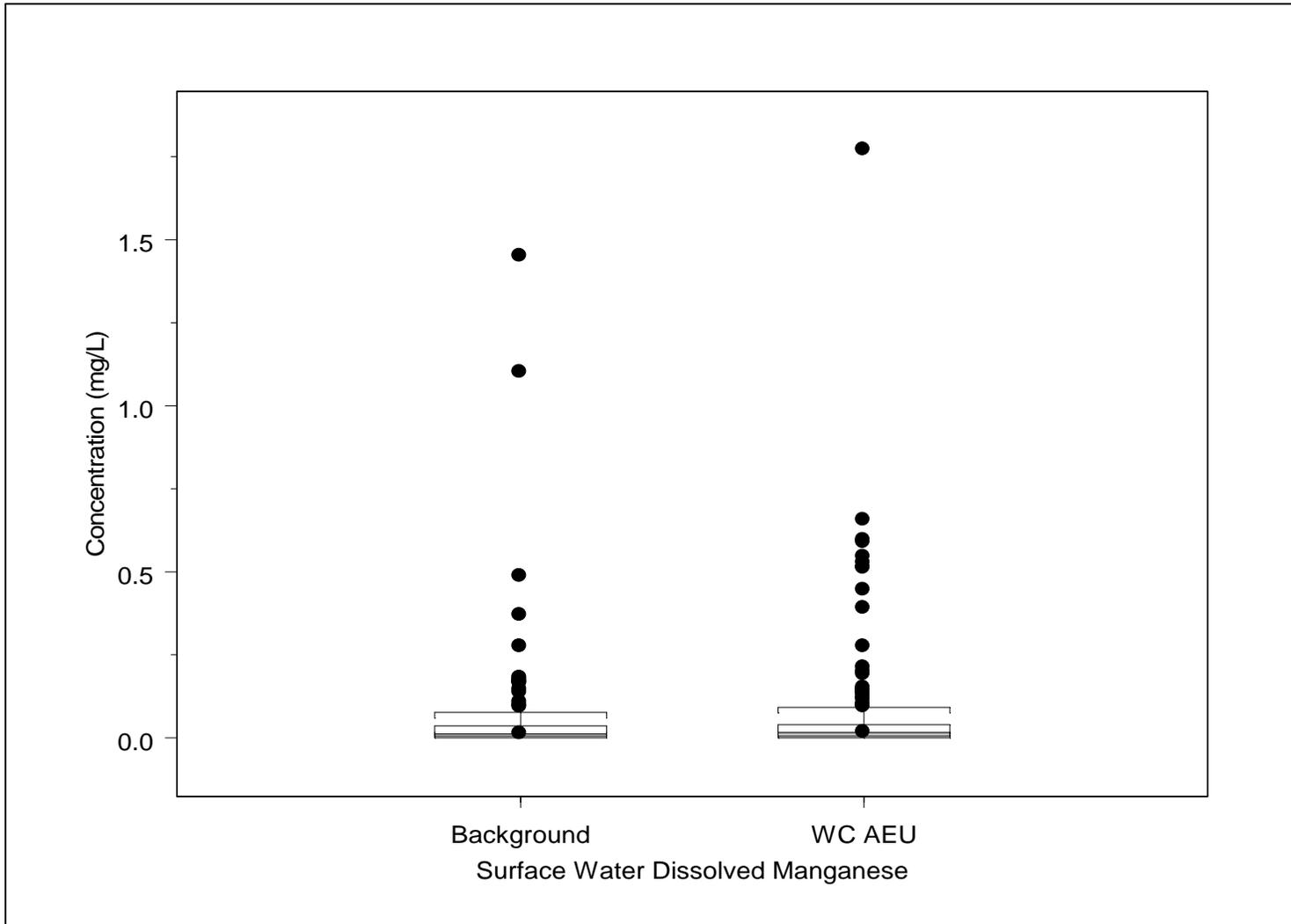
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.30  
WC AEU Surface Water Dissolved Box Plots for Lithium



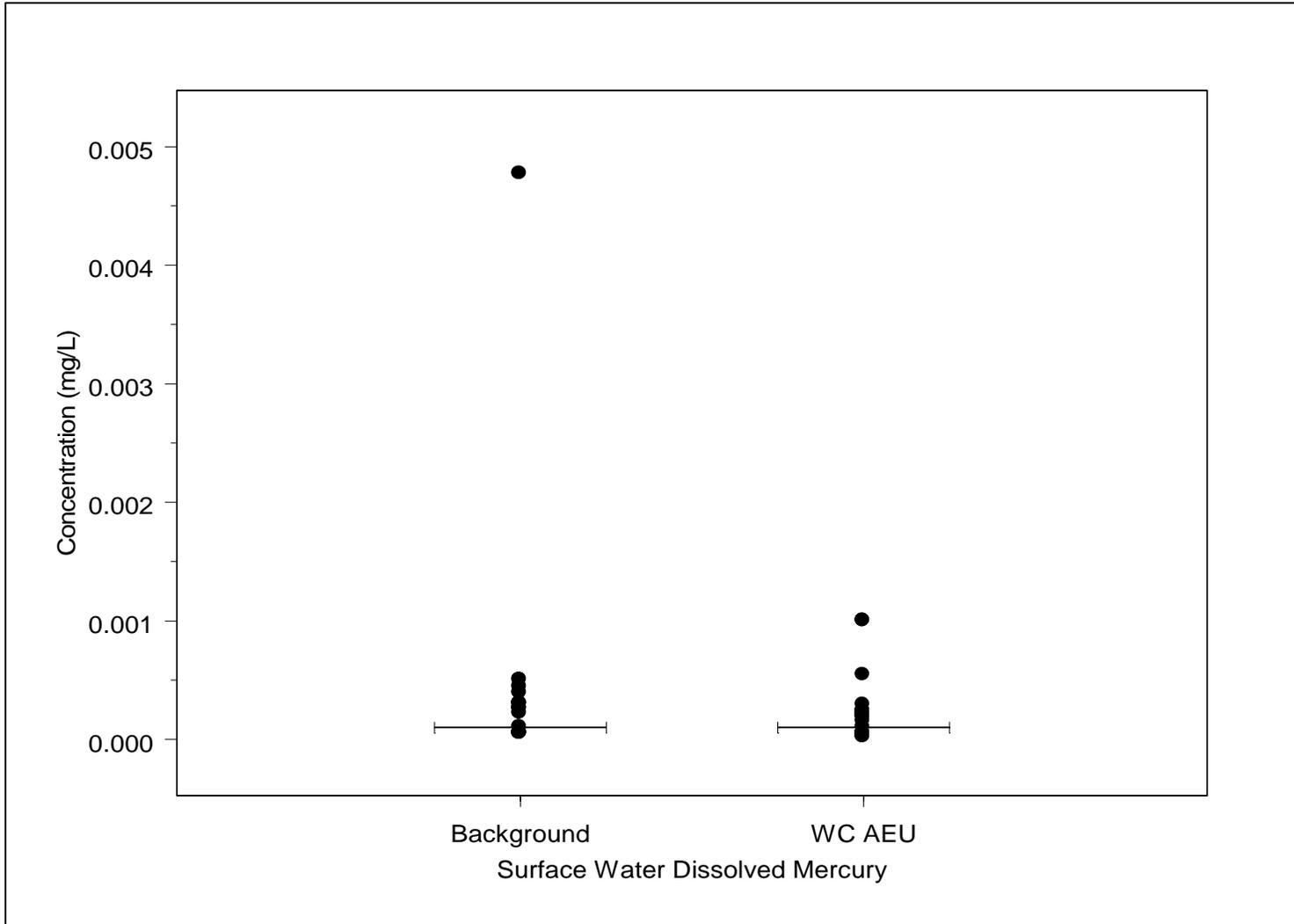
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.31  
WC AEU Surface Water Dissolved Box Plots for Manganese



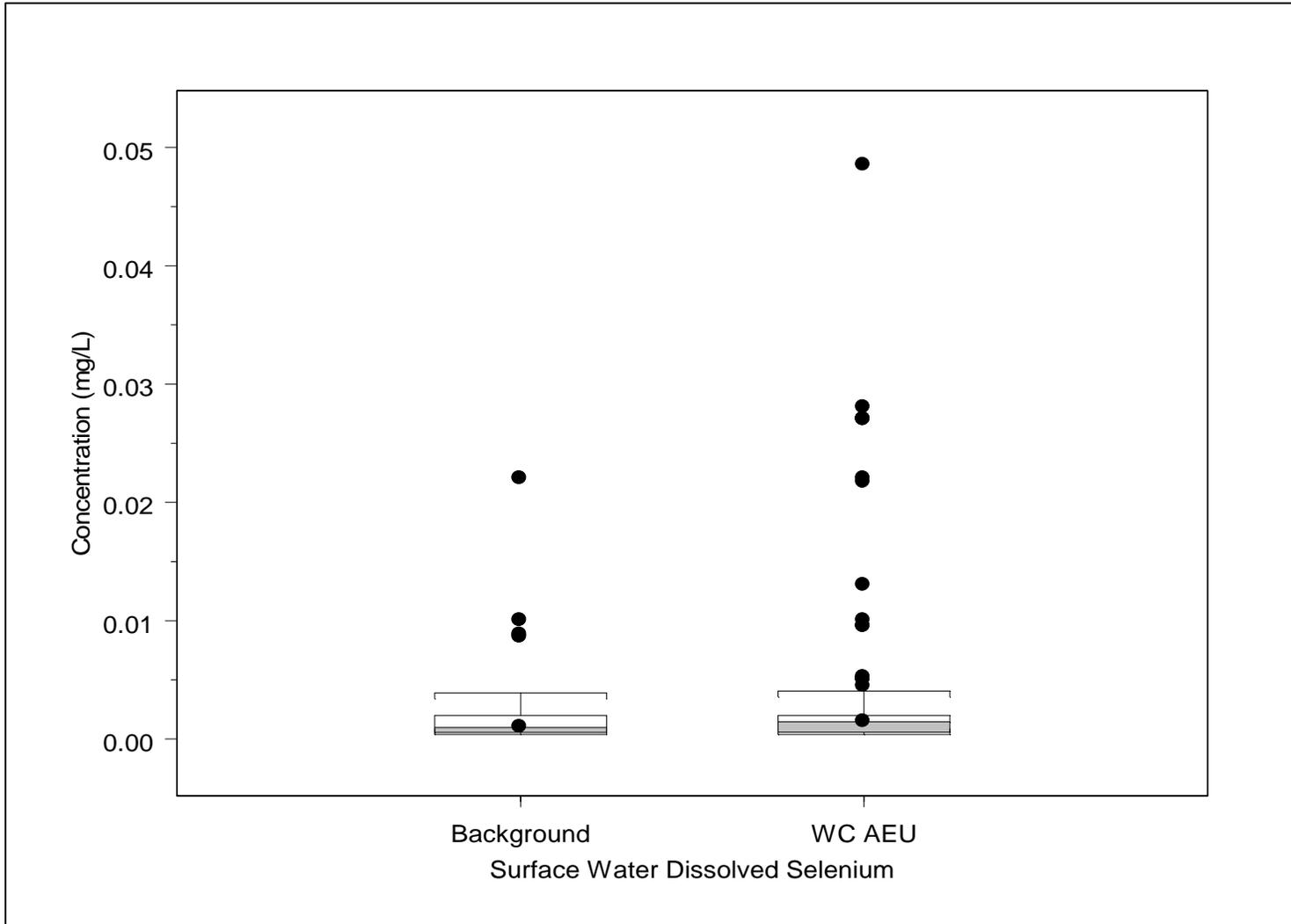
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.32  
WC AEU Surface Water Dissolved Box Plots for Mercury



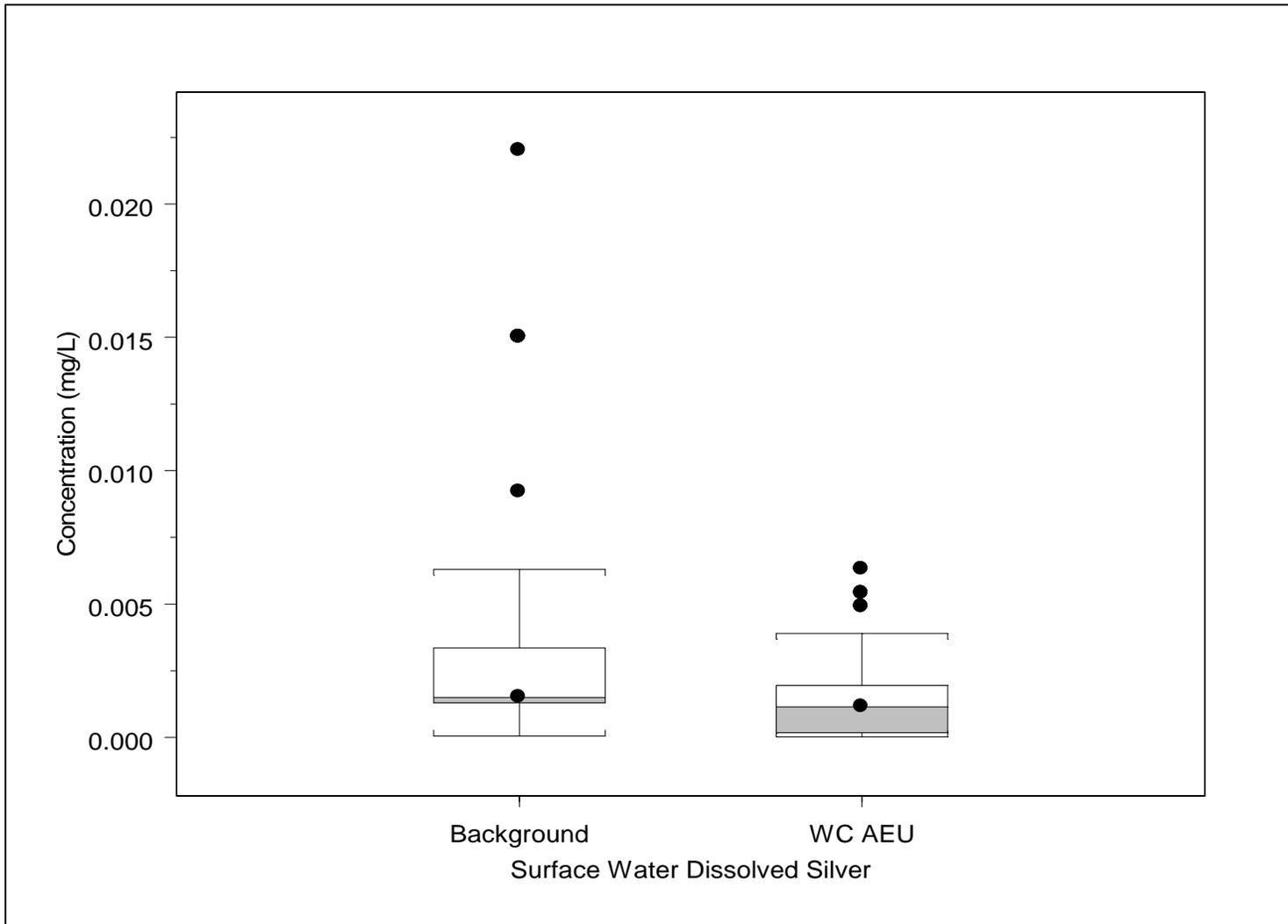
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.33  
WC AEU Surface Water Dissolved Box Plots for Selenium



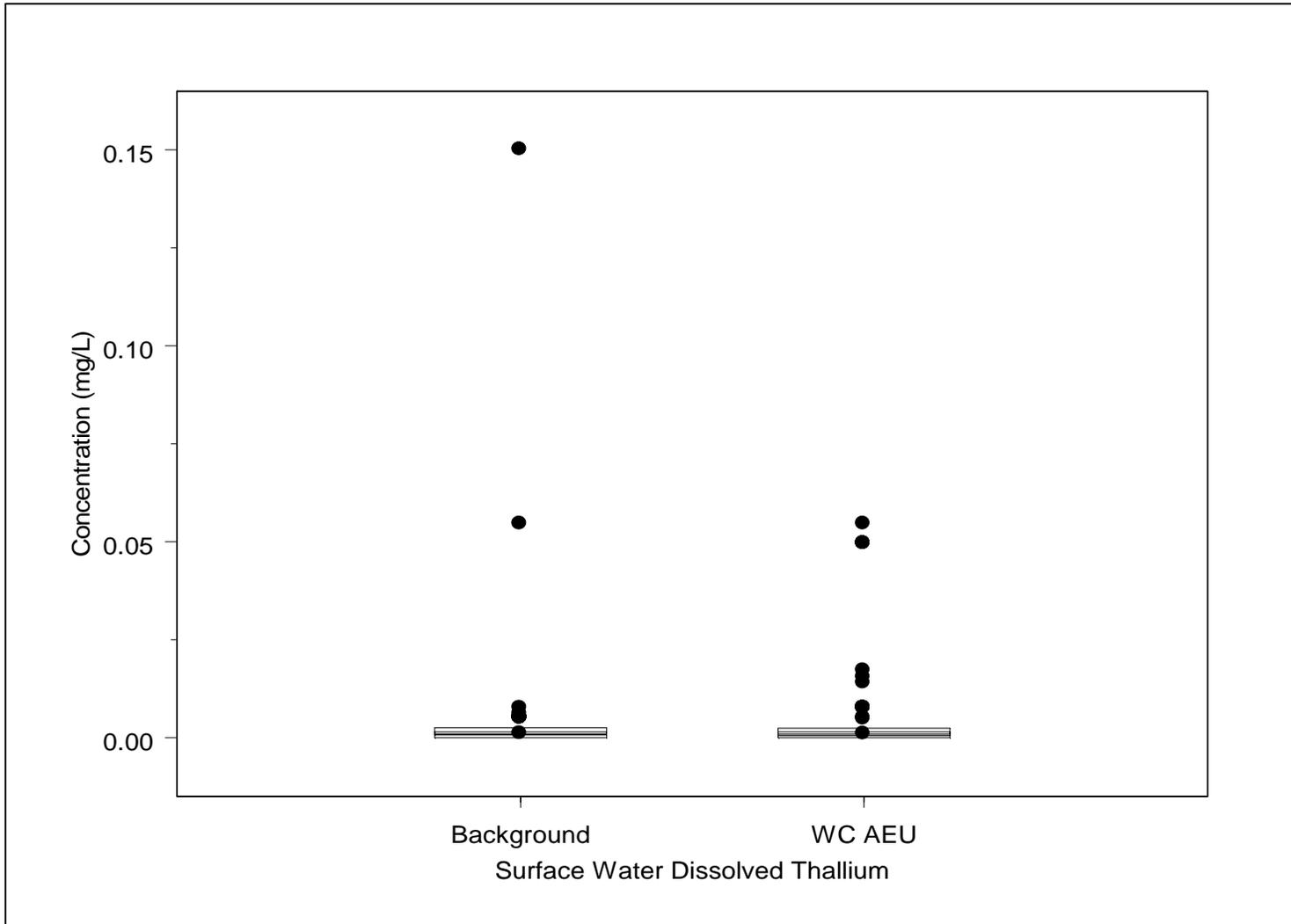
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.34  
WC AEU Surface Water Dissolved Box Plots for Silver



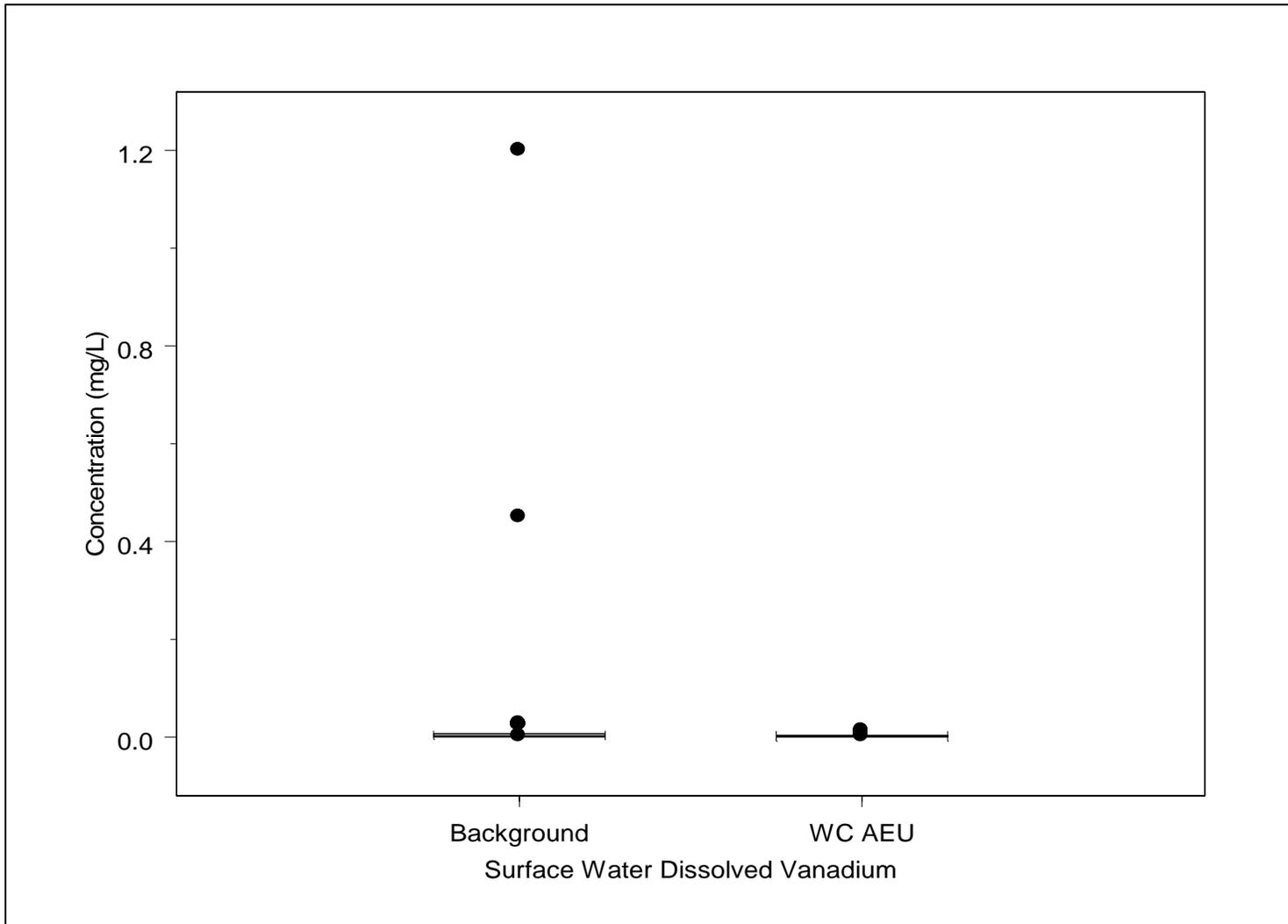
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.35  
WC AEU Surface Water Dissolved Box Plots for Thallium



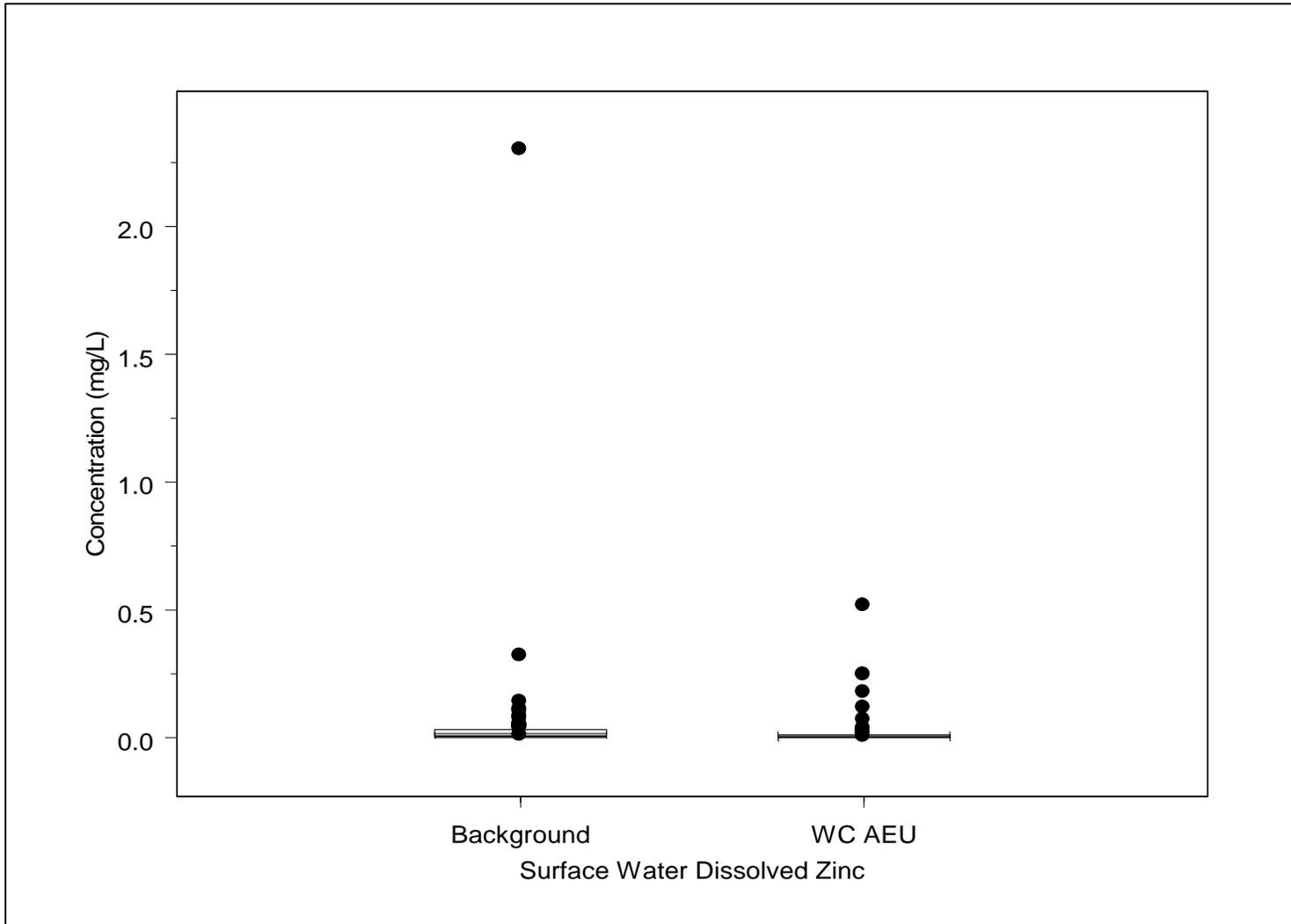
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.36  
WC AEU Surface Water Dissolved Box Plots for Vanadium



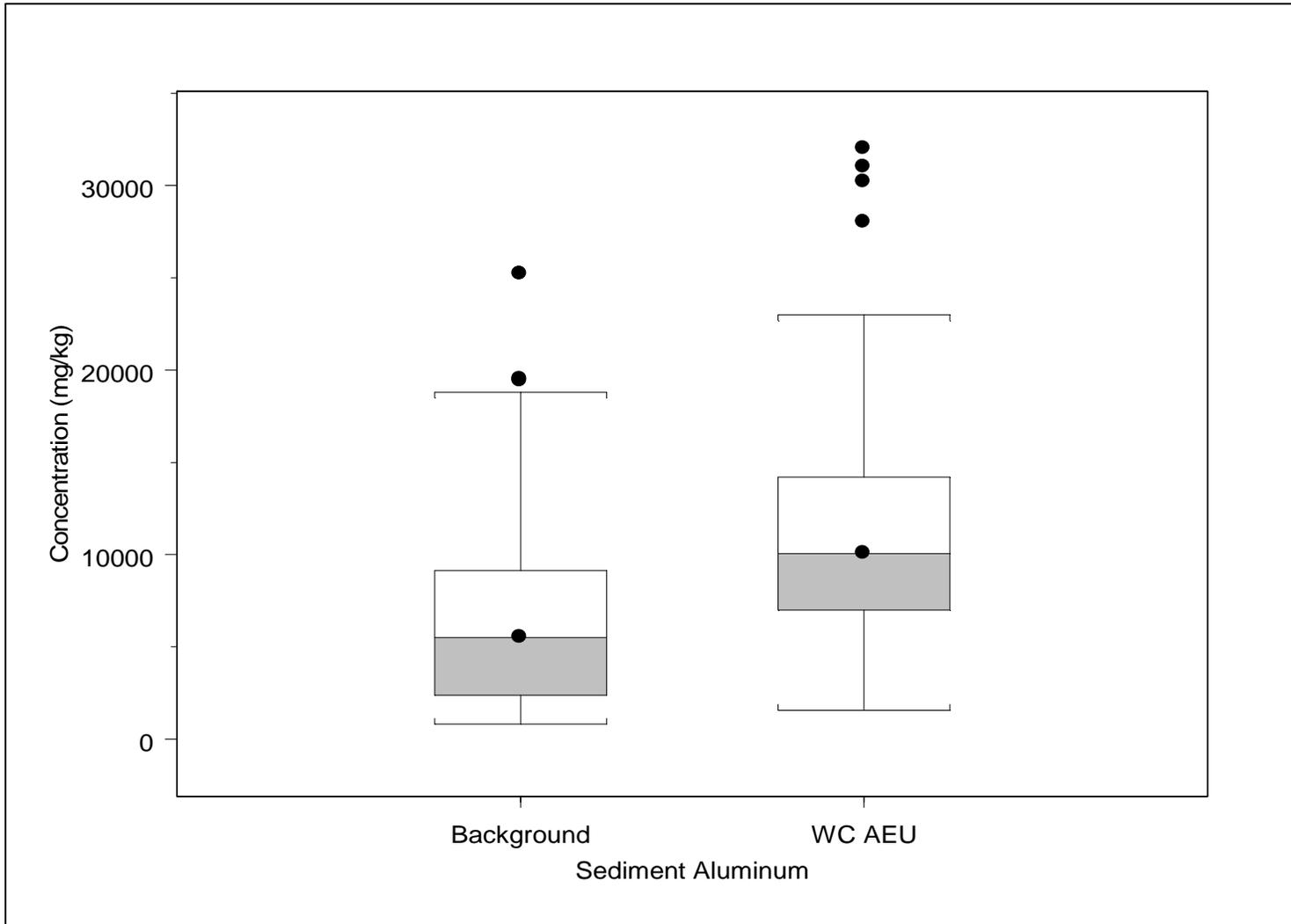
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.37  
WC AEU Surface Water Dissolved Box Plots for Zinc



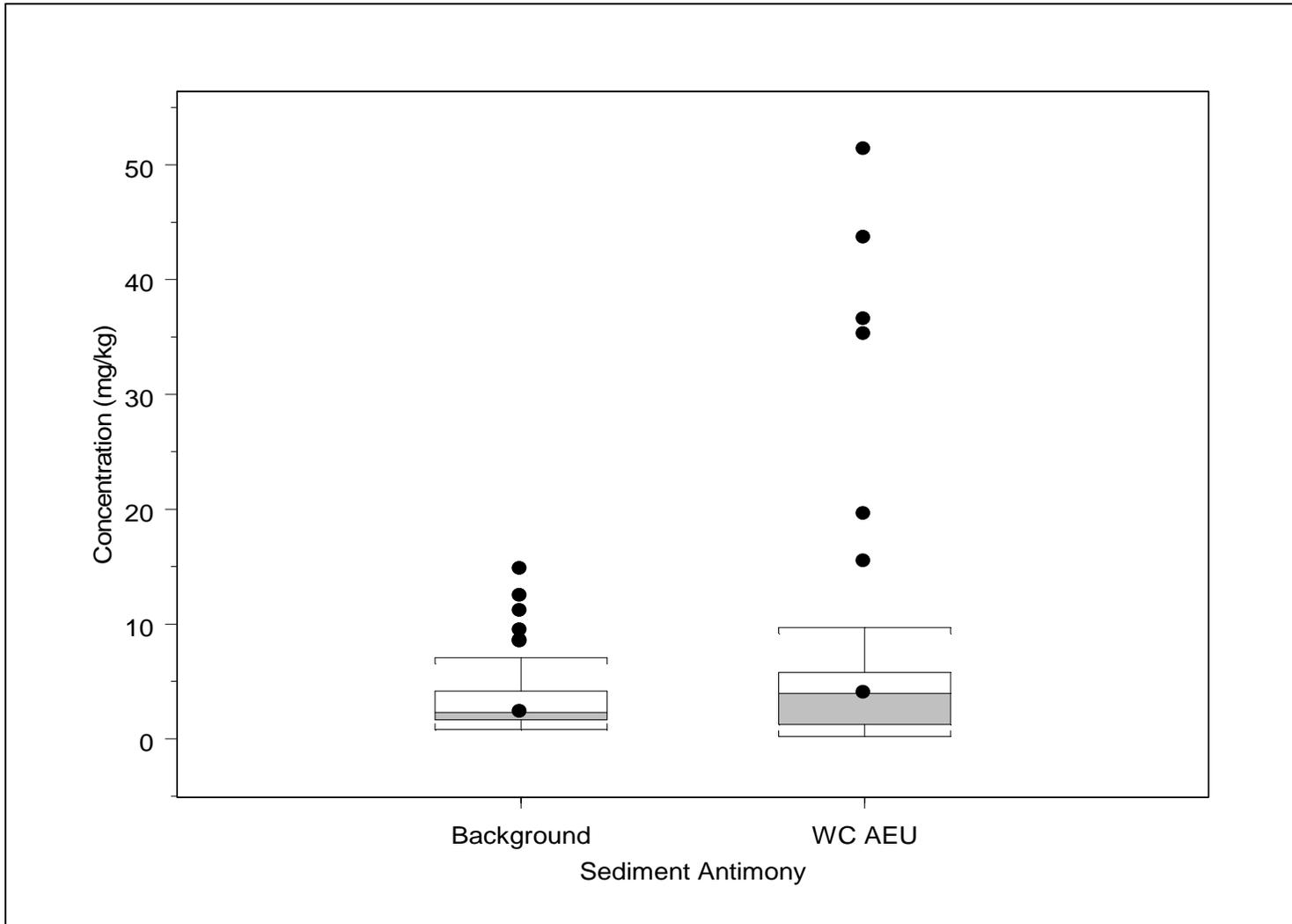
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.38  
WC AEU Sediment Box Plots for Aluminum



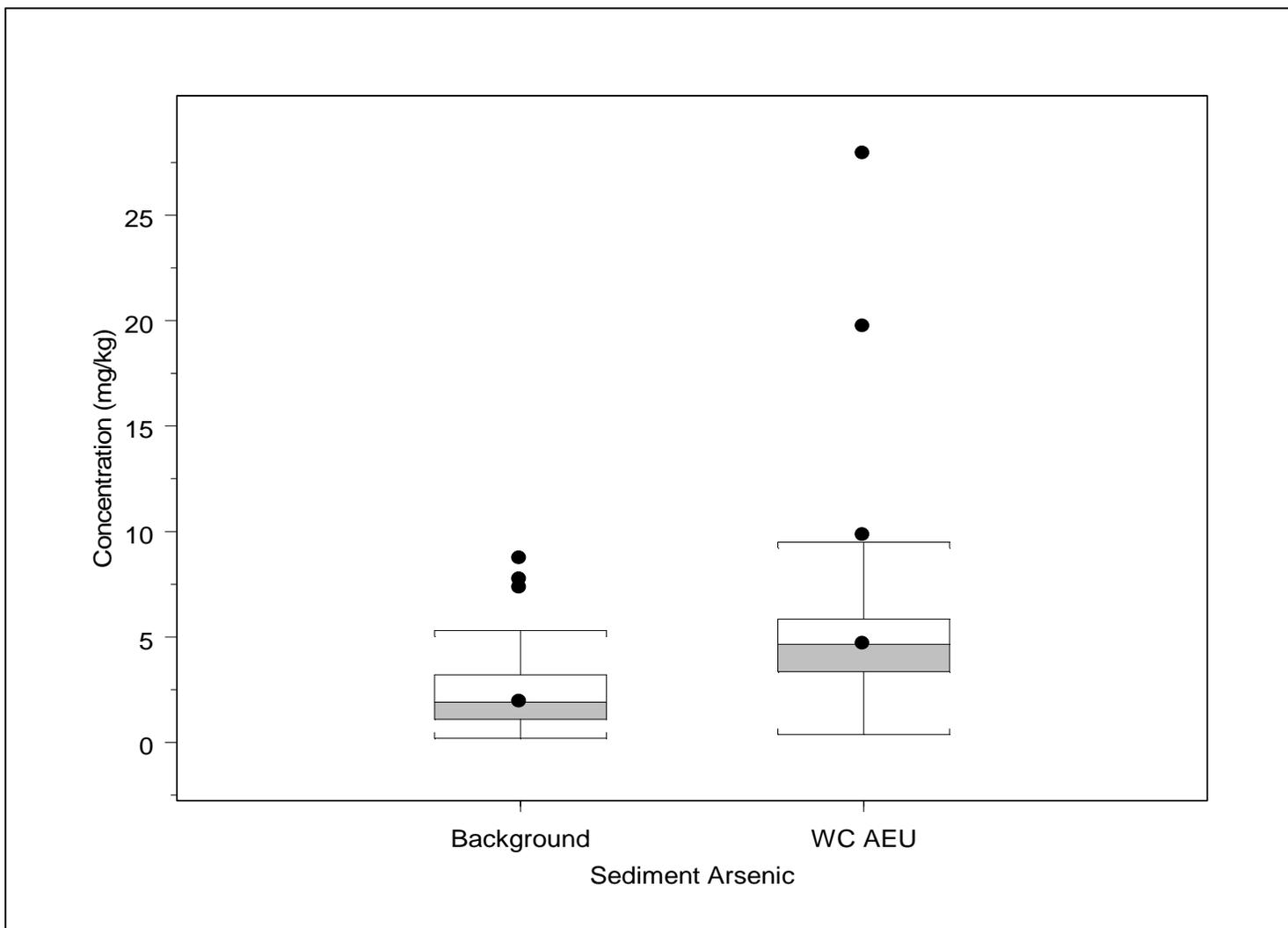
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.39  
WC AEU Sediment Box Plots for Antimony



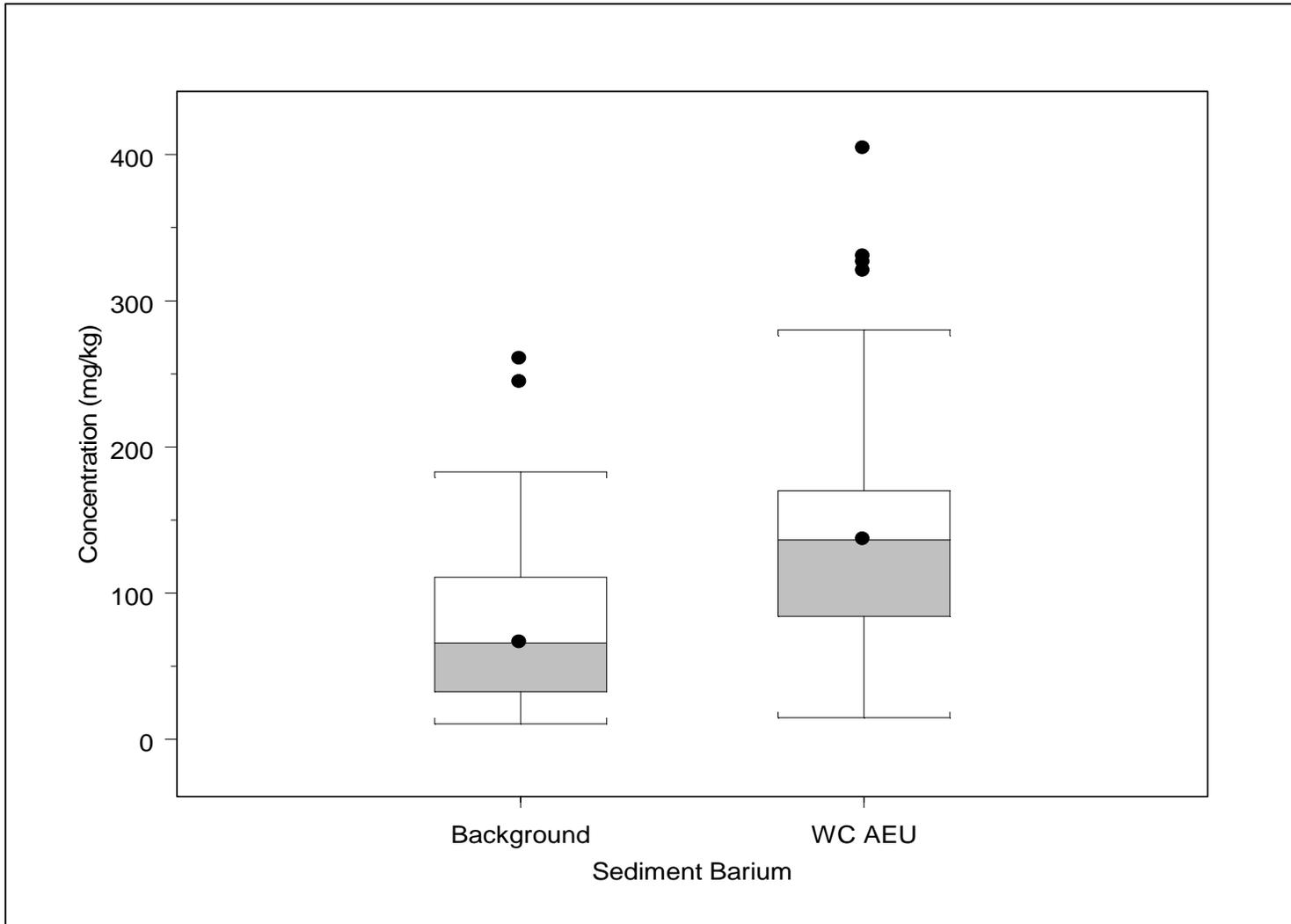
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.40  
WC AEU Sediment Box Plots for Arsenic



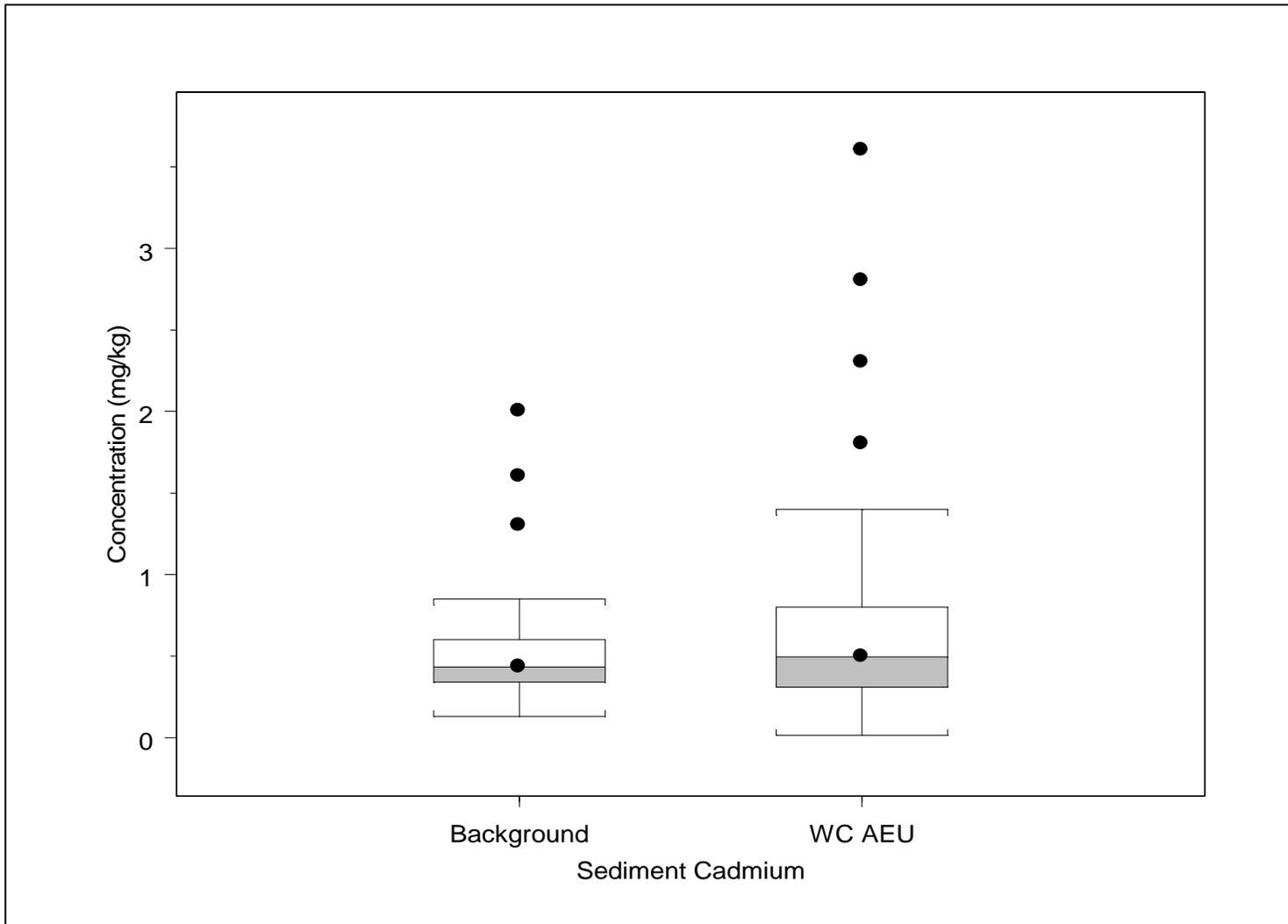
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.41  
WC AEU Sediment Box Plots for Barium



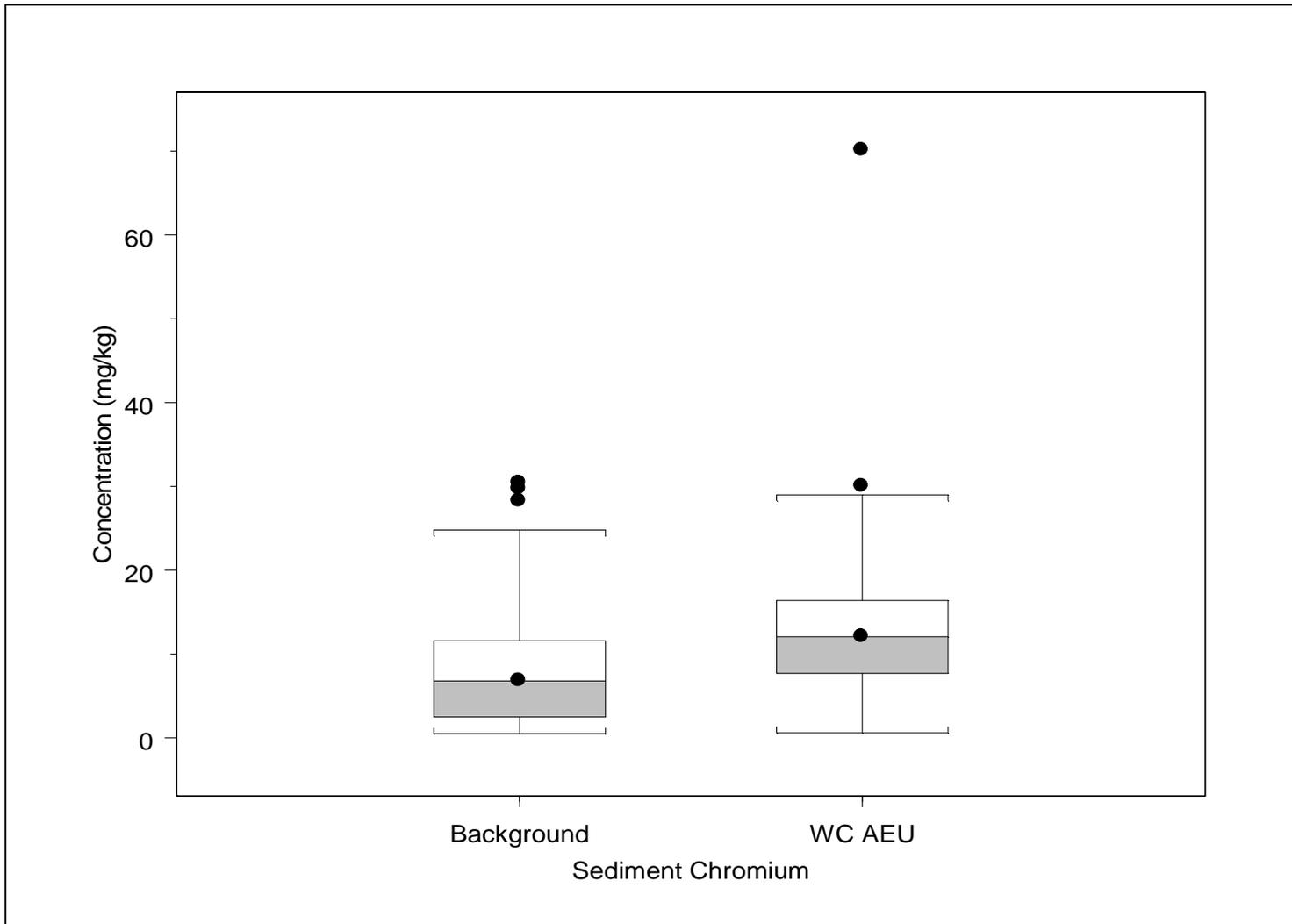
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.42  
WC AEU Sediment Box Plots for Cadmium



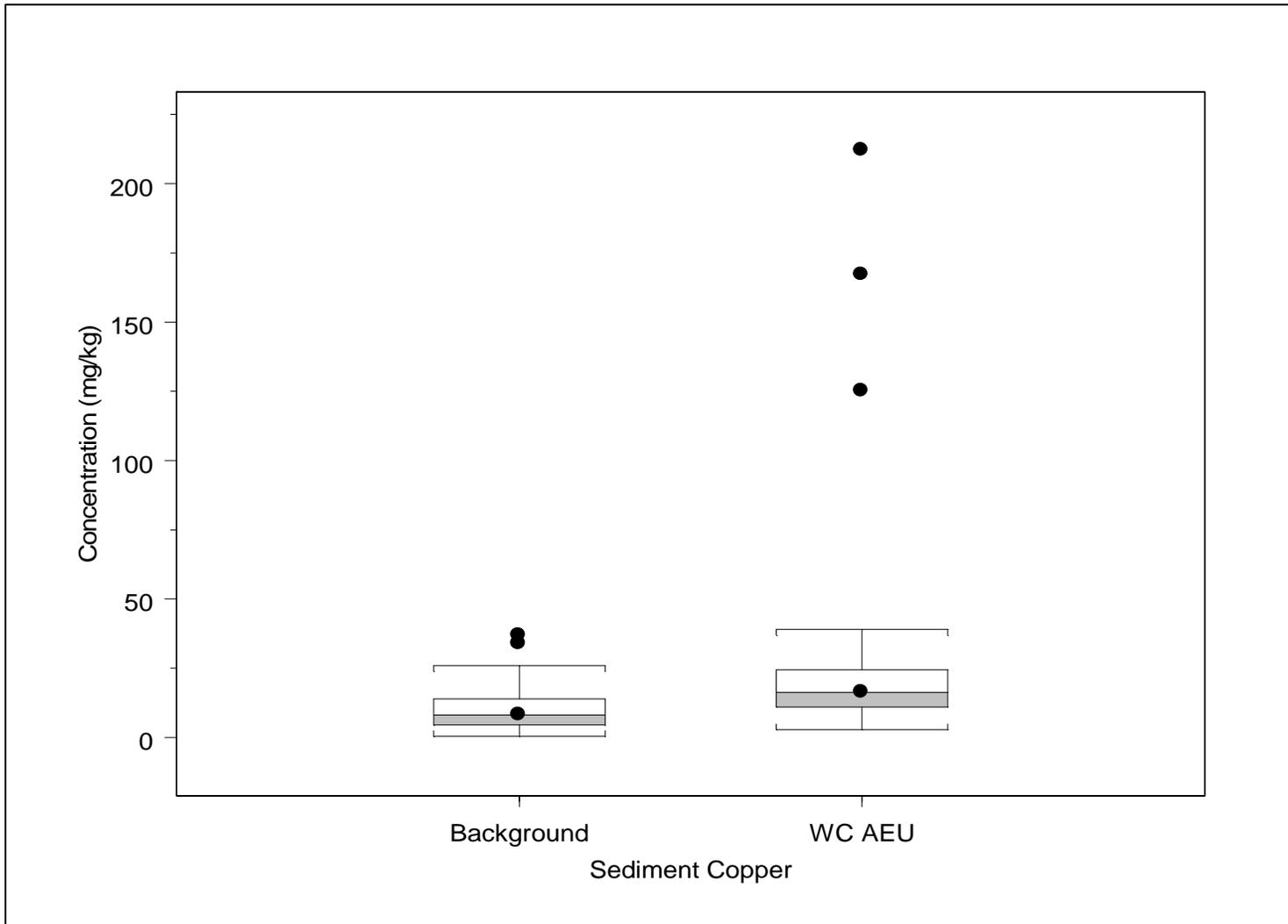
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.43  
WC AEU Sediment Box Plots for Chromium



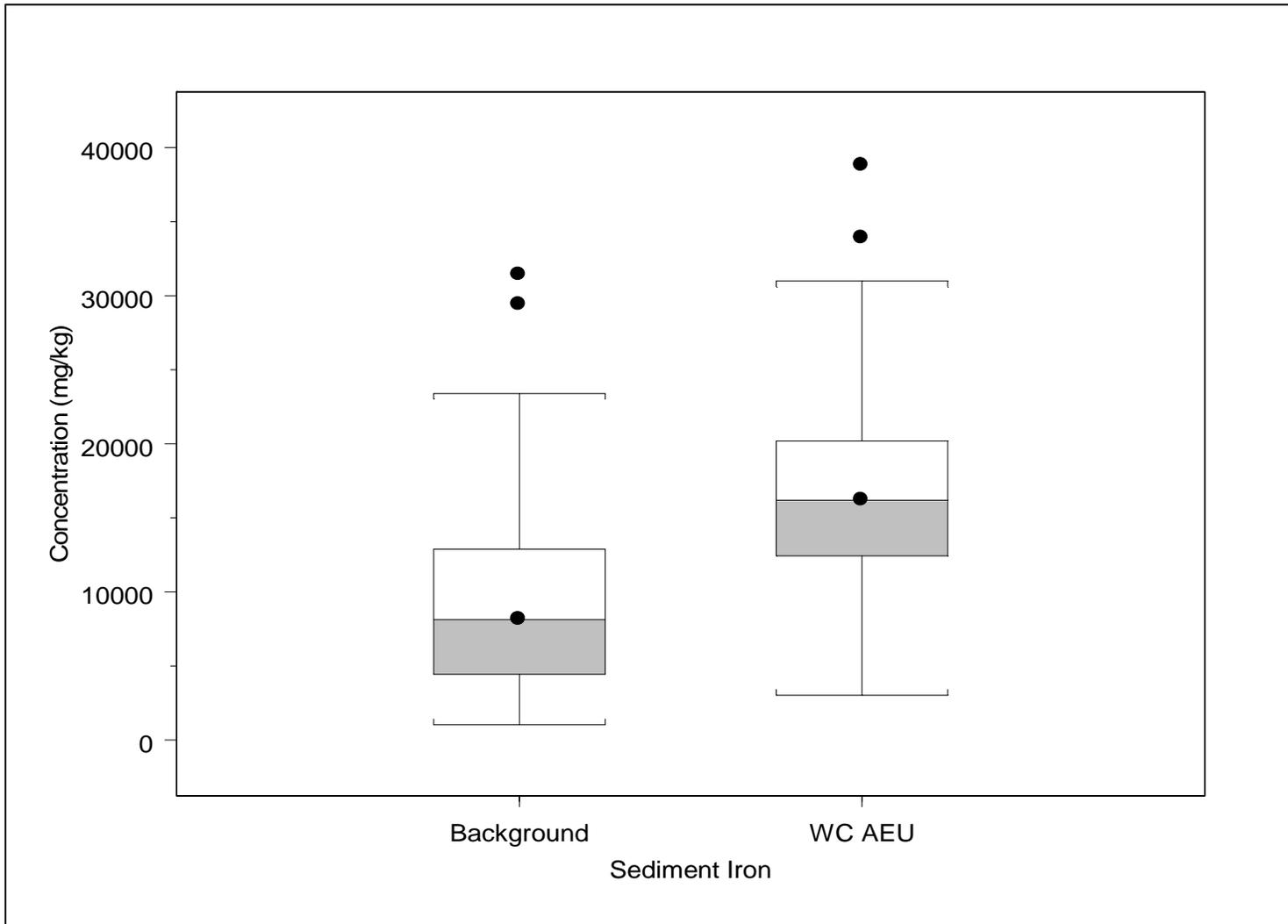
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.44  
WC AEU Sediment Box Plots for Copper



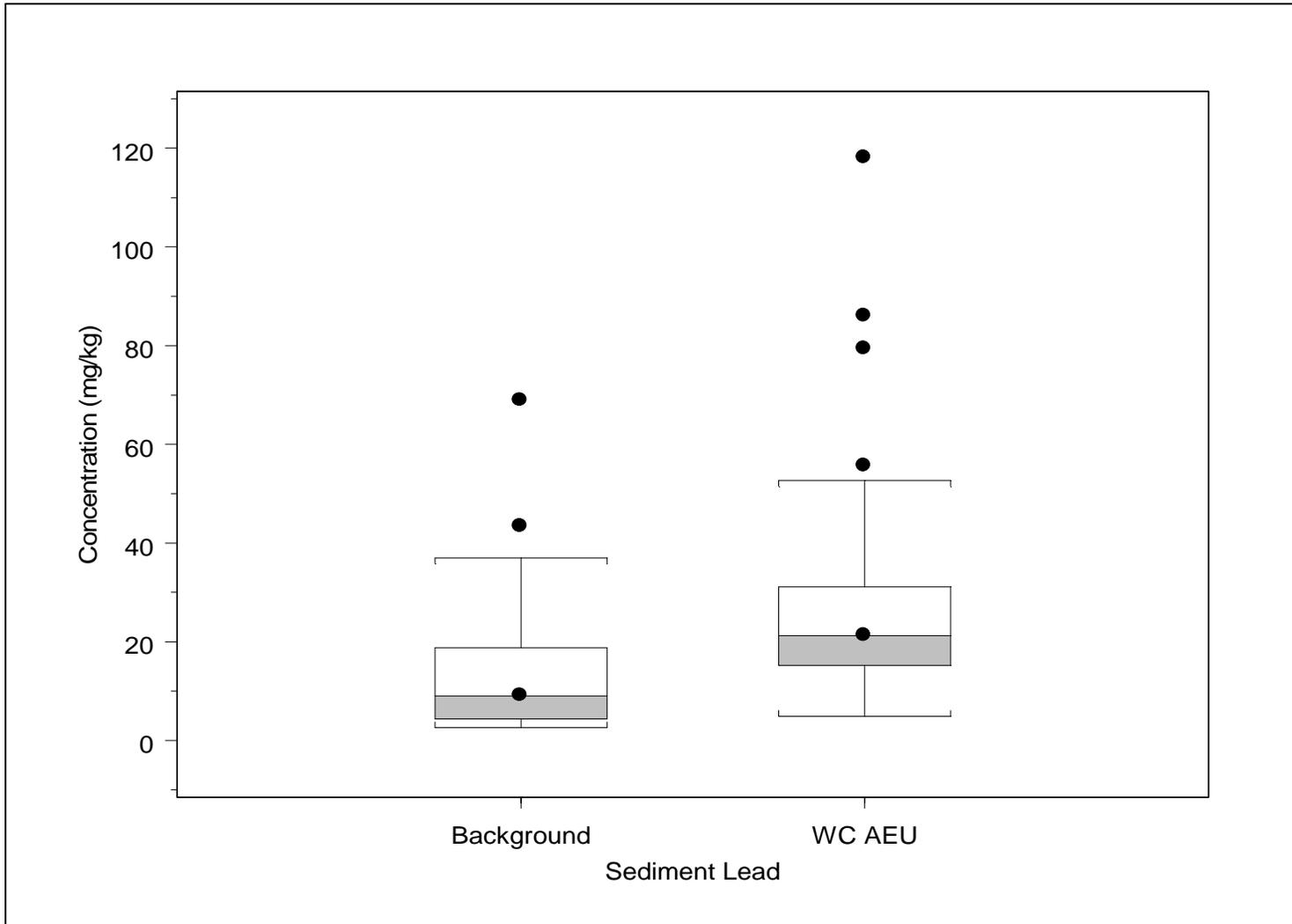
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.45  
WC AEU Sediment Box Plots for Iron



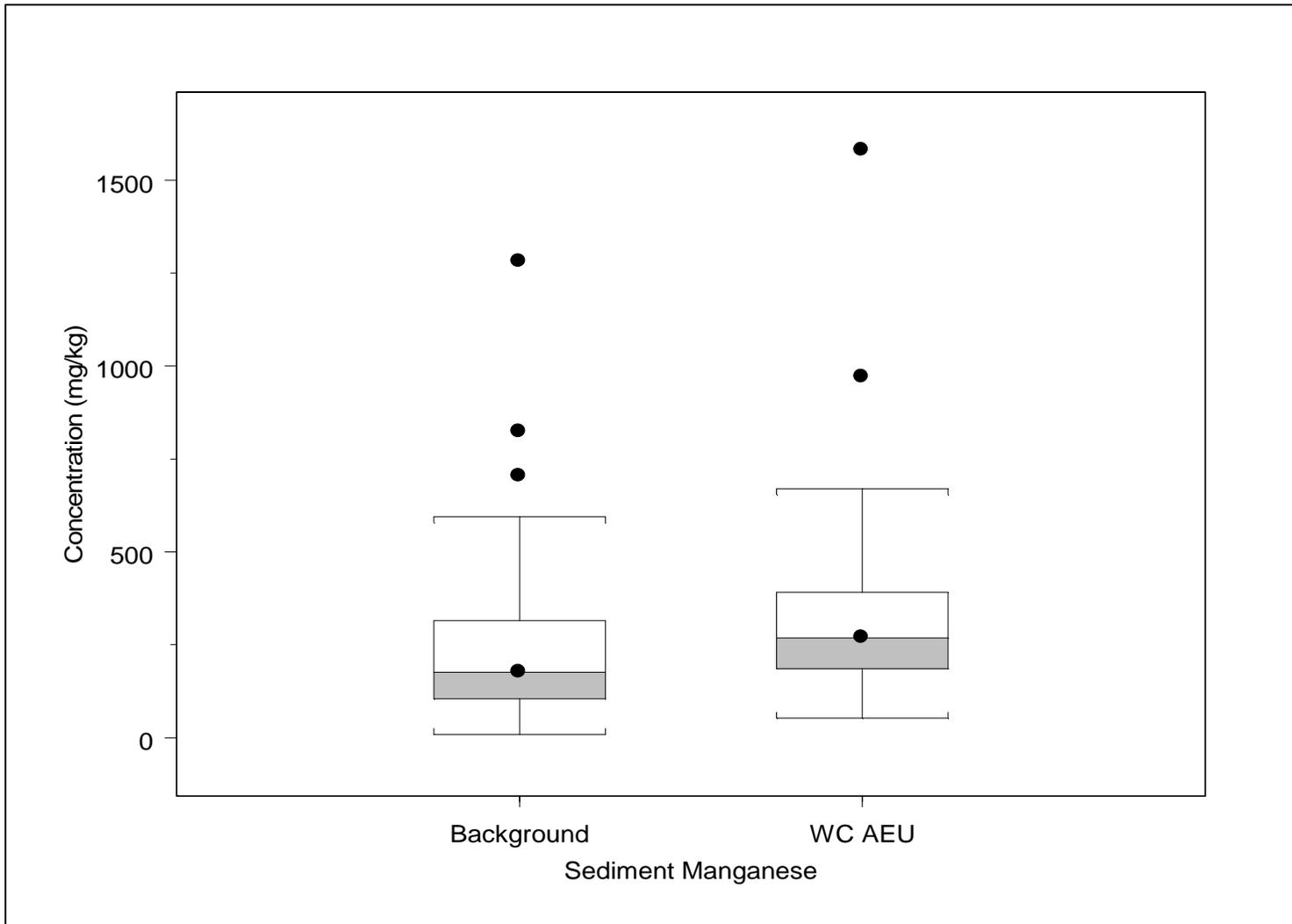
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.46  
WC AEU Sediment Box Plots for Lead



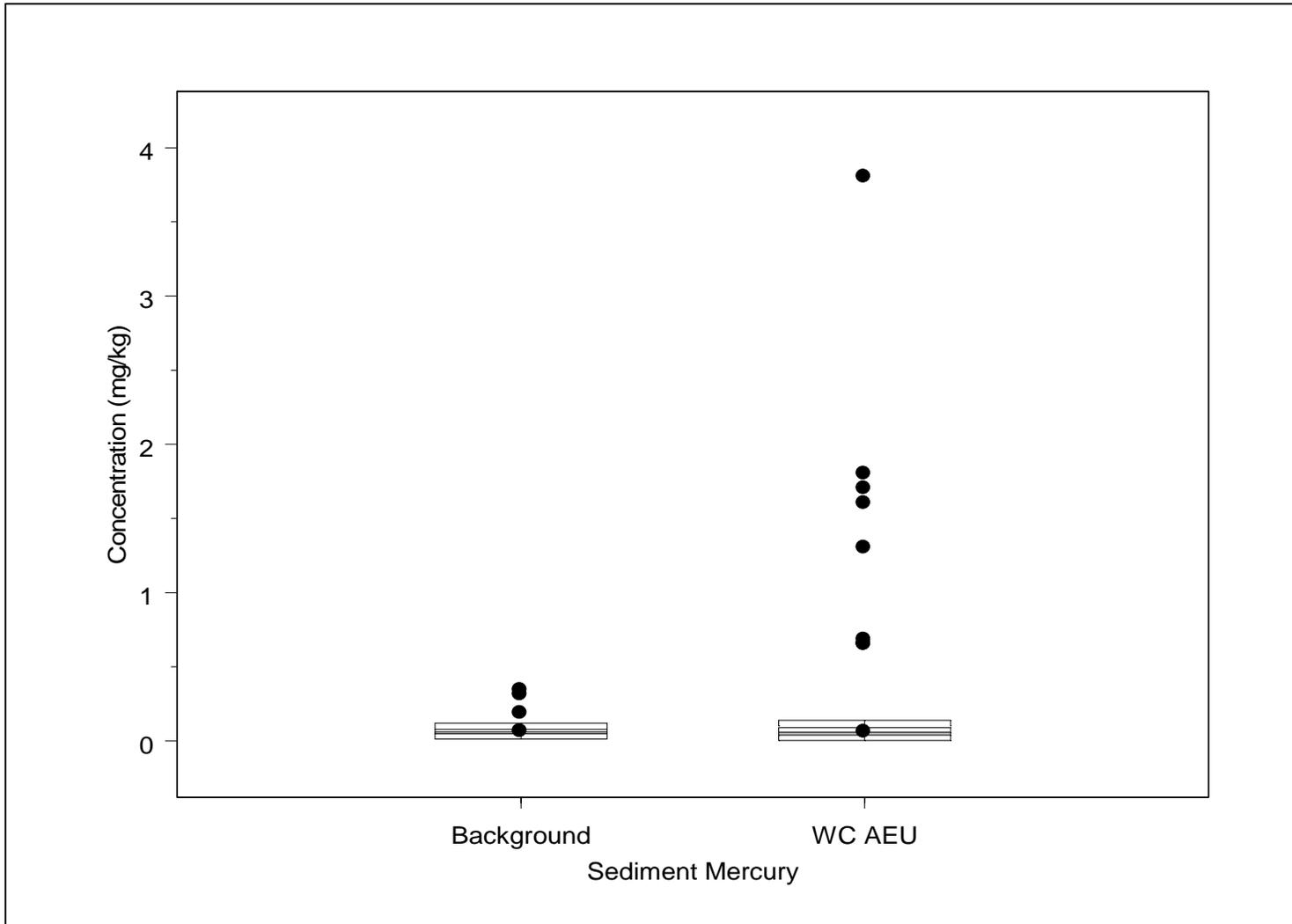
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.47  
WC AEU Sediment Box Plots for Manganese



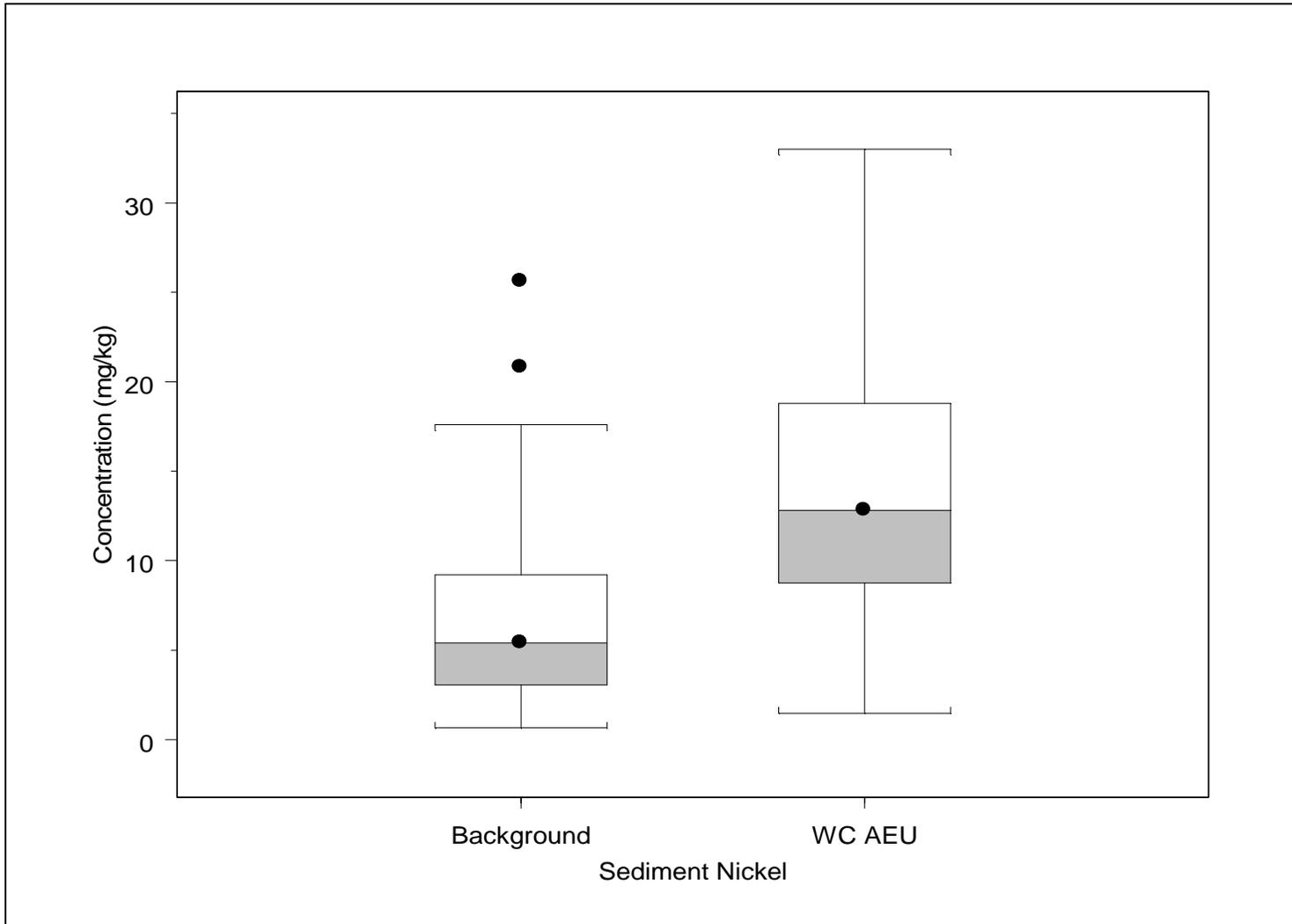
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.48  
WC AEU Sediment Box Plots for Mercury



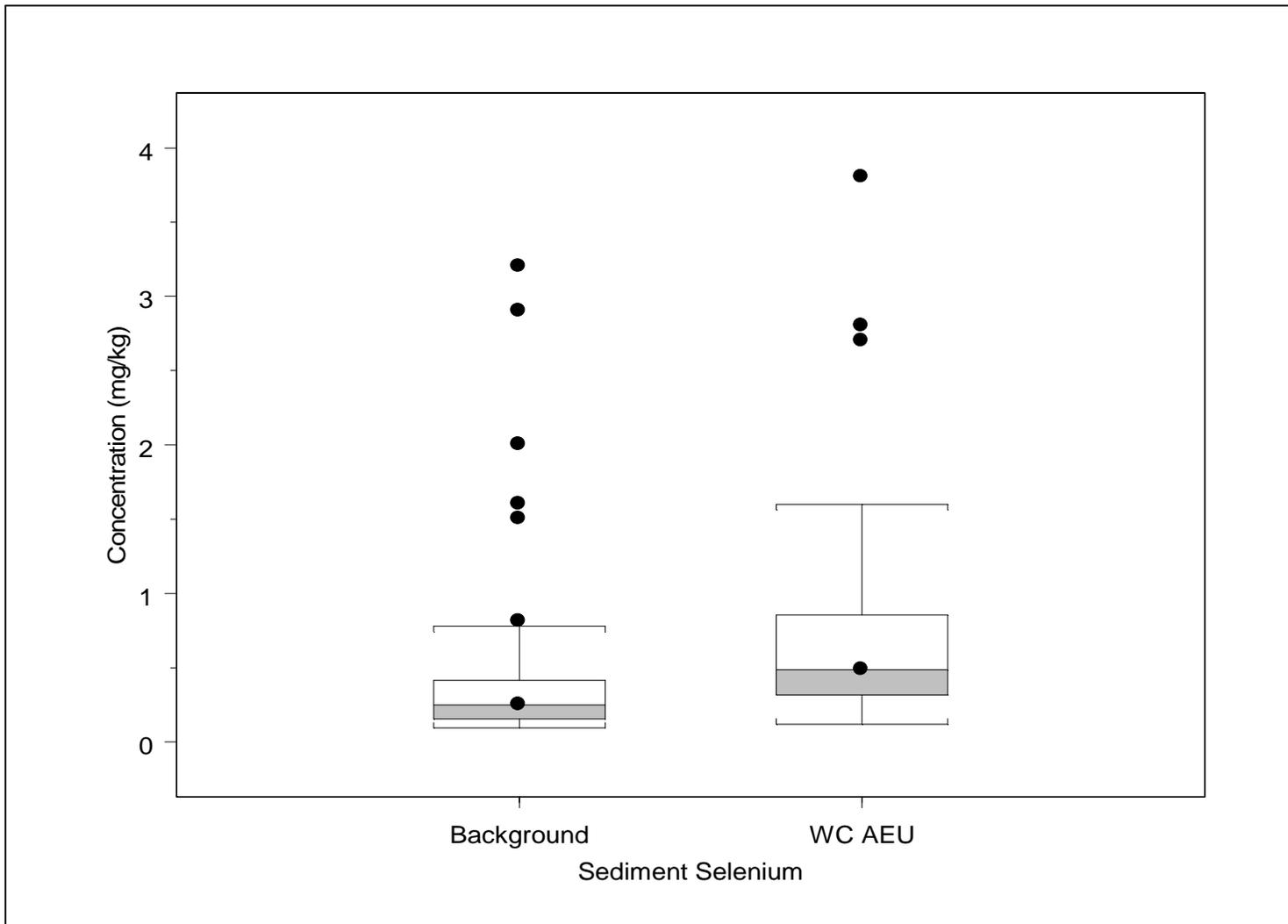
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.49  
WC AEU Sediment Box Plots for Nickel



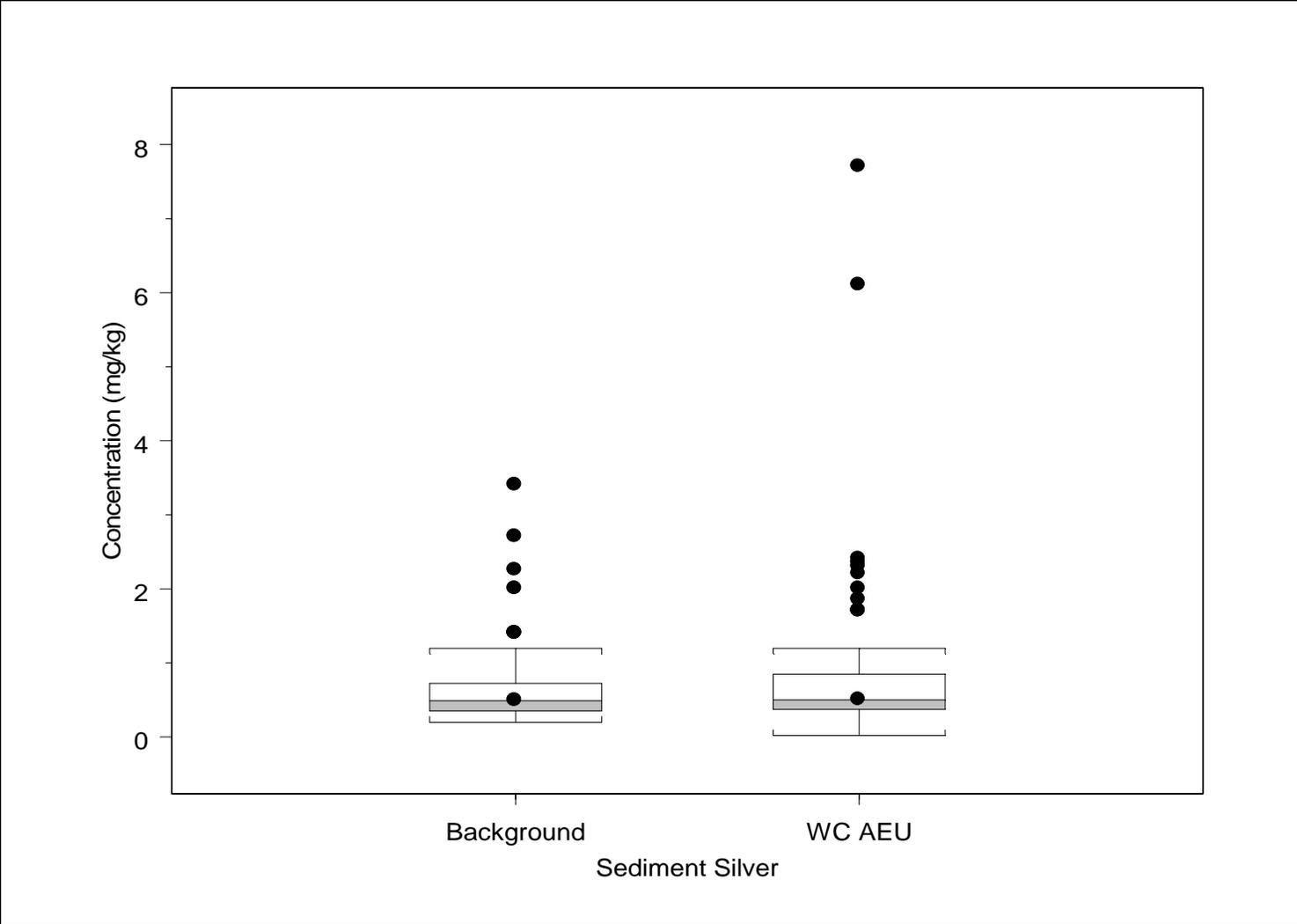
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.50  
WC AEU Sediment Box Plots for Selenium



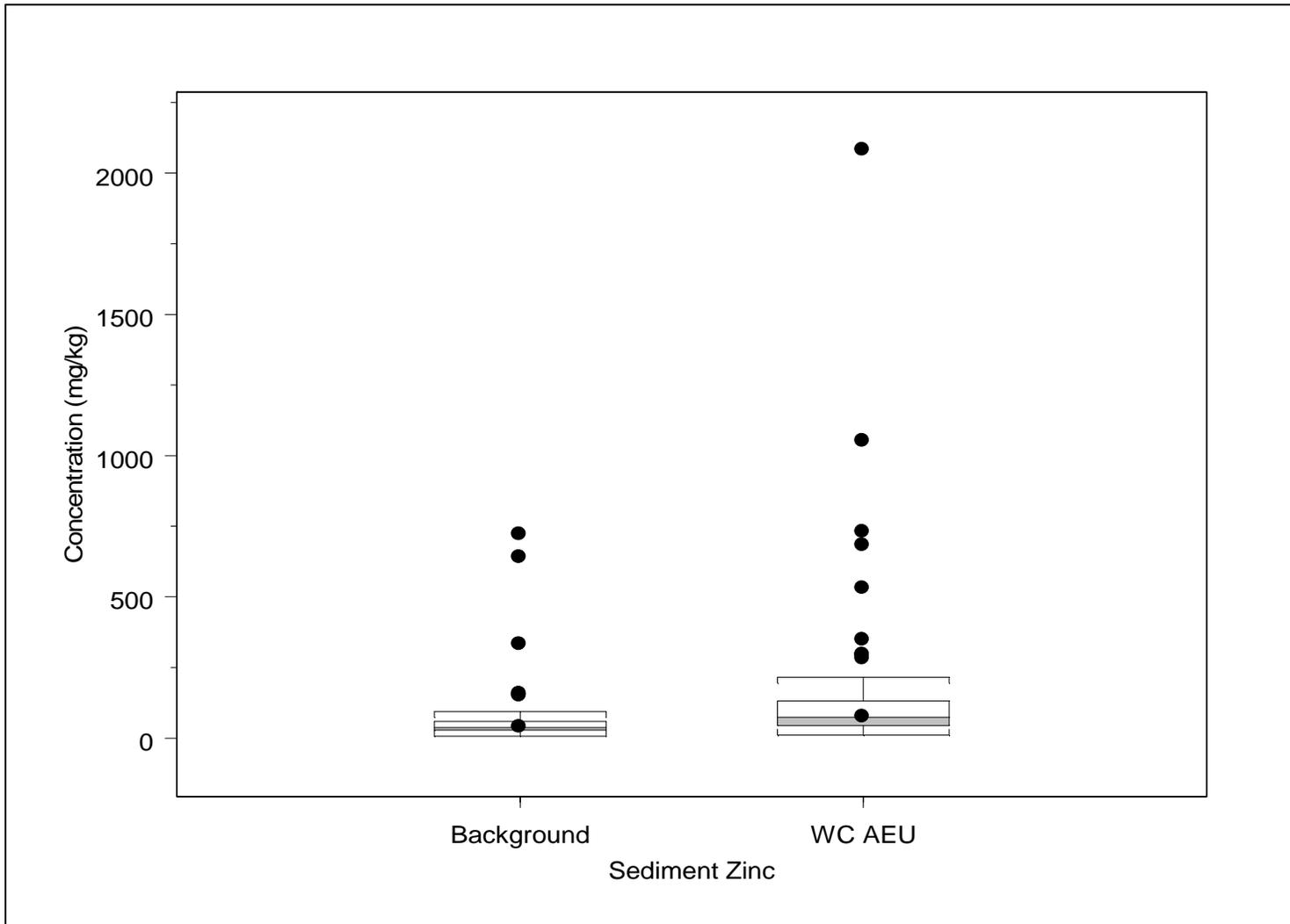
Box Plot Reference Points - 1) Line inside of box is median, 2) Lower edge of box is 25th percentile, 3) Upper edge of box is 75th percentile, 4) Lower and upper whiskers are drawn to the nearest values not beyond 1.5 times the inter-quartile range.

Figure A3.2.WC AEU.51  
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.

Figure A3.2.WC AEU.52  
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**

**Site-Specific ESLs and Additional Benchmarks for Surface Water and Sediment**

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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
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
LOEC	Lowest observed effect concentration
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
NN AEU	No Name Gulch Aquatic Exposure Unit
NOEC	No observed effect concentration
NW AEU	North Walnut Creek Aquatic Exposure Unit
NYSDEC	New York State Department of Environmental Conservation
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PEC	probable effect concentration
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 first step in this two-tiered risk evaluation was the initial ecological contaminant of potential concern (ECOPC) identification screening evaluation. Maximum detected concentrations (MDCs) of ecological contaminants of interest (ECOIs) at the Rocky Flats Environmental Technology Site (RFETS) were compared to conservative ecological screening level (ESL) benchmarks to eliminate ECOIs that clearly pose no risks and to identify ECOPCs for further risk evaluation.

The second step considered more realistic exposure and effects characterization of ECOPCs in the Aquatic Exposure Units (AEUs). This was done by including both surface water ESLs, which typically represent chronic water quality benchmarks, and acute water quality criteria for surface water ECOPCs. Similarly, lowest observed effects concentration (LOEC) benchmarks were identified for sediment ECOPCs.

For surface water, chronic criteria are intended to be protective of 95% of aquatic species (5-CCR-1002-31.10) and can be thought of as analogous to NOEC concentrations based on (but not limited to) survival, growth and reproduction of aquatic receptors. Long-term average exceedances of chronic criteria can be indicative of effects to sensitive genera and populations of aquatic receptors. Acute criteria are not, however, analogous to LOEC concentrations. Acute criteria are typically based on mortality endpoints over shorter periods of time than chronic criteria and exceedances of acute criteria may be indicative of potential risk to aquatic receptors.

For sediments, 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 are presented for each AEU in Tables ES.1 and ES.2, respectively, of the Executive Summary in Appendix A, Volume 15B2. Table A5.1 presents site-specific chronic ESLs and acute criteria used to evaluate surface water ECOPCs in the risk characterization process. Table A5.2 presents sediment ESLs and LOEC benchmark values for evaluating sediment ECOPCs. This attachment includes ESLs and acute or LOEC benchmark values for the North Walnut Creek AEU (NW AEU), South Walnut Creek AEU (SW AEU), and Woman Creek AEU (WC AEU). Sources, endpoints, and toxicity information used for deriving site-specific surface water ESLs and sediment LOEC benchmarks are described below.

## 2.0 SURFACE WATER

Original surface water ESLs, typically representing chronic water quality benchmarks, were developed in the CRA Methodology (DOE 2005a). Some of these surface water ESLs were refined to represent conditions at the RFETS using site-specific water quality considerations (i.e., pH, hardness, and temperature) where water quality affects ECOPC toxicity. This pertained to ammonia, pentachlorophenol, and several divalent metals

(barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, silver, uranium, and zinc). In these cases, AEU-specific water quality parameters (Table A5.3) were used for recalculation of ESLs, referred to as refined ESLs. Acute surface water criteria, derived from acute water quality benchmarks, were also calculated using these site-specific water quality parameters (Table A5.4). In the CRA Methodology, a default hardness value equal to 100 mg/L was used to calculate hardness-dependant ESLs. The default value was reviewed against site-specific hardness values and was determined in the CRA Methodology to be an adequately conservative value for use in ECOPC identification.

Both chronic and acute values for surface water ECOPCs were consistent with regard to the type of benchmark calculated. The majority of the chronic and acute surface water values represent Ambient Water Quality Criteria (AWQC) from the Colorado Department of Public Health and Environment (CDPHE) (CDPHE 2005). 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 2002) 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.

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.

## **2.1 CHRONIC ESL AND ACUTE CRITERION REFINEMENTS FOR INORGANIC ECOPCS**

The chronic ESL for ammonia used during ECOPC selection was a default value for un-ionized ammonia (CDPHE 2005). Concentrations of surface water ammonia from RFETS samples were reported as total aqueous ammonia (which includes both un-ionized ammonia [NH<sub>3</sub>] and ammonium [NH<sub>4</sub><sup>+</sup>]) and were converted to the un-ionized fraction using AEU-specific unionized fraction percentages from EPA (1985) (e.g., 1.81 percent at pH 7.69 and 20°C at WCAEU). AEU-specific surface water quality parameters at NW AEU, SW AEU, and WC AEU for these calculations are presented in Table A5.4. The appropriate fraction of ammonia in the site samples was then compared to ESLs in the ECOPC selection.

Ammonia toxicity is temperature- and pH-dependent. Although the chronic ESL was based on a default value (0.02 mg/L) and remained unchanged, calculations for determining the acute criterion included a pH and temperature component. Acute criteria were calculated using the AEU-specific average pH and assuming a 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 acute criterion for un-ionized ammonia are presented in Table A5.1.

Laboratory test results indicate that toxicity for some metals is reduced by water hardness. Therefore, the refined chronic and acute ESLs for barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, silver, uranium, and zinc were derived from water hardness-based equations (EPA 2002; MIDEQ 2003; CDPHE 2005). AEU-specific refinements for these metals were completed for the NW AEU, SW AEU, and WC AEU (Table A5.3). Site-specific hardness data are presented in Table A5.4.

## **2.2 CHRONIC ESL AND ACUTE CRITERION 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 calculated for the NW AEU, SW AEU, and WC AEU (Table A5.3). Site-specific pH data are presented in Table A5.4. The refined chronic ESL and acute criterion for pentachlorophenol are presented in Table A5.1.

### **2.3 CHRONIC ESL AND ACUTE CRITERION REFINEMENTS FOR RADIONUCLIDES**

The acute criterion for radium-228 (8.49 pCi/L) represents the Level 3 biota concentration guideline (BCG) for radium-228 using RESRAD-BIOTA Version 1.1 (beta) (DOE 2002). This dose is equivalent to the chronic maximum no-effect exposure of 1 rad/day (0.4 mGy/h) to the maximally exposed individual, and will be protective of aquatic organism populations (IAEA 1976). This benchmark Level 3 BCGs are radionuclide concentrations based on the benchmark dose for aquatic species, while the Level 1 BCG used to calculate the chronic ESL is based on the more radiosensitive aquatic and riparian receptors.

Radiation benchmarks were developed following an extensive review of the published literature reporting effects to aquatic organisms and was supported by more recent reviews (IAEA 1992; DOE 2005b). Species included in the determination of this criterion included fish and invertebrates of many species. The most sensitive LOEC from various life stages and endpoints of various sensitivities was selected as the maximum dose adequately protective of the population (reproduction in snails; Cooley et al. 1970). It is assumed that the diverse test conditions considered in the guideline development will also be protective of the aquatic species potentially present at RFETS.

### **3.0 SEDIMENT**

Sediment ESLs provide a low value of no effects to threshold effects analogous to a no effect concentration (NOEC), below which effects are unlikely to occur. Upper-bound estimates of concentrations for each ECOPC, above which exists an increased potential for adverse effects, were identified in the published literature and are referred to as lowest observed effects concentration (LOEC) benchmarks. Concentrations that occur between these upper- and lower-bound values are of uncertain but potential toxicity, and population-level risks are expected to be low for concentrations in this range.

The hierarchy for identification and selection of LOEC benchmarks 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.

The original sediment NOEC/threshold ESLs from the ECOPC identification process in the CRA Methodology were used in this assessment, along with LOEC benchmarks for each ECOPC. 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 LOEC benchmark for each ECOPC is provided below, and a summary of these values is provided in Table A5.2.

The endpoints for the sediment toxicity values vary. In general, the median observed toxicity values from available studies were selected as LOEC benchmarks. When compared to the ranges reported in Table A5.2, these values represent a central tendency measure and were greater than the NOEC/threshold ESLs. The following paragraphs describe these endpoints, as identified by the investigative studies from which they were drawn.

**Bolton et al., 1985.** The benchmark value for fluoride was derived from this study using an equilibrium partitioning approach. The LOEC 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 NOEC/threshold ESL and LOEC benchmark 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 NOEC/threshold ESL (0.00085 microgram per kilogram [ $\mu\text{g}/\text{kg}$ ]) and the LOEC benchmark (0.0215  $\mu\text{g}/\text{kg}$ ) 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) (see Van den Berg et al. 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 not included in this calculation. All TEQs within a sample were summed, and the summed TEQ was compared to the NOEC/threshold ESL and LOEC benchmark 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 NOEC/threshold ESL.

**Cabbage, 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. LOEC benchmarks for 4-methylphenol and pentachlorophenol were selected from this reference.

**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 LOEC benchmark, for which no other LOEC benchmark value was available. The ERM represents the chemical concentration above which adverse effects would frequently occur. For the purposes of this evaluation, the reported ERLs were selected as the LOEC benchmarks 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 LOEC benchmarks and various approaches for their development. The LOEC 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 screening concentrations 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. The selected LOEC benchmarks are as follows:

- The LOEC benchmark 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 LOEC benchmark for acenaphthene represents a PEL from Nagpal, et al. (1995).
- The LOEC 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 LOEC benchmark 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 concentrations 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 the AEU were evaluated both as individual PCBs and as total PCBs. These concentrations were evaluated against their respective NOEC/threshold ESLs and LOEC benchmarks (MacDonald, et al. 2000a and 2000b). Aroclor 1254 and/or Aroclor 1260 were the only PCB congeners detected in at least 5 percent of the sediment samples within an AEU. 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 (i.e. Aroclor 1254 or Aroclor 1260) were included in this calculation with half the reported value 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.

The consensus-based TEC (CB-TEC) and PEC (CB-PEC) for PAHs were identified from MacDonald et al. (2000a) for use as the total PAH-NOEC/threshold ESL and LOEC benchmarks, 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 LOEC benchmark concentrations. Chronic surface water AWQCs were used as the basis for calculating sediment NOEC/threshold ESLs, while acute AWQCs were used as the basis for calculating sediment LOEC benchmarks, where:

$$\text{EqP}_{\text{ESL}} = \text{ESL}_{\text{water}} * \text{Koc} * \text{foc}$$

EqP = Equilibrium partitioning-based sediment ESL

ESL<sub>water</sub> = Surface water ESL (chronic)

Koc = Organic carbon portioning coefficient

foc = Fraction organic carbon (assumed 1%)

$$\text{EqP}_{\text{TT}} = \text{A}_{\text{water}} * \text{Koc} * \text{foc}$$

EqP = Equilibrium partitioning-based sediment LOEC benchmark

A<sub>water</sub> = Surface water acute ESL

Koc = Organic carbon portioning coefficient

foc = Fraction organic carbon (assumed 1%)

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## **TABLES**

**Table A5.1**  
**Chronic ESLs and Acute Criteria for Surface Water ECOPCs**

ECOPC	Units	Site-Wide		Woman Creek		North Walnut		South Walnut		Reference
		ESL	Acute	ESL	Acute	ESL	Acute	ESL	Acute	
<b>Inorganic</b>										
Aluminum (T)	µg/L	87	750	Same as site-wide						CDPHE 2005a
Ammonia (unionized)	µg/L	20	181	20	177	20	190	20	199	CDPHE 2005a
Antimony (T)	µg/L	240	2,300	Same as site-wide						MIDEQ 2003
Barium (T)	µg/L	1027	5859	721	4117	1184	6757	983	5608	MIDEQ 2003
Beryllium (T)	µg/L	18.2	327	7.9	141.3	25.5	459.1	16.4	294.8	MIDEQ 2003
Cadmium (D)	µg/L	0.43	4.4	0.34	3.18	0.47	5.00	0.42	4.22	CDPHE 2005a
Cyanide (T)	µg/L	0.5	5	Same as site-wide						CDPHE 2005a
Iron (T)	µg/L	1,000	N/A	Same as site-wide						CDPHE 2005a
Selenium (D)	µg/L	4.6	18.4	Same as site-wide						CDPHE 2005a
Silver (D)	µg/L	1.27	8.06	0.72	4.55	1.60	10.2	1.18	7.51	CDPHE 2005a
Vanadium (T)	µg/L	12	220	Same as site-wide						MIDEQ 2003
Zinc (D)	µg/L	233	231	175	176	259	261	223	225	CDPHE 2005a
<b>Organic</b>										
4,4'-DDT	µg/L	0.001	0.55	Same as site-wide						CDPHE 2005a
Total PCBs	µg/L	0.014	2	Same as site-wide						CDPHE 2005a
<b>Radionuclides</b>										
Radium-228	pCi/L	0.849	8.49	Same as site-wide						DOE 2002 <sup>a</sup>

<sup>a</sup> RESRAD-BIOTA version 1.1 (beta) used to derive acute criteria for radionuclides.

Hardness-dependant criteria were calculated based on mean site-specific hardness values.

Site -specific water quality parameters presented in Table A5.3

Ammonia NAWQC were calculated based on site specific pH and temperature = 20°C.

Pentachlorophenol chronic criterion determined as  $\exp(1.005 \cdot (\text{pH}) - 5.134)$ .

Pentachlorophenol acute criterion determined as  $(\exp(1.005 \cdot (\text{pH}) - 4.869))^2$ .

N/A = Not applicable or not available.

(T) = Total

(D) = Dissolved

**Table A5.2**  
**NOEC/Threshold ESLs and LOECs for Sediment ECOPCs**

ECOPC	Units	Reported Range of Benchmarks <sup>1</sup>	(n)	NOEC ESL	Reference	Type of Value	LOEC	Reference	Type of Value
<b>Inorganics</b>									
Aluminum	mg/kg	15,900 – 58,000	(3)	15,900	MacDonald et al., 1999	SQG	58,000	Ingersoll et al., 1996	ERM
Antimony	mg/kg	2 – 500	(9)	2	MacDonald et al., 1999	SQG	3.2	NYSDEC, 1994	SLCA
Barium	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
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
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
<b>Organics</b>									
2-Methylnaphthalene	µg/kg	20 – 201	(8)	20.2	CCME 2002	ISQG	201	CCME 2002	PEL
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
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
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
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)
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
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
Naphthalene	µg/kg	10 – 140,000	(21)	176	MacDonald et al., 2000a	CB-TEC	561	MacDonald et al., 2000a	CB-PEC
Phenanthrene	µg/kg	6.8 – 210,000	(27)	204	MacDonald et al., 2000a	CB-TEC	1,170	MacDonald et al., 2000a	CB-PEC

**Table A5.2  
NOEC/Threshold ESLs and LOECs for Sediment ECOPCs**

ECOPC	Units	Reported Range of Benchmarks <sup>1</sup>	(n)	NOEC ESL	Reference	Type of Value	LOEC	Reference	Type of Value
Pyrene	µg/kg	7.6 – 85,000	(25)	195	MacDonald et al., 2000a	CB-TEC	1,520	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

<sup>1</sup> Range of benchmarks is derived from McDonald et al. 1999 and presented values.

The hierarchy of use of the LOECs 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 LOEC value.

CB-PEC = consensus-based probable effect concentration.

CB-TEC = consensus-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 = Ministère de l'Environnement du Québec / 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.

**Table A5.3  
Site-Specific Chronic ESL and Acute Criterion Calculations**

Analyte	Units	Site Wide		Woman Creek		North Walnut		South Walnut		CF <sub>c</sub>	M <sub>a</sub>	B <sub>a</sub>	M <sub>c</sub>	B <sub>c</sub>	Source
		ESL (Chronic)	Acute Criteria												
Ammonia (un-ionized)	mg/L	0.02	0.191	0.02	0.177	0.02	0.190	0.02	0.199						CDPHE 2005a
Barium, Total	µg/L	1027	5,859	721.48	4,117	1,184	6,757	982.79	5,608	-	1.0629	1.1869	1.0629	2.9285	MIDEQ 2002
Beryllium, Total	µg/L	18.17	327	7.85	141.3	25.50	459.1	16.4	294.8	-	2.5279	-10.7689	2.5279	-7.8785	MIDEQ 2002
Cadmium, Dissolved	µg/L	0.43	4.39	0.34	3.18	0.47	5.00	0.42	4.22	0.9122	1.0166	-3.924	0.7409	-4.719	EPA 2002
Silver, Dissolved	µg/L	1.27	8.06	0.72	4.55	1.60	10.15	1.18	7.51	-	1.72	-6.52	1.72	-9.06	CDPHE 2005a
Zinc, Dissolved	µg/L	233	231	176	175	261	259	225	223	0.986	0.8473	0.8618	0.8473	0.8699	CDPHE 2005a

Site specific water quality parameters are provided in Table A5.4

Ammonia criteria based on one hr (acute) 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 should

Acute (dissolved) =  $\exp(\text{Ma}[\ln(\text{hardness})] + \text{Ba}) * (\text{CF})$ .

Chronic ESL (dissolved) =  $\exp(\text{Mc}[\ln(\text{hardness})] + \text{Bc}) * (\text{CF})$ .

Acute (total) =  $\exp(\text{Ma}[\ln(\text{hardness})] + \text{Ba})$ .

Chronic ESL (total) =  $\exp(\text{Mc}[\ln(\text{hardness})] + \text{Bc})$ .

Where CF = metal specific total to dissolved conversion factor

- = Not available.

**Table A5.4  
Water Quality Parameters for Rocky Flats AEU's**

<b>AEU/Analyte</b>	<b>n</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Mean Value</b>	<b>Standard Deviation</b>
<b>Site-Wide</b>					
pH	982	4.6	11.7	<b>7.7</b>	0.6
Fraction of un-ionized ammonia in total aqueous ammonia (%)	-	-	-	<b>1.91</b>	-
Hardness (mg/L)	945	0.1	850	<b>223</b>	124
<b>Woman Creek AEU</b>					
pH	508	5	8.8	<b>7.7</b>	0.4
Fraction of un-ionized ammonia in total aqueous ammonia (%)	-	-	-	<b>1.81</b>	-
Total Organic Carbon (mg/L)	251	1	44	7.4	5.4
Hardness (mg/L)	130	46.3	470	<b>160</b>	67
<b>North Walnut Creek AEU</b>					
pH	182	4.6	11.7	<b>7.8</b>	0.7
Fraction of un-ionized ammonia in total aqueous ammonia (%)	-	-	-	<b>2.25</b>	-
Total Organic Carbon (mg/L)	114	2	26	7.7	5.2
Hardness (mg/L)	368	0.1	800	<b>255</b>	133
<b>South Walnut Creek AEU</b>					
pH	175	6.3	9.8	<b>7.9</b>	0.7
Fraction of un-ionized ammonia in total aqueous ammonia (%)	-	-	-	<b>2.61</b>	-
Total Organic Carbon (mg/L)	87	1.4	22	8.0	4.1
Hardness (mg/L)	372	8.8	850	<b>213</b>	120

Fraction of un-ionized ammonia calculated using an equation derived from the values presented in USEPA (1985) between pH 7 and 8 at 20°C..

- = Not available.

**Table A5.5**  
**TEFs for Dioxins and Furans**

<b>Dioxin Congener</b>	<b>Aquatic TEF<sup>b</sup></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 <sup>a</sup>	0.01
Heptachlorodibenzo-p-dioxin <sup>a</sup>	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 <sup>a</sup>	0.1
Hexachlorodibenzo-p-dioxin <sup>a</sup>	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 <sup>a</sup>	0.5
Pentachlorodibenzo-p-dioxin <sup>a</sup>	1
2,3,7,8-Tetrachlorodibenzodioxin	1
2,3,7,8-Tetrachlorodibenzofuran	0.05
Tetrachlorodibenzo-p-dioxin <sup>a</sup>	1
Octachlorodibenzofuran	0.0001
Octachlorodibenzo-p-dioxin	0.0001

<sup>a</sup> The highest TEF within the series was assigned for results listed as generic dioxin/furan.

Sources: WHO 1997; Van den Berg et al. (1998).

**COMPREHENSIVE RISK ASSESSMENT**

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

**VOLUME 15B2: ATTACHMENT 6**

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

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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
Table A6.4	Statistical Concentrations in Surface Water, Dissolved Analyses (including background samples) - 2000 - 2005 Data NW AEU
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Table A6.6	Summary of Surface Water ECOI Data in the SW AEU - Post 1999 Data
Table A6.7	Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples) – 2000-2005 Data SW AEU
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Table A6.9	Statistical Concentrations in Surface Water, Dissolved Analyses (including background samples) - 2000 - 2005 Data SW AEU
Table A6.10	Statistical Concentrations in Surface Water, Total Analyses (including background samples) - 2000 - 2005 Data SW AEU
Table A6.11	Summary of Post-1999 Surface Water ECOI Data in the WC AEU
Table A6.12	Statistical Distribution and Comparison to Background for Surface Water, Dissolved Analyses (excluding background samples) – 2000-2005 Data WC AEU

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Table A6.13	Statistical Distribution and Comparison to Background for Surface Water, Total Analyses – (excluding background samples) – 2000-2005 Data WC AEU
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Table A6.30	Total PAH Values by Sample for SW AEU Sediment
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Table A6.33	Total PAH Values for the WC AEU Sediment

## 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 INTRODUCTION**

The identified surface water and sediment ecological contaminants of potential concern (ECOPCs) were carried into the risk characterization process, and additional evaluations were performed in order to better understand current and future exposure conditions at the Aquatic Exposure Units (AEUs).

Surface water data for samples collected during 2000 to 2005 (“post-1999”) were evaluated to assess the more recent conditions at the site. Similarly, the surface sediment (top 6 inches) was evaluated as a more representative exposure media for the aquatic biota.

An additional data interpretation step involved the evaluation of adjacent surface soils. As a line of evidence, concentrations of sediment ECOPCs in adjacent surface soils were evaluated 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 greater than or equal to the sediment concentrations, then a potential future exposure issue may exist as a result of overland runoff of these materials.

## **2.0 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.

## **3.0 SEDIMENT**

The AEU sediment ECOPC selection process relied upon the comprehensive data sets that included sediment samples collected from all depth intervals. However, sediment at depths several feet below ground surface is not a relevant exposure medium for aquatic life receptors. The surface sediment (the top 6 inches) is more representative of the exposure medium for aquatic species. As an additional line of evidence in risk characterization, a separate dataset comprising only of surface sediment was compiled for each AEU. The data for the ECOPCs were compared between the two datasets. 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 were statistically summarized, and results are presented in Tables 6.16 through 6.18 for the NW AEU, Tables A6.19 through A6.21 for the SW AEU, and Tables 6.22 through A6.24 for the WC AEU.

#### **4.0 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 AEU. 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 was evaluated 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 A6.25 through A6.27), 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.

#### **5.0 TOTAL PAHS IN SEDIMENT**

For sediments, total PAHs were calculated as follows:

1. A list of 16 standard PAHs was identified and used to calculate total PAH concentrations;
2. The sum of PAHs was determined for each sample using the reported result for the detected PAHs, and ½ the reported result for nondetected PAHs as a proxy value;
3. The total PAH concentration was compared to the total PAH Ecological Screening Level (ESL) for the ECOPC selection process and risk characterization; and
4. The total detected PAH concentration for each sample was calculated for sediment and compared to the ESL for the risk characterization.

Tables A6.28 and A6.29 provide the total PAH values by sample, and the total detected PAH values for NW AEU. Tables A6.30 and A6.31 provide similar information for SW AEU, while Tables A6.32 and A6.33 provide information for WC AEU.

## **TABLES**

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

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation	
<b>Inorganic (Dissolved) (mg/L)</b>									
Arsenic	12	34	35.3	1.50E-04 - 0.00280	6.40E-04	0.00410	8.54E-04	8.48E-04	
Cadmium	54	201	26.9	1.70E-05 - 3.70E-04	1.60E-05	0.00200	8.85E-05	1.58E-04	
Chromium	24	34	70.6	2.20E-04 - 9.50E-04	2.70E-04	0.00710	0.00156	0.00189	
Copper	19	34	55.9	4.50E-04 - 0.00200	9.70E-04	0.00950	0.00204	0.00231	
Lead	5	34	14.7	1.60E-05 - 0.00163	2.00E-04	0.00562	6.32E-04	0.00122	
Manganese	24	34	70.6	4.60E-05 - 0.00210	6.60E-04	1.18	0.147	0.290	
Mercury	3	34	8.82	1.40E-05 - 1.00E-04	1.40E-05	4.70E-05	3.02E-05	1.72E-05	
Nickel	18	34	52.9	1.40E-04 - 0.00340	3.00E-04	0.00500	0.00143	0.00133	
Selenium	17	34	50	4.00E-04 - 0.00604	8.80E-04	0.00890	0.00262	0.00217	
Silver	11	201	5.47	5.00E-06 - 7.00E-04	1.60E-04	0.0324	3.00E-04	0.00230	
Thallium	5	32	15.6	5.00E-06 - 0.00430	1.20E-05	0.00400	8.35E-04	0.00100	
Uranium	10	28	35.7	0.00240 - 0.0680	0.00231	0.0170	0.00957	0.0122	
Zinc	28	34	82.4	0.00100 - 0.0234	0.00200	0.150	0.0338	0.0362	
<b>Inorganic (Total) (mg/L)</b>									
Aluminum	333	333	100	0 - 0	0.00655	217	15.2	23.8	
Antimony	238	333	71.5	4.20E-04 - 0.00610	4.80E-04	0.0315	0.00287	0.00453	
Barium	333	333	100	0 - 0	1.60E-04	1.42	0.209	0.177	
Beryllium	379	503	75.3	2.00E-05 - 9.40E-04	2.00E-05	0.0118	5.75E-04	0.00108	
Boron	1	1	100	0 - 0	0.180	0.180	0.180	0	
Calcium	333	333	100	0 - 0	0.0381	303	66.1	51.2	
Cobalt	310	333	93.1	1.75E-04 - 0.00410	1.80E-04	0.0741	0.00453	0.00757	
Iron	332	333	99.7	0.110 - 0.110	0.0489	205	13.3	21.4	
Lithium	328	333	98.5	0.00380 - 0.0228	8.00E-05	0.499	0.0360	0.0456	
Magnesium	333	333	100	0 - 0	0.00833	74	13.1	10.9	
Molybdenum	313	333	94.0	2.80E-04 - 0.00190	3.20E-04	0.0285	0.00294	0.00351	
Nitrate / Nitrite	257	258	99.6	0.0500 - 0.0500	0.0820	120	12.4	14.3	
Potassium	330	333	99.1	0.00880 - 3.08	0.383	674	14.6	45.8	
Silica	1	1	100	0 - 0	3.70	3.70	3.70	0	

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

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation	
Sodium	333	333	100	0 - 0	0.0646	6,460	279	603	
Strontium	333	333	100	0 - 0	2.00E-04	2.05	0.400	0.344	
Tin	41	333	12.3	4.80E-04 - 0.00500	5.50E-04	0.00920	7.26E-04	7.73E-04	
Titanium	1	1	100	0 - 0	0.00470	0.00470	0.00470	0	
Vanadium	324	333	97.3	1.80E-04 - 0.00544	1.30E-04	0.434	0.0312	0.0465	
<b>Organic (Total) (ug/L)</b>									
1,1,1-Trichloroethane	4	63	6.35	0.200 - 5	0.370	2	0.576	0.351	
1,1,2,2-Tetrachloroethane	1	63	1.59	0.300 - 5	0.100	0.100	0.517	0.264	
1,1,2-Trichloro-1,2,2-trifluoroethane	3	41	7.32	0.200 - 5	7	19.8	2.09	3.87	
1,1-Dichloroethane	1	63	1.59	0.200 - 5	0.300	0.300	0.518	0.262	
1,1-Dichloroethene	4	63	6.35	0.200 - 5	0.200	3	0.595	0.477	
1,3-Dichlorobenzene	1	63	1.59	0.200 - 5	0.820	0.820	0.529	0.263	
1,4-Dichlorobenzene	1	63	1.59	0.200 - 5	0.200	0.200	0.517	0.263	
2-Butanone	1	38	2.63	5 - 10	16	16	4.82	2.10	
2-Hexanone	1	42	2.38	1 - 10	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	2 - 22.2	3	40.8	6.21	6.02	
Benzene	1	63	1.59	0.200 - 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	0.500 - 5	0.290	0.290	0.522	0.257	
Carbon Disulfide	1	42	2.38	0.200 - 5	0.100	0.100	1.07	0.927	
Carbon Tetrachloride	8	63	12.7	0.200 - 5	8.25	310	15.5	58.5	
Chloroform	15	63	23.8	0.500 - 5	0.200	120	5.92	22.7	
cis-1,2-Dichloroethene	4	43	9.30	0.200 - 5	0.300	2	0.570	0.390	
Dimethoate	1	1	100	0 - 0	0.620	0.620	0.620	0	
Dimethylphthalate	1	7	14.3	10 - 11.1	0.790	0.790	4.57	1.68	
Di-n-butylphthalate	2	7	28.6	10.2 - 11.2	1.50	2	4.30	1.76	
Ethylbenzene	1	63	1.59	0.200 - 5	0.430	0.430	0.519	0.261	
Methylene Chloride	10	63	15.9	0.500 - 3.40	0.100	15	0.850	1.88	

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

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
PCB-1254	2	9	22.2	0.500 - 0.500	0.260	0.700	0.301	0.150
Tetrachloroethene	5	62	8.06	1 - 5	0.230	7	0.752	1.08
Toluene	7	63	11.1	0.200 - 5	0.300	10	0.725	1.28
Total PCBs	2	9	22.2	0.500 - 0.500	0.260	0.700	0.301	0.150
Trichloroethene	2	63	3.17	0.200 - 5	0.500	0.910	0.530	0.263
<b>Radionuclides (Total) (pCi/L)<sup>c</sup></b>				-				
Americium-241	662	662	100	0 - 0	-0.00700	84	0.479	3.77
Gross Alpha	15	15	100	0 - 0	0.117	521	57.1	135
Gross Beta	15	15	100	0 - 0	-3.20	398	39.3	101
Neptunium-237	19	19	100	0 - 0	-0.263	0.238	-0.00767	0.105
Plutonium-239/240	680	680	100	0 - 0	-0.0160	259	1.07	11.1
Tritium	130	130	100	0 - 0	-351	575	24.7	148
Uranium-233/234	692	692	100	0 - 0	-0.00400	26.7	1.88	2.22
Uranium-235	692	692	100	0 - 0	-0.0614	0.982	0.0727	0.0858
Uranium-238	692	692	100	0 - 0	0.00200	28.6	1.63	1.94

<sup>a</sup> Values in this column represent reported results for U-qualified data (i.e., nondetects).

<sup>b</sup> For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

<sup>c</sup> All radionuclide values are considered detects.

**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	NON-PARAMETRIC	46	33	NON-PARAMETRIC	45	WRS	1.000	No
Barium	mg/L	140	NON-PARAMETRIC	68	34	GAMMA	100	WRS	1.31E-11	Yes
Cadmium	mg/L	136	NON-PARAMETRIC	7	201	NON-PARAMETRIC	27	N/A	N/A	N/A
Copper	mg/L	138	NON-PARAMETRIC	33	34	GAMMA	56	WRS	1.000	No
Iron	mg/L	137	LOGNORMAL	80	34	NON-PARAMETRIC	56	WRS	1.000	No
Lead	mg/L	133	NON-PARAMETRIC	24	34	NON-PARAMETRIC	15	N/A	N/A	N/A
Selenium	mg/L	133	NON-PARAMETRIC	8	34	LOGNORMAL	50	N/A	N/A	N/A
Silver	mg/L	141	NON-PARAMETRIC	6	201	NON-PARAMETRIC	5	N/A	N/A	N/A
Zinc	mg/L	138	NON-PARAMETRIC	57	34	GAMMA	82	WRS	0.003	Yes

WRS = Wilcoxon Rank Sum

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

**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 (%)			
PCB-1254	ug/L	N/A	N/A	N/A	9	NON-PARAMETRIC	22	N/A	N/A	N/A
Total PCBs	ug/L	N/A	N/A	N/A	9	NON-PARAMETRIC	22	N/A	N/A	N/A
Aluminum	mg/L	166	NON-PARAMETRIC	82	333	NON-PARAMETRIC	100	WRS	0	Yes
Barium	mg/L	172	NON-PARAMETRIC	78	333	NON-PARAMETRIC	100	WRS	0	Yes
Beryllium	mg/L	167	NON-PARAMETRIC	13	503	LOGNORMAL	75	N/A	N/A	N/A
Cadmium	mg/L	165	NON-PARAMETRIC	5	336	NON-PARAMETRIC	76	N/A	N/A	N/A
Chromium	mg/L	167	NON-PARAMETRIC	29	505	NON-PARAMETRIC	94	WRS	1.15E-07	Yes
Copper	mg/L	164	NON-PARAMETRIC	46	333	LOGNORMAL	99	WRS	0	Yes
Iron	mg/L	172	NON-PARAMETRIC	97	333	NON-PARAMETRIC	100	WRS	0	Yes
Lead	mg/L	166	NON-PARAMETRIC	45	333	LOGNORMAL	89	WRS	0	Yes
Lithium	mg/L	166	NON-PARAMETRIC	49	333	NON-PARAMETRIC	98	WRS	0	Yes
Manganese	mg/L	171	LOGNORMAL	91	333	LOGNORMAL	100	t-Test_LN	9.27E-09	Yes
Mercury	mg/L	162	NON-PARAMETRIC	11	305	NON-PARAMETRIC	19	N/A	N/A	N/A
Nickel	mg/L	167	NON-PARAMETRIC	26	333	NON-PARAMETRIC	99	WRS	1.30E-04	Yes
Selenium	mg/L	162	NON-PARAMETRIC	14	333	NON-PARAMETRIC	51	N/A	N/A	N/A
Silver	mg/L	170	NON-PARAMETRIC	6	333	NON-PARAMETRIC	12	N/A	N/A	N/A
Vanadium	mg/L	171	NON-PARAMETRIC	34	333	NON-PARAMETRIC	97	WRS	0	Yes
Zinc	mg/L	N/A	N/A	74	333	NON-PARAMETRIC	96	WRS	0	Yes
Americium-241	pCi/L	101	NON-PARAMETRIC	100	662	NON-PARAMETRIC	100	WRS	0	Yes
Plutonium-239/240	pCi/L	107	NON-PARAMETRIC	100	680	NON-PARAMETRIC	100	WRS	0	Yes
Uranium-233/234	pCi/L	77	NON-PARAMETRIC	100	692	NON-PARAMETRIC	100	WRS	0	Yes
Uranium-238	pCi/L	77	NON-PARAMETRIC	100	692	NON-PARAMETRIC	100	WRS	0	Yes

WRS = Wilcoxon Rank Sum

t-Test-LN = Student's t-test using log-transformed data

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

**Table A6.4**  
**Statistical Concentrations in Surface Water, Dissolved Analyses (including background samples) - 2000 - 2005 Data NW AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
Aluminum	mg/L	33	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.048	0.012	0.020	0.085	0.337	0.105	0.968
Barium	mg/L	34	95% Approximate Gamma UCL	GAMMA	0.228	0.179	0.271	0.672	0.301	0.730	0.844
Cadmium	mg/L	201	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	8.85E-05	5.00E-05	9.00E-05	2.30E-04	1.37E-04	2.10E-04	0.002
Copper	mg/L	34	95% Approximate Gamma UCL	GAMMA	0.002	0.001	0.003	0.007	0.003	0.007	0.010
Iron	mg/L	34	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.253	0.009	0.068	1.30	1.16	1.68	2.21
Lead	mg/L	34	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	6.32E-04	3.25E-04	5.00E-04	0.002	0.003	0.005	0.006
Selenium	mg/L	34	95% H-UCL	LOGNORMAL	0.003	0.001	0.004	0.006	0.004	0.009	0.009
Silver	mg/L	201	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	3.00E-04	1.10E-04	1.30E-04	1.75E-04	0.001	1.75E-04	0.032
Zinc	mg/L	34	95% Approximate Gamma UCL	GAMMA	0.034	0.021	0.052	0.100	0.049	0.110	0.150

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value

<sup>c</sup> Maximum = maximum value in data set, may not be a detect

**Table A6.5**  
**Statistical Concentrations in Surface Water, Total Analyses (including background samples) - 2000 - 2005 Data NW AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
PCB-1254	ug/L	9	95% Student's-t UCL	NON-PARAMETRIC	0.301	0.250	0.250	0.524	0.394	0.700	0.700
Total PCBs	ug/L	9	95% Student's-t UCL	NON-PARAMETRIC	0.301	0.250	0.250	0.524	0.394	0.700	0.700
Aluminum	mg/L	333	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	15.2	6.54	16.6	54.5	23.4	47.6	217
Barium	mg/L	333	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.209	0.162	0.255	0.522	0.251	0.471	1.42
Beryllium	mg/L	503	95% H-UCL	LOGNORMAL	5.75E-04	2.10E-04	5.50E-04	0.002	6.98E-04	0.002	0.012
Cadmium	mg/L	336	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	5.32E-04	2.35E-04	6.50E-04	0.002	7.97E-04	0.002	0.007
Chromium	mg/L	505	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.013	0.006	0.014	0.047	0.019	0.038	0.199
Copper	mg/L	333	95% H-UCL	LOGNORMAL	0.025	0.014	0.033	0.078	0.030	0.067	0.236
Iron	mg/L	333	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	13.3	5.96	14.6	46.8	20.6	39.3	205
Lead	mg/L	333	95% H-UCL	LOGNORMAL	0.013	0.006	0.014	0.052	0.018	0.040	0.173
Lithium	mg/L	333	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.036	0.023	0.038	0.101	0.047	0.088	0.499
Manganese	mg/L	333	95% H-UCL	LOGNORMAL	0.321	0.155	0.393	1.17	0.458	1.02	3.21
Mercury	mg/L	305	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.15E-04	5.00E-05	5.00E-05	2.30E-04	2.24E-04	1.70E-04	0.006
Nickel	mg/L	333	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.014	0.008	0.015	0.049	0.019	0.036	0.178
Selenium	mg/L	333	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.001	9.50E-04	0.002	0.003	0.001	0.003	0.005
Silver	mg/L	333	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.90E-04	1.10E-04	1.35E-04	3.98E-04	3.12E-04	2.80E-04	0.008
Vanadium	mg/L	333	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.031	0.015	0.034	0.114	0.047	0.084	0.434
Zinc	mg/L	333	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.526	0.152	0.392	2.00	0.952	1.24	12.2
Americium-241	pCi/L	662	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.479	0.024	0.138	1.21	1.12	0.639	84.0
Plutonium-239/240	pCi/L	680	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.07	0.017	0.087	1.46	2.92	0.737	259
Uranium-233/234	pCi/L	692	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.88	1.31	2.04	5.92	2.24	4.71	26.7
Uranium-238	pCi/L	692	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.63	1.22	1.88	4.50	1.95	3.71	28.6

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value

<sup>c</sup> Maximum = maximum value in data set, may not be a detect

**Table A6.6**  
**Summary of Surface Water ECOI Data in the SW AEU - Post 1999 Data**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>		Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation	
<b>Inorganic (Dissolved) (mg/L)</b>										
Arsenic	7	40	17.5	5.80E-04	- 0.00300	9.80E-04	0.00250	7.30E-04	5.48E-04	
Cadmium	77	192	40.1	7.50E-05	- 5.00E-04	8.00E-05	0.00210	1.52E-04	2.47E-04	
Chromium	11	40	27.5	1.50E-04	- 0.00100	2.80E-04	0.00760	5.24E-04	0.00121	
Copper	30	40	75	5.50E-04	- 0.00480	3.10E-04	0.00710	0.00192	0.00127	
Lead	6	40	15.0	4.20E-04	- 0.00150	5.10E-04	0.00160	4.39E-04	3.11E-04	
Manganese	40	40	100	0	- 0	0.00860	1.40	0.166	0.302	
Mercury	7	40	17.5	2.30E-05	- 1.00E-04	1.10E-04	3.10E-04	7.25E-05	7.05E-05	
Nickel	27	40	67.5	0.00100	- 0.00340	9.40E-04	0.00290	0.00141	4.89E-04	
Selenium	21	40	52.5	7.20E-04	- 0.00250	7.10E-04	0.00490	0.00141	9.97E-04	
Silver	8	192	4.17	1.20E-04	- 0.00100	1.80E-04	3.70E-04	1.23E-04	7.24E-05	
Thallium	5	40	12.5	7.00E-04	- 0.00300	7.60E-04	0.00410	9.10E-04	7.90E-04	
Uranium	7	27	25.9	0.00280	- 0.0680	0.00300	0.00730	0.00617	0.00748	
Zinc	38	40	95	0.00650	- 0.00960	0.00900	0.354	0.0711	0.0725	
<b>Inorganic (Total) (mg/L)</b>										
Aluminum	378	383	98.7	0.00650	- 0.0442	0.0112	325	10.8	23.9	
Ammonia	203	284	71.5	0.100	- 0.100	0.0260	4.40	0.423	0.782	
Antimony	306	383	79.9	4.80E-04	- 0.0221	4.30E-04	0.108	0.00652	0.0119	
Barium	382	383	99.7	5.00E-04	- 5.00E-04	0.0194	2.30	0.223	0.232	
Beryllium	366	519	70.5	2.00E-05	- 0.00130	2.00E-05	0.0159	4.91E-04	0.00105	
Calcium	382	383	99.7	0.0258	- 0.0258	6.91	1,118	74.0	82.1	
Chloride	60	60	100	0	- 0	1.10	340	108	85.0	
Cobalt	327	383	85.4	1.50E-04	- 0.00630	1.70E-04	0.0781	0.00365	0.00773	
Cyanide	2	2	100	0	- 0	0.00459	0.0365	0.0205	0.0226	
Fluoride	58	60	96.7	0.610	- 0.660	0.0600	9.60	0.444	1.21	
Iron	381	383	99.5	0.0125	- 0.110	0.0132	245	11.3	21.5	
Lithium	380	383	99.2	0.00380	- 0.0228	0.00160	1.71	0.0279	0.0926	
Magnesium	382	383	99.7	0.0990	- 0.0990	0.628	87.9	16.3	15.3	

**Table A6.6**  
**Summary of Surface Water ECOI Data in the SW AEU - Post 1999 Data**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Molybdenum	351	383	91.6	2.20E-04	-	0.00360	2.80E-04	0.0331	0.00241	0.00251
Nitrate / Nitrite	346	378	91.5	0.0500	-	0.0500	0.0110	1,200	7.15	71.8
Potassium	381	383	99.5	0.0190	-	7.69	0.872	94.8	8.20	9.03
Silicon	49	49	100	0	-	0	0.0284	36.2	8.87	7.64
Sodium	382	383	99.7	0.0491	-	0.0491	1.69	3,240	209	368
Strontium	382	383	99.7	5.00E-04	-	5.00E-04	0.0320	3.51	0.494	0.488
Sulfate	59	60	98.3	5	-	5	3	67	17.8	12.6
Tin	46	377	12.2	4.80E-04	-	0.00350	5.75E-04	0.00610	6.39E-04	5.50E-04
Vanadium	367	383	95.8	1.20E-04	-	0.00544	1.60E-04	0.527	0.0234	0.0447
<b>Organic (Total) (ug/L)</b>										
1,1,1-Trichloroethane	7	93	7.53	1	-	10	0.300	4	1.35	1.14
1,1-Dichloroethane	6	93	6.45	1	-	10	0.180	1.70	1.33	1.10
1,1-Dichloroethene	2	93	2.15	1	-	10	0.510	5	1.33	1.16
1,3-Dichlorobenzene	2	98	2.04	1	-	11	0.440	0.570	1.47	1.35
2-Butanone	1	61	1.64	5	-	100	15	15	5.90	8.38
2-Chloroethyl vinyl et	1	21	4.76	0	-	5	0	0	1.29	1.09
4-Nitroaniline	1	13	7.69	26	-	84	5.30	5.30	24.6	8.34
Acetone	23	61	37.7	5	-	10	2	63.1	6.68	10.3
Benzene	1	93	1.08	1	-	10	1	1	1.29	1.10
Butylbenzylphthalate	1	13	7.69	9.80	-	33	1.60	1.60	5.80	3.37
Carbon Tetrachloride	18	93	19.4	1	-	10	0.590	18	1.92	2.81
Chloroform	38	93	40.9	1	-	10	0.100	5	1.29	1.11
Chloromethane	1	93	1.08	1	-	10	0.740	0.740	1.57	1.47
cis-1,2-Dichloroethene	15	61	24.6	1	-	5	0.150	210	7.93	33.7
Dichlorodifluorometh	1	91	1.10	1	-	10	0.280	0.280	1.49	1.39
Diethylphthalate	1	13	7.69	9.80	-	11	2	2	4.94	0.899
Dimethoate	1	2	50	0.510	-	0.510	67	67	33.6	47.2
Dimethylphthalate	2	13	15.4	9.80	-	33	0.930	3.60	5.62	3.49

**Table A6.6**  
**Summary of Surface Water ECOI Data in the SW AEU - Post 1999 Data**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Di-n-butylphthalate	2	13	15.4	9.80	-	11	1	6	4.94	1.21
Methylene Chloride	30	93	32.3	1	-	16	0.100	14	1.91	2.39
Naphthalene	1	68	1.47	1	-	11	1.10	1.10	1.94	1.48
N-Nitrosomorpholine	1	2	50	33	-	33	1	1	8.75	11.0
Tetrachloroethene	18	91	19.8	1	-	10	0.200	44	2.53	5.77
Toluene	9	93	9.68	1	-	10	0.100	6	1.30	1.20
Total PAHS	1	68	1.47	1	-	11	1.10	1.10	1.94	1.48
trans-1,2-Dichloroethene	1	91	1.10	0.500	-	5	0.700	0.700	1.18	1.01
Trichloroethene	16	93	17.2	1	-	10	0.200	66	2.75	8.16
Vinyl Chloride	5	93	5.38	1	-	10	0.800	9.70	1.70	1.73
<b>Radionuclides (pCi/L)<sup>c</sup></b>										
Americium-241	964	964	100	0	-	0	-0.0100	15	0.161	0.874
Gross Alpha	7	7	100	0	-	0	0.660	6.15	2.34	2.08
Gross Beta	7	7	100	0	-	0	4.29	7.73	6.02	1.27
Plutonium-239/240	971	971	100	0	-	0	-0.00900	84.8	0.349	2.97
Tritium	167	167	100	0	-	0	-286	400	-8.30	118
Uranium-233/234	813	813	100	0	-	0	0.0160	17.9	1.19	1.39
Uranium-235	813	813	100	0	-	0	-0.0654	0.538	0.0467	0.0544
Uranium-238	813	813	100	0	-	0	-0.00200	9.02	1.15	1.12

<sup>a</sup> Values in this column represent reported results for U-qualified data (i.e., nondetects).

<sup>b</sup> For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

<sup>c</sup> All radionuclide values are considered detects.

**Table A6.7**  
**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%.

**Table A6.8**  
**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 (%)			
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
Sulfate	mg/L	165	GAMMA	96	N/A	N/A	98	WRS	0.996	No

**Table A6.8**  
**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 (%)			
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%.

**Table A6.9**  
**Statistical Concentrations in Surface Water, Dissolved Analyses (including background samples) - 2000 - 2005 Data SW AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
Aluminum	mg/L	40	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.050	0.011	0.018	0.071	0.378	0.074	1.33
Barium	mg/L	40	95% Student's-t UCL	NORMAL	0.276	0.295	0.334	0.476	0.306	0.468	0.592
Cadmium	mg/L	192	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.52E-04	5.00E-05	1.40E-04	5.10E-04	2.30E-04	4.40E-04	0.002
Lithium	mg/L	40	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.063	0.018	0.025	0.088	0.235	0.130	1.59
Selenium	mg/L	40	95% Approximate Gamma UCL	GAMMA	0.001	0.001	0.002	0.003	0.002	0.003	0.005
Silver	mg/L	192	95% Student's-t UCL	NON-PARAMETRIC	1.23E-04	1.10E-04	1.40E-04	2.10E-04	1.32E-04	1.80E-04	5.00E-04
Zinc	mg/L	40	95% H-UCL	LOGNORMAL	0.071	0.042	0.088	0.200	0.109	0.247	0.354

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value.

<sup>c</sup> Maximum = maximum value in data set, may not be a detect.

**Table A6.10**  
**Statistical Concentrations in Surface Water, Total Analyses (including background samples) - 2000 - 2005 Data SW AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
Aluminum	mg/L	383	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	10.8	3.97	11.5	38.9	23.0	30.6	325
Ammonia	mg/L	284	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.423	0.105	0.383	1.99	0.713	1.70	4.40
Barium	mg/L	383	95% H-UCL	LOGNORMAL	0.223	0.143	0.292	0.683	0.258	0.563	2.30
Beryllium	mg/L	519	95% H-UCL	LOGNORMAL	4.91E-04	1.96E-04	5.40E-04	0.002	5.74E-04	0.001	0.016
Cadmium	mg/L	386	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	8.60E-04	3.45E-04	9.80E-04	0.003	0.001	0.002	0.017
Chromium	mg/L	526	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.011	0.005	0.013	0.040	0.016	0.029	0.248
Copper	mg/L	383	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.018	0.011	0.023	0.061	0.026	0.046	0.202
Cyanide	mg/L	2	Too Few Observations To Calculate UCLs	0	0.021	0.021	0.029	0.035	N/A	0.037	0.037
Fluoride	mg/L	60	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.444	0.285	0.383	0.556	1.13	0.660	9.60
Iron	mg/L	383	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	11.3	4.37	12.1	41.3	18.2	32.3	245
Lead	mg/L	377	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.013	0.006	0.015	0.056	0.020	0.039	0.189
Lithium	mg/L	383	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.028	0.015	0.025	0.074	0.049	0.053	1.71
Manganese	mg/L	383	95% H-UCL	LOGNORMAL	0.385	0.140	0.488	1.60	0.601	1.29	4.30
Mercury	mg/L	351	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	7.03E-05	5.00E-05	5.00E-05	1.75E-04	9.01E-05	1.40E-04	0.001
Nickel	mg/L	383	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.010	0.005	0.010	0.034	0.016	0.025	0.224
Selenium	mg/L	383	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	9.82E-04	5.50E-04	0.001	0.002	0.001	0.002	0.007
Silver	mg/L	385	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	4.44E-04	1.40E-04	2.70E-04	8.58E-04	0.001	6.30E-04	0.074
Vanadium	mg/L	383	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.023	0.009	0.025	0.084	0.038	0.066	0.527
Zinc	mg/L	383	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.311	0.194	0.399	0.866	0.483	0.714	8.07
Plutonium-239/240	pCi/L	971	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.349	0.021	0.100	0.959	0.765	0.549	84.8

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value

<sup>c</sup> Maximum = maximum value in data set, may not be a detect

**Table A6.11**  
**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 <sup>a</sup>		Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
<b>Inorganic (Dissolved) (mg/L)</b>									
Arsenic	0	0	0	0	- 0	0	0	0	0
Cadmium	7	39	17.9	7.50E-05	- 1.00E-04	9.00E-05	1.60E-04	6.04E-05	3.53E-05
Chromium	0	0	0	0	- 0	0	0	0	0
Copper	0	0	0	0	- 0	0	0	0	0
Lead	0	0	0	0	- 0	0	0	0	0
Manganese	0	0	0	0	- 0	0	0	0	0
Mercury	0	0	0	0	- 0	0	0	0	0
Nickel	0	0	0	0	- 0	0	0	0	0
Selenium	0	0	0	0	- 0	0	0	0	0
Silver	3	39	7.69	1.20E-04	- 0.00100	1.50E-04	0.00160	1.67E-04	2.47E-04
Thallium	0	0	0	0	- 0	0	0	0	0
Uranium	0	0	0	0	- 0	0	0	0	0
Zinc	0	0	0	0	- 0	0	0	0	0
<b>Inorganic (Total) (mg/L)</b>									
Aluminum	171	177	96.6	0.0154	- 0.0413	0.0203	415	11.5	39.4
Antimony	66	176	37.5	2.80E-04	- 0.00240	6.20E-04	0.00260	6.80E-04	4.86E-04
Barium	177	177	100	0	- 0	0.0435	2.56	0.186	0.237
Beryllium	113	220	51.4	2.00E-05	- 6.90E-04	3.00E-05	0.0255	5.64E-04	0.00217
Calcium	177	177	100	0	- 0	11.4	185	67.9	39.4
Chloride	21	21	100	0	- 0	5.10	170	62.4	49.2
Cobalt	134	177	75.7	1.50E-04	- 8.90E-04	1.70E-04	0.112	0.00356	0.0108
Fluoride	20	21	95.2	0.540	- 0.540	0.100	0.550	0.325	0.147
Iron	175	177	98.9	0.0381	- 0.0465	0.0128	398	10.3	36.7
Lithium	172	177	97.2	0.00380	- 0.0228	0.00330	0.277	0.0172	0.0258
Magnesium	177	177	100	0	- 0	2.21	51.9	15.5	9.37
Molybdenum	156	177	88.1	4.00E-04	- 0.00200	4.07E-04	0.0155	0.00187	0.00233
Potassium	175	177	98.9	1.29	- 1.63	0.870	50	4.54	5.22
Sodium	177	177	100	0	- 0	2.27	1,430	89.6	166
Strontium	177	177	100	0	- 0	0.0538	1.31	0.428	0.266
Sulfate	21	21	100	0	- 0	3.90	350	40.2	73.0

**Table A6.11**  
**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 <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation	
Tin	15	177	8.47	4.80E-04 - 0.00290	8.30E-04	0.00600	6.26E-04	5.17E-04	
Vanadium	156	177	88.1	1.80E-04 - 0.00544	2.20E-04	0.747	0.0229	0.0725	
<b>Organic (Total) (ug/L)</b>									
Acetone	1	11	9.09	10 - 10	3.70	3.70	4.88	0.392	
Benzene	2	20	10	1 - 1	0.100	0.200	0.465	0.109	
Bromoform	1	20	5	1 - 1	1.90	1.90	0.570	0.313	
Carbon Tetrachloride	1	20	5	1 - 1	0.700	0.700	0.510	0.0447	
Chloroform	3	20	15.0	1 - 1	0.420	3	0.746	0.771	
Methylene Chloride	5	20	25	1 - 2	0.100	1	0.535	0.241	
Tetrachloroethene	3	20	15.0	1 - 1	0.200	0.380	0.464	0.0942	
Toluene	6	20	30.0	1 - 1	0.100	1.10	0.482	0.191	
Trichloroethene	3	20	15.0	1 - 1	0.670	4	0.859	1.08	
<b>Radionuclides (Total) (pCi/L)<sup>c</sup></b>									
Americium-241	411	411	100	0 - 0	-0.0120	13.5	0.196	1.01	
Gross Alpha	10	10	100	0 - 0	0.241	5.69	1.97	1.93	
Gross Beta	10	10	100	0 - 0	0.888	11	5.63	3.02	
Plutonium-239/240	419	419	100	0 - 0	-0.0140	119	1.63	9.19	
Tritium	61	61	100	0 - 0	-227	407	21.6	137	
Uranium-233/234	373	373	100	0 - 0	0.0240	12.2	1.52	1.81	
Uranium-235	373	373	100	0 - 0	-0.0960	0.628	0.0648	0.0961	
Uranium-238	373	373	100	0 - 0	-0.00867	30.8	1.96	4.60	

<sup>a</sup> Values in this column represent reported results for U-qualified data (i.e., nondetects).

<sup>b</sup> For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

<sup>c</sup> All radionuclide values are considered detects.

**Table A6.12**  
**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%.

**Table A6.13**  
**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)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
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

**Table A6.13**  
**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)			Test	1 - p	> Bkg
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
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
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%.

**Table A6.14**  
**Statistical Concentrations in Surface Water, Dissolved Analyses (including background samples) - 2000 - 2005 Data WC AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
Silver	mg/L	39	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.67E-04	1.25E-04	1.35E-04	3.02E-04	3.40E-04	5.00E-04	0.002

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value

<sup>c</sup> Maximum = maximum value in data set, may not be a detect

**Table A6.15**  
**Statistical Concentrations in Surface Water, Total Analyses (including background samples) - 2000 - 2005 Data WC AEU**

Analyte	Units	Total Samples	UCL Recommended by ProUCL	Distribution Recommended by ProUCL	Mean	Median	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
Aluminum	mg/L	177	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	11.5	1.23	4.64	58.1	41.0	53.0	415
Barium	mg/L	177	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.186	0.136	0.193	0.429	0.264	0.368	2.56
Beryllium	mg/L	220	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	5.64E-04	9.00E-05	2.33E-04	0.003	0.001	0.001	0.026
Cadmium	mg/L	182	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	3.44E-04	1.15E-04	3.00E-04	0.002	6.35E-04	0.001	0.005
Chromium	mg/L	220	95% H-UCL	LOGNORMAL	0.010	0.002	0.006	0.045	0.013	0.024	0.348
Cobalt	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.004	5.80E-04	0.002	0.016	0.009	0.014	0.112
Copper	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.016	0.005	0.016	0.074	0.030	0.063	0.259
Iron	mg/L	177	99% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	10.3	1.14	5.06	42.9	37.7	39.1	398
Lead	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.010	0.001	0.008	0.045	0.022	0.036	0.262
Lithium	mg/L	177	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.017	0.011	0.015	0.059	0.026	0.047	0.277
Manganese	mg/L	177	95% H-UCL	LOGNORMAL	0.200	0.058	0.153	0.840	0.355	0.664	4.47
Mercury	mg/L	157	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	9.44E-05	5.00E-05	5.00E-05	3.62E-04	1.52E-04	2.90E-04	0.002
Nickel	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.010	0.002	0.006	0.045	0.022	0.037	0.272
Selenium	mg/L	177	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.001	5.00E-04	0.001	0.003	0.001	0.003	0.007
Silver	mg/L	178	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.90E-04	1.00E-04	1.40E-04	5.56E-04	3.18E-04	4.70E-04	0.003
Vanadium	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.023	0.003	0.012	0.108	0.057	0.100	0.747
Zinc	mg/L	177	97.5% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	0.134	0.041	0.167	0.624	0.234	0.569	1.28
Plutonium-239/240	pCi/L	419	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.63	0.011	0.138	5.10	3.59	2.50	119
Uranium-238	pCi/L	373	95% Chebyshev (Mean, Sd) UCL	NON-PARAMETRIC	1.96	0.682	1.40	11.4	2.99	3.62	30.8

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value

<sup>c</sup> Maximum = maximum value in data set, may not be a detect

**Table A6.16**  
**Summary of Surface Sediment ECOI Data in the NW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
<b>Inorganic (mg/kg)</b>								
Aluminum	68	68	100	0 - 0	1,700	26,000	11,395	6,615
Antimony	7	63	11.1	0.220 - 37.4	0.390	41.4	3.50	6.28
Arsenic	67	68	98.5	4.80 - 4.80	0.570	11	5.27	2.28
Barium	68	68	100	0 - 0	22	260	118	59.4
Beryllium	47	68	69.1	0.210 - 1.70	0.190	1.50	0.662	0.356
Boron	16	16	100	0 - 0	2.90	16	8.61	3.47
Cadmium	29	67	43.3	0.0680 - 3.30	0.0800	4.40	0.722	0.789
Calcium	68	68	100	0 - 0	950	140,000	13,498	18,662
Cesium	3	47	6.38	1.60 - 587	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	1.30 - 20	2.20	66.5	13.8	9.03
Chromium VI	6	21	28.6	0.00500 - 0.00500	0.00500	0.00800	0.00374	0.00209
Cobalt	63	68	92.6	2.40 - 6.50	1.80	20.1	6.98	3.36
Copper	68	68	100	0 - 0	6	77.6	18.0	9.23
Fluoride	12	21	57.1	0.875 - 2.50	2.38	16.7	3.30	3.56
Iron	68	68	100	0 - 0	5,050	37,100	15,843	5,915
Lead	68	68	100	0 - 0	5.20	234	23.5	27.5
Lithium	53	68	77.9	3.05 - 9.60	1.80	24	8.41	5.50
Magnesium	68	68	100	0 - 0	721	6,200	2,994	1,345
Manganese	68	68	100	0 - 0	84	1,760	378	318
Mercury	22	64	34.4	0.00510 - 0.180	0.0160	0.260	0.0689	0.0460
Molybdenum	22	68	32.4	0.410 - 13	0.330	6.20	1.74	1.26
Nickel	66	68	97.1	16.4 - 26.4	3.20	31.6	14.3	6.21
Nitrate / Nitrite	16	41	39.0	0.200 - 2.50	0.346	89.3	5.66	14.9
Nitrite	1	17	5.88	0.0200 - 2.50	5.61	5.61	1.36	1.17
Potassium	64	68	94.1	1,150 - 2,180	402	4,300	1,853	934
Selenium	21	68	30.9	0.220 - 4.60	0.450	2.40	0.675	0.578
Silica	16	16	100	0 - 0	600	3,300	1,237	687
Silicon	33	33	100	0 - 0	64.9	1,960	651	433
Silver	9	63	14.3	0.0100 - 4.10	0.0980	5	0.761	0.822
Sodium	66	68	97.1	81 - 96.2	60.3	2,100	524	407
Strontium	68	68	100	0 - 0	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	0.270 - 3.50	0.400	1.60	0.419	0.304

**Table A6.16**  
**Summary of Surface Sediment ECOI Data in the NW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Tin	12	66	18.2	0.710 - 61.9	0.920	15.5	5.42	5.69
Titanium	16	16	100	0 - 0	36	180	125	42.4
Uranium	1	21	4.76	1.40 - 39	4.30	4.30	4.96	4.01
Vanadium	68	68	100	0 - 0	6.70	59	30.5	12.8
Zinc	68	68	100	0 - 0	31.1	704	139	135
<b>Organic (ug/kg)</b>				<b>-</b>				
1,1,2,2-Tetrachloroethane	1	41	2.44	5 - 22	2	2	5.72	2.09
2-Butanone	4	40	10	7 - 33	9	43	9.48	7.94
2-Methylnaphthalene	5	63	7.94	360 - 3,500	49	2,000	380	365
2-Methylphenol	1	63	1.59	350 - 3,500	200	200	364	294
4,4'-DDT	4	49	8.16	3.50 - 180	2.90	4.90	10.4	14.9
Acenaphthene	18	63	28.6	350 - 1,800	24	620	251	157
Acetone	4	39	10.3	10 - 230	16	230	25.1	43.5
Aldrin	1	48	2.08	1.80 - 89	54	54	6.48	10.2
Anthracene	27	63	42.9	350 - 1,800	20	970	245	200
Benzene	1	41	2.44	5 - 22	3	3	5.67	2.09
Benzo(a)anthracene	43	63	68.3	380 - 3,500	26	1,400	297	348
Benzo(a)pyrene	33	63	52.4	380 - 3,500	23	1,300	337	345
Benzo(b)fluoranthene	37	63	58.7	380 - 3,500	25	1,500	346	362
Benzo(g,h,i)perylene	24	63	38.1	360 - 3,500	37	900	311	294
Benzo(k)fluoranthene	26	63	41.3	350 - 3,500	35	1,200	330	323
Benzoic Acid	3	35	8.57	1,800 - 18,000	180	220	2,030	1,734
bis(2-ethylhexyl)phthalate	34	63	54.0	350 - 1,600	1	1,500	322	272
Butylbenzylphthalate	2	63	3.17	350 - 3,500	34	51	358	299
Carbazole	11	25	44	360 - 1,000	28	300	186	126
Chrysene	44	63	69.8	380 - 3,500	22	1,500	335	379
delta-BHC	1	49	2.04	1.80 - 89	13	13	5.62	7.45
Dibenz(a,h)anthracene	5	63	7.94	360 - 3,500	41	330	337	270
Dibenzofuran	5	63	7.94	360 - 3,500	26	300	358	299
Di-n-butylphthalate	23	63	36.5	380 - 3,500	31	190	307	319
Di-n-octylphthalate	1	63	1.59	350 - 3,500	45	45	361	296
Endosulfan I	1	49	2.04	1.80 - 89	20	20	5.28	6.79
Fluoranthene	47	63	74.6	380 - 3,500	44	3,100	513	614
Fluorene	14	63	22.2	360 - 3,500	21	650	327	286
Indeno(1,2,3-cd)pyrene	25	63	39.7	360 - 3,500	23	890	304	296

**Table A6.16**  
**Summary of Surface Sediment ECOI Data in the NW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>	Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Methylene Chloride	1	40	2.50	5 - 48	9.30	9.30	8.97	5.15
Naphthalene	6	64	9.38	7 - 3,500	95	310	328	267
PCB-1254	20	82	24.4	35 - 1,800	7.30	920	125	161
PCB-1260	1	79	1.27	35 - 1,800	180	180	113	129
Pentachlorophenol	1	63	1.59	860 - 18,000	39	39	1,516	1,460
Phenanthrene	45	63	71.4	380 - 3,500	26	3,300	440	596
Phenol	1	63	1.59	350 - 3,500	22	22	361	297
Pyrene	41	63	65.1	380 - 3,500	37	3,900	524	658
TEQ	7	7	100	0 - 0	5.66E-04	0.161	0.0279	0.0591
Tetrachloroethene	1	41	2.44	5 - 22	2	2	5.72	2.09
Toluene	6	41	14.6	5 - 22	3	31	6.62	4.47
Total PAHs	435	946	46.0	7 - 3,500	20	3,900	348	392
Total PCBs	21	161	13.0	35 - 1,800	7.30	920	119	146
Trichloroethene	3	41	7.32	5 - 22	3	13	5.85	2.31
<b>Radionuclide (pCi/g)<sup>c</sup></b>				<b>-</b>				
Americium-241	76	76	100	0 - 0	-0.0147	6.89	0.507	0.949
Cesium-134	41	41	100	0 - 0	-0.157	0.200	0.0857	0.0790
Cesium-137	57	57	100	0 - 0	0.00343	0.610	0.206	0.174
Gross Alpha	54	54	100	0 - 0	-6.20	39.6	18.6	8.89
Gross Beta	58	58	100	0 - 0	8.02	39.3	26.6	6.80
Plutonium-239/240	85	85	100	0 - 0	0.00200	22.4	1.53	3.04
Radium-226	39	39	100	0 - 0	-0.340	3.08	1.07	0.818
Radium-228	27	27	100	0 - 0	0.0400	2.40	1.58	0.437
Strontium-89/90	55	55	100	0 - 0	-0.140	1.80	0.258	0.408
Uranium-233/234	76	76	100	0 - 0	0.140	3.70	1.38	0.832
Uranium-235	76	76	100	0 - 0	-0.0523	0.285	0.0733	0.0619
Uranium-238	76	76	100	0 - 0	0.190	6.10	1.76	1.40

<sup>a</sup> Values in this column represent reported results for U-qualified data (i.e., nondetects).

<sup>b</sup> For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

<sup>c</sup> All radionuclide values are considered detects.

**Table A6.17**  
**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)			Test	1 - p	> Background?
		Total Samples	Distribution Recommended by ProUCL	Detects (%)	Total Samples	Distribution Recommended by ProUCL	Detects (%)			
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%.

**Table A6.18**  
**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	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
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

<sup>a</sup> UCL = 95% upper confidence limit on the mean; <sup>b</sup> UTL = 95% upper confidence limit on the 90<sup>th</sup> percentile value; <sup>c</sup> Maximum = maximum proxy result; may not be a detect.

**Table A6.19**  
**Summary of Surface Sediment ECOI Data in the SW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
<b>Inorganics (mg/kg)</b>										
Aluminum	92	92	100	0	-	0	763	29,000	7,882	6,311
Antimony	23	91	25.3	0.210	-	22.9	0.270	15.9	2.74	3.30
Arsenic	85	91	93.4	0.463	-	2.40	0.690	21.6	3.93	2.89
Barium	92	92	100	0	-	0	7.20	220	82.3	54.9
Beryllium	67	92	72.8	0.120	-	1.90	0.110	2.10	0.505	0.400
Boron	18	21	85.7	1.10	-	1.20	1.20	30	5.66	6.45
Cadmium	43	92	46.7	0.0380	-	1.70	0.0360	6.20	0.609	0.771
Calcium	92	92	100	0	-	0	653	82,300	10,600	12,909
Cesium	9	49	18.4	0.830	-	116	1.80	13.6	9.59	14.7
Chloride	10	13	76.9	25	-	25	13	206	58.4	65.1
Chromium	85	92	92.4	1.20	-	13.4	1.90	49	13.6	8.47
Chromium VI	6	16	37.5	0.00500	-	0.00500	0.00500	0.0130	0.00431	0.00295
Cobalt	78	92	84.8	1.61	-	5.30	1.60	10.8	4.83	2.87
Copper	86	92	93.5	0.745	-	17.5	4.30	324	19.1	33.6
Cyanide	1	5	20	0.270	-	0.310	0.230	0.230	0.161	0.0393
Fluoride	8	16	50	0.951	-	2.50	0.831	9.27	2.41	2.67
Iron	92	92	100	0	-	0	1,680	24,000	11,016	4,873
Lead	92	92	100	0	-	0	2.90	170	28.0	26.3
Lithium	75	92	81.5	2.98	-	16.4	1.60	23.5	6.49	4.50
Magnesium	92	92	100	0	-	0	263	22,900	2,480	2,442
Manganese	92	92	100	0	-	0	39.1	410	183	82.6
Mercury	20	73	27.4	0.00540	-	0.212	0.0170	0.150	0.0479	0.0296
Molybdenum	31	92	33.7	0.140	-	8	0.260	7.70	1.29	1.22
Nickel	85	92	92.4	2.76	-	16.2	2.90	216	13.2	22.7
Nitrate / Nitrite	12	29	41.4	0.263	-	3.84	0.157	12.9	1.78	2.64
Potassium	90	92	97.8	163	-	169	321	3,900	1,362	787

**Table A6.19**  
**Summary of Surface Sediment ECOI Data in the SW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Selenium	12	91	13.2	0.140	-	2.24	0.330	1.80	0.425	0.286
Silica	21	21	100	0	-	0	259	2,000	873	432
Silicon	21	21	100	0	-	0	79.2	836	380	189
Silver	20	90	22.2	0.0610	-	6.30	0.160	39.3	1.67	5.33
Sodium	79	92	85.9	61.3	-	163	62.7	2,240	412	372
Strontium	92	92	100	0	-	0	4.60	150	35.9	29.9
Sulfate	6	13	46.2	25	-	25	3.81	25.9	12.4	6.05
Thallium	12	92	13.0	0.250	-	1.60	0.300	1.20	0.378	0.208
Tin	9	92	9.78	0.900	-	37.9	1.50	39.5	3.53	5.47
Titanium	21	21	100	0	-	0	57	330	153	64.9
Vanadium	84	92	91.3	2.20	-	33.6	2.30	63	21.8	12.8
Zinc	92	92	100	0	-	0	18.6	888	180	186
<b>Organics (ug/kg)</b>										
1,1-Dichloroethene	1	60	1.67	1.47	-	1,300	2	2	14.6	83.4
1,2,3-Trichlorobenzene	1	24	4.17	0.696	-	8	2	2	2.30	1.19
1,2,4-Trichlorobenzene	1	73	1.37	0.963	-	3,600	2	2	227	281
2-Butanone	4	61	6.56	6	-	1,300	3	38	27.8	116
2-Methylnaphthalene	1	55	1.82	350	-	3,600	41	41	322	273
4,4'-DDE	1	44	2.27	3.50	-	29	4.10	4.10	7.60	4.52
4-Methylphenol	1	55	1.82	350	-	3,600	47	47	319	273
Acenaphthene	11	55	20	350	-	1,800	26	180	217	133
Acetone	5	61	8.20	6	-	1,300	11	210	34.9	118
Anthracene	18	55	32.7	350	-	1,800	19	430	213	143
Benzo(a)anthracene	33	55	60.0	350	-	3,600	25	1,400	294	344
Benzo(a)pyrene	28	55	50.9	350	-	3,600	41	1,300	319	329
Benzo(b)fluoranthene	32	55	58.2	350	-	3,600	37	1,500	329	376
Benzo(g,h,i)perylene	24	55	43.6	350	-	3,600	43	1,100	302	304
Benzo(k)fluoranthene	29	55	52.7	350	-	3,600	31	920	287	299

**Table A6.19**  
**Summary of Surface Sediment ECOI Data in the SW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>		Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Benzoic Acid	3	39	7.69	370	- 18,000	240	1,400	1,660	1,662
beta-BHC	1	44	2.27	1.80	- 14	28	28	4.40	4.28
bis(2-ethylhexyl)phthalate	38	55	69.1	350	- 3,600	28	8,800	625	1,328
Bromomethane	6	61	9.84	1.58	- 1,300	2	5	26.2	116
Butylbenzylphthalate	8	55	14.5	350	- 3,600	21	1,700	324	337
Carbazole	6	16	37.5	350	- 690	25	290	186	85.4
Carbon Tetrachloride	2	61	3.28	1.16	- 21	390	440	17.3	74.0
Chloroform	5	61	8.20	0.885	- 1,300	1	2	24.9	116
Chrysene	36	55	65.5	370	- 3,600	23	1,400	307	348
Dibenz(a,h)anthracene	13	55	23.6	350	- 3,600	21	360	282	274
Dibenzofuran	3	55	5.45	350	- 3,600	20	65	316	277
Dieldrin	1	44	2.27	3.50	- 29	4.60	4.60	7.61	4.51
Diethylphthalate	1	55	1.82	350	- 3,600	53	53	322	272
Dimethylphthalate	4	55	7.27	350	- 3,600	75	490	310	275
Di-n-butylphthalate	15	55	27.3	350	- 3,600	28	220	293	290
Di-n-octylphthalate	13	55	23.6	350	- 3,600	21	9,800	693	1,466
Ethylbenzene	2	61	3.28	1.05	- 1,300	1.40	9	25.2	116
Fluoranthene	40	55	72.7	370	- 3,600	33	2,700	471	565
Fluorene	9	55	16.4	350	- 3,600	21	180	295	278
Heptachlor epoxide	1	44	2.27	1.80	- 37	33	33	4.80	5.36
Hexachlorobutadiene	1	73	1.37	1.23	- 3,600	2	2	227	281
Indeno(1,2,3-cd)pyrene	28	55	50.9	350	- 3,600	30	910	269	298
Methoxychlor	1	44	2.27	18	- 140	2.70	2.70	37.7	23.1
Methylene Chloride	18	61	29.5	1.11	- 94	2	420	23.6	73.7
Naphthalene	4	73	5.48	0.815	- 3,600	2	59	223	282
PCB-1254	17	67	25.4	35	- 430	27	1,700	128	230
PCB-1260	5	67	7.46	35	- 430	53	2,000	119	250
Pentachlorophenol	3	55	5.45	880	- 18,000	420	1,100	1,359	1,463

**Table A6.19**  
**Summary of Surface Sediment ECOI Data in the SW AEU**

Analyte	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Phenanthrene	35	55	63.6	350	-	3,600	35	1,800	356	396
Phenol	1	55	1.82	350	-	3,600	110	110	322	272
Pyrene	36	55	65.5	370	-	3,600	20	1,700	410	411
Tetrachloroethene	3	61	4.92	1.25	-	1,300	3	7	25.1	116
Toluene	9	60	15.0	1.30	-	1,300	3	82	18.6	84.0
Total PAHs	376	843	44.6	0.815	-	3,600	2	2,700	303	337
Total PCBs	22	134	16.4	35	-	430	27	2,000	123	240
Trichlorofluoromethane	12	24	50	1.29	-	6	1	5	2.19	1.17
Xylene	3	61	4.92	2.65	-	1,300	6	68	26.4	116
<b>Radionuclides (pCi/g)<sup>c</sup></b>										
Americium-241	140	140	100	0	-	0	-0.0140	1.83	0.226	0.373
Cesium-134	34	34	100	0	-	0	-0.201	0.200	0.0521	0.0997
Cesium-137	42	42	100	0	-	0	0.00400	0.959	0.124	0.149
Gross Alpha	50	50	100	0	-	0	6.50	160	20.1	22.1
Gross Beta	50	50	100	0	-	0	22	125	31.9	15.6
Plutonium-239/240	141	141	100	0	-	0	-0.0160	10.1	0.565	1.31
Radium-226	29	29	100	0	-	0	-9.84	1.59	0.185	1.98
Radium-228	21	21	100	0	-	0	0.888	2.08	1.40	0.329
Strontium-89/90	40	40	100	0	-	0	-0.110	1.06	0.102	0.206
Uranium-233/234	110	110	100	0	-	0	0.294	9.81	1.10	0.949
Uranium-235	110	110	100	0	-	0	-0.0140	0.852	0.0628	0.0889
Uranium-238	110	110	100	0	-	0	0	59	1.66	5.58

<sup>a</sup> Values in this column represent reported results for U-qualified data (i.e., nondetects).

<sup>b</sup> For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

<sup>c</sup> All radionuclide values are considered detects.

**Table A6.20**  
**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.  
, N/A = not applicable; site and/or background detection frequency less than 20%.

**Table A6.21**  
**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	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
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

<sup>a</sup> UCL = 95% upper confidence limit on the mean.

<sup>b</sup> UTL = 95% upper confidence limit on the 90th percentile value.

<sup>c</sup> Maximum = maximum value in data set, may not be a detect.

**Table A6.22**  
**Summary of Surface Sediment ECOI Data in the WC AEU**

Analyte	Units	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
<b>Inorganic (mg/kg)</b>											
Aluminum	mg/kg	78	78	100	0	-	0	1,140	31,000	10,727	6,632
Antimony	mg/kg	7	73	9.59	0.430	-	39.1	0.820	51.3	6.26	9.36
Arsenic	mg/kg	76	78	97.4	0.530	-	0.741	0.480	27.9	4.93	3.79
Barium	mg/kg	77	78	98.7	32.1	-	32.1	14.6	404	132	79.0
Beryllium	mg/kg	54	75	72	0.0900	-	1.10	0.110	6.70	0.737	0.814
Boron	mg/kg	10	10	100	0	-	0	4.60	14	8.67	2.76
Cadmium	mg/kg	21	74	28.4	0.0280	-	2.80	0.130	3.60	0.645	0.585
Calcium	mg/kg	78	78	100	0	-	0	673	48,200	10,129	10,174
Cesium	mg/kg	10	62	16.1	0.520	-	211	0.680	5.20	32.5	31.9
Chromium	mg/kg	77	78	98.7	1.20	-	1.20	1.50	70.1	12.6	9.27
Chromium VI	mg/kg	1	4	25	0.00500	-	0.00500	0.0120	0.0120	0.00488	0.00475
Cobalt	mg/kg	74	77	96.1	1.73	-	10.6	1.30	13.1	7.00	3.20
Copper	mg/kg	73	78	93.6	5.50	-	8.10	2.20	212	22.2	31.4
Fluoride	mg/kg	1	4	25	1.86	-	2.50	20.3	20.3	5.93	9.58
Iron	mg/kg	78	78	100	0	-	0	2,660	38,800	15,487	7,628
Lead	mg/kg	78	78	100	0	-	0	2.60	118	25.6	18.0
Lithium	mg/kg	64	75	85.3	2.10	-	28.4	1.70	28	8.54	5.50
Magnesium	mg/kg	78	78	100	0	-	0	448	6,600	2,697	1,510
Manganese	mg/kg	78	78	100	0	-	0	53	1,580	309	222
Mercury	mg/kg	17	76	22.4	0.0500	-	0.260	0.0150	3.80	0.156	0.478
Molybdenum	mg/kg	23	76	30.3	0.400	-	7.80	0.560	11.7	2.13	2.02
Nickel	mg/kg	66	78	84.6	2.20	-	19.5	2.20	33	13.1	7.47
Nitrate / Nitrite	mg/kg	42	58	72.4	0.980	-	7.40	0.429	32	3.24	5.72
Potassium	mg/kg	68	77	88.3	729	-	4,180	276	4,200	1,590	946
Selenium	mg/kg	29	71	40.8	0.240	-	1.90	0.300	3.80	0.622	0.628
Silica	mg/kg	10	10	100	0	-	0	720	1,600	1,189	327
Silicon	mg/kg	43	43	100	0	-	0	83.8	1,890	452	395
Silver	mg/kg	11	74	14.9	0.110	-	4.70	0.850	7.70	0.910	1.15
Sodium	mg/kg	67	76	88.2	49.8	-	180	36.6	2,060	210	264
Strontium	mg/kg	77	78	98.7	13.6	-	13.6	4.80	167	53.2	37.1
Thallium	mg/kg	12	73	16.4	0.260	-	2.40	0.230	10	0.615	1.43
Tin	mg/kg	21	77	27.3	1.50	-	127	3.40	77.2	10.9	13.9
Titanium	mg/kg	10	10	100	0	-	0	53	300	166	77.4
Vanadium	mg/kg	78	78	100	0	-	0	4.90	68.6	28.1	13.7
Zinc	mg/kg	78	78	100	0	-	0	10.6	2,080	149	277
<b>Organic (ug/kg)</b>											
2,4-Dinitrophenol	ug/kg	1	52	1.92	960	-	10,000	890	890	1,512	867

**Table A6.22**  
**Summary of Surface Sediment ECOI Data in the WC AEU**

Analyte	Units	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
2-Butanone	ug/kg	7	48	14.6	11	-	24	3	380	20.0	58.5
2-Methylnaphthalene	ug/kg	1	55	1.82	350	-	2,100	110	110	316	179
4,4'-DDT	ug/kg	1	55	1.82	3.80	-	200	18	18	16.5	16.2
4,6-Dinitro-2-methylphenol	ug/kg	1	54	1.85	960	-	10,000	750	750	1,493	856
4-Methyl-2-pentanone	ug/kg	1	49	2.04	11	-	32	3	3	7.62	2.31
4-Methylphenol	ug/kg	4	55	7.27	350	-	2,100	68	510	311	186
Acenaphthene	ug/kg	3	55	5.45	350	-	2,100	74	510	293	146
Acetone	ug/kg	14	53	26.4	11	-	230	9	890	50.1	132
Aldrin	ug/kg	2	55	3.64	1.90	-	99	0	0	8.14	8.79
alpha-Chlordane	ug/kg	2	55	3.64	1.90	-	990	0	0	80.4	88.7
Anthracene	ug/kg	5	55	9.09	350	-	2,100	90	470	296	147
Benzo(a)anthracene	ug/kg	9	55	16.4	350	-	2,100	22	1,200	293	214
Benzo(a)pyrene	ug/kg	7	55	12.7	350	-	2,100	37	970	303	200
Benzo(b)fluoranthene	ug/kg	6	55	10.9	350	-	2,100	84	1,500	315	232
Benzo(g,h,i)perylene	ug/kg	4	55	7.27	350	-	2,100	45	630	310	182
Benzo(k)fluoranthene	ug/kg	5	55	9.09	350	-	2,100	72	690	307	183
Benzoic Acid	ug/kg	3	50	6	1,800	-	10,000	240	660	1,506	900
beta-BHC	ug/kg	2	55	3.64	1.90	-	99	0	0	8.14	8.79
bis(2-ethylhexyl)phthalate	ug/kg	30	56	53.6	350	-	2,100	49	2,600	389	476
Butylbenzylphthalate	ug/kg	3	56	5.36	350	-	2,100	57	210	309	183
Chrysene	ug/kg	12	56	21.4	350	-	2,100	41	1,200	288	211
delta-BHC	ug/kg	2	55	3.64	1.90	-	99	0	0	8.14	8.79
Dibenz(a,h)anthracene	ug/kg	2	55	3.64	350	-	2,100	220	530	315	172
Dibenzofuran	ug/kg	1	55	1.82	350	-	2,100	230	230	318	177
Diethylphthalate	ug/kg	1	56	1.79	350	-	2,100	79	79	313	179
Di-n-butylphthalate	ug/kg	13	56	23.2	360	-	2,100	39	390	282	204
Di-n-octylphthalate	ug/kg	3	56	5.36	350	-	2,100	21	210	309	183
Endosulfan I	ug/kg	2	55	3.64	1.90	-	99	0	0	8.41	8.95
Fluoranthene	ug/kg	17	56	30.4	350	-	2,100	31	2,900	307	390
Fluorene	ug/kg	1	55	1.82	350	-	2,100	400	400	321	177
gamma-BHC (Lindane)	ug/kg	1	55	1.82	1.90	-	99	4.40	4.40	8.68	9.41
gamma-Chlordane	ug/kg	2	27	7.41	85	-	990	0	0	104	119
Heptachlor	ug/kg	2	55	3.64	1.90	-	99	0	0	8.14	8.79
Heptachlor epoxide	ug/kg	2	55	3.64	1.90	-	99	0	0	8.14	8.79
Indeno(1,2,3-cd)pyrene	ug/kg	4	55	7.27	350	-	2,100	24	500	311	171
Methylene Chloride	ug/kg	13	53	24.5	5	-	57	2	220	14.5	33.9
Naphthalene	ug/kg	1	55	1.82	350	-	2,100	300	300	319	177
PCB-1254	ug/kg	11	63	17.5	36	-	2,000	19	250	156	184

**Table A6.22**  
**Summary of Surface Sediment ECOI Data in the WC AEU**

Analyte	Units	Number of Detects	Number of Samples	Detection Frequency (%)	Range of Reported Detection Limits <sup>a</sup>			Minimum Detected Concentration	Maximum Detected Concentration	Arithmetic Mean Concentration <sup>b</sup>	Standard Deviation
Pentachlorophenol	ug/kg	1	55	1.82	960	-	10,000	950	950	1,494	845
Phenanthrene	ug/kg	14	56	25	350	-	2,100	24	2,900	317	385
Phenol	ug/kg	1	55	1.82	350	-	2,100	150	150	307	171
Pyrene	ug/kg	14	56	25	350	-	2,100	45	3,100	336	420
TEQ	ug/kg	4	4	100	0	-	0	8.07E-04	0.0306	0.00944	0.0142
Tetrachloroethene	ug/kg	1	49	2.04	5	-	16	1	1	4	1.34
Toluene	ug/kg	10	52	19.2	5	-	15	2	410	28.8	88.5
Total PAHs	ug/kg	104	829	12.5	350	-	2,100	22	3,100	309	243
Total PCBs	ug/kg	11	63	17.5	36	-	2,000	19	250	156	184
Trichloroethene	ug/kg	1	50	2	5	-	16	23	23	4.42	2.96
Xylene	ug/kg	1	49	2.04	5	-	16	5	5	4.09	1.26
<b>Radionuclide (pCi/g)<sup>c</sup></b>					-						
Americium-241	pCi/g	94	94	100	0	-	0	-0.0130	5.06	0.166	0.537
Cesium-134	pCi/g	35	35	100	0	-	0	-0.0674	0.300	0.0837	0.0793
Cesium-137	pCi/g	51	51	100	0	-	0	-0.00176	0.564	0.152	0.128
Gross Alpha	pCi/g	69	69	100	0	-	0	-9.70	320	27.7	42.1
Gross Beta	pCi/g	69	69	100	0	-	0	4.95	74.9	29.7	12.0
Plutonium-239/240	pCi/g	101	101	100	0	-	0	0	30	0.985	3.43
Radium-226	pCi/g	19	19	100	0	-	0	-1.90	2.19	0.833	0.899
Radium-228	pCi/g	20	20	100	0	-	0	0.732	2.90	1.41	0.584
Strontium-89/90	pCi/g	51	51	100	0	-	0	-0.300	4.86	0.463	0.949
Uranium-233/234	pCi/g	85	85	100	0	-	0	0.230	4.78	1.27	0.807
Uranium-235	pCi/g	85	85	100	0	-	0	-0.0140	0.405	0.0731	0.0712
Uranium-238	pCi/g	85	85	100	0	-	0	0.300	10.1	1.42	1.34

a Values in this column represent reported results for U-qualified data (i.e., nondetects).

b For organics and inorganics, statistics are computed using one-half the reported result for nondetects.

c All radionuclide values are considered detects.

**Table A6.23**  
**Statistical Distribution and Comparison to Background for Surface Sediments (excluding background samples) for WC AEU**

Analyte	Units	Statistical Distribution Testing Results						Background Comparison Test		
		Background			WC 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	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%.

**Table A6.24**  
**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	75 <sup>th</sup> percentile	95 <sup>th</sup> percentile	UCL <sup>a</sup>	UTL <sup>b</sup>	Maximum <sup>c</sup>
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

<sup>a</sup> UCL = 95% upper confidence limit on the mean; <sup>b</sup> UTL = 95% upper confidence limit on the 90<sup>th</sup> percentile value, <sup>c</sup> Maximum = maximum proxy result; may not be a detect.

**Table A6.25**  
**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 <sup>1</sup> Concentration	Standard Deviation <sup>1</sup>	ESL <sup>2</sup>	MDC > ESL
<b>Inorganics (mg/kg)</b>									
Aluminum	119	119	100%	1,450	28,000	10,781	6,038	15,900	<b>Yes</b>
Antimony	109	39	36%	0.31	3.5	1	2	2	<b>Yes</b>
Barium	119	119	100%	20	263	81	34	189	<b>Yes</b>
Cadmium	117	43	37%	0.075	10.6	1	1	0.99	<b>Yes</b>
Copper	119	117	98%	6.7	1340	54	145	31.6	<b>Yes</b>
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	<b>Yes</b>
Lead	119	119	100%	3.2	283	22	34	35.8	<b>Yes</b>
Manganese	116	116	100%	68.4	700	222	103	630	<b>Yes</b>
Mercury	118	76	64%	0.0083	1.1	0.06	0.11	0.18	<b>Yes</b>
Nickel	119	116	97%	3	64	12	6.9	22.7	<b>Yes</b>
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	<b>Yes</b>
Zinc	119	119	100%	16	1,600	122	221	121	<b>Yes</b>
<b>Organics (ug/kg)</b>									
2-Methylnaphthalene	82	15	18%	36	360	285	371	20.2	<b>Yes</b>
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	<b>Yes</b>
Anthracene	82	47	57%	39	3,000	376	556	57	<b>Yes</b>
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	<b>Yes</b>
Benzo(a)pyrene	82	58	71%	56	7,900	724	1,143	150	<b>Yes</b>
Benzo(g,h,i)perylene	82	51	62%	36	2,800	440	579	13	<b>Yes</b>
Benzo(k)fluoranthene	81	56	69%	35	3,700	547	756	240	<b>Yes</b>
Carbazole	2	1	50%	500	500	340	226	25	<b>Yes</b>
Chrysene	82	72	88%	36	7,700	747	1,228	166	<b>Yes</b>
Dibenz(a,h)anthracene	82	30	37%	38	1,000	301	385	33	<b>Yes</b>
Fluoranthene	82	74	90%	57	23,000	1,705	3,214	423	<b>Yes</b>

**Table A6.25  
Summary of Adjacent Surface Soil Data in the NW AEU**

<b>Analyte</b>	<b>Number of Results</b>	<b>Detected</b>	<b>Detection Frequency (%)</b>	<b>Minimum Detected Concentration</b>	<b>Maximum Detected Concentration (MDC)</b>	<b>Arithmetic Mean<sup>1</sup></b>	<b>Standard Deviation<sup>1</sup></b>	<b>ESL<sup>2</sup></b>	<b>MDC &gt; ESL</b>
Fluorene	82	37	45%	39	2,100	324	442	77	<b>Yes</b>
Indeno(1,2,3-cd)pyrene	82	52	63%	36	3,500	471	635	17	<b>Yes</b>
Naphthalene	96	28	29%	1	1,000	206	375	176	<b>Yes</b>
PCB-1254	73	23	32%	7	2,300	109	316	60	<b>Yes</b>
Phenanthrene	82	74	90%	39	20,000	1,412	2,781	204	<b>Yes</b>
Pyrene	82	74	90%	60	18,000	1,490	2,711	195	<b>Yes</b>

**Notes:**

Includes soil data for all years

<sup>1</sup> Non-detected concentrations included in calculations at 1/2 reported result

<sup>2</sup> Sediment ecological screening level (ESL)

N/A= Not applicable.

**Table A6.26**  
**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 <sup>1</sup> Concentration	Standard Deviation <sup>1</sup>	ESL <sup>2</sup>	MDC > ESL
<b>Inorganics (mg/kg)</b>									
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
<b>Organics (ug/kg)</b>									
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

<sup>1</sup> Non-detected concentrations included in calculations at 1/2 reported result

<sup>2</sup> Sediment ecological screening level (ESL)

N/A= Not applicable.

**Table A6.27**  
**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 <sup>1</sup> Concentration	Standard Deviation <sup>1</sup>	ESL <sup>2</sup>	MDC > ESL
<b>Inorganics (mg/kg)</b>									
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
<b>Organics (ug/kg)</b>									
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

<sup>1</sup> Non-detected concentrations included in calculations at 1/2 reported result

<sup>2</sup> Sediment ecological screening level (ESL)

N/A= Not applicable.

Table A6.28  
Total PAH Values by Sample for NW AEU Sediment

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
AND	CR53-000	05F0792-001	07/07/2005	9	ND	N/A	ND	120	150	180	100	100	150	ND	300	ND	90	ND	140	ND	1324
AND	CS53-000	05F0348-002	12/21/2004	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	210	ND	ND	ND	196
AND	CS53-001	05F0792-002	07/07/2005	9	ND	N/A	ND	92	110	120	77	72	110	ND	200	ND	62	ND	87	ND	924
AND	CS53-002	05F0792-004	07/07/2005	5	ND	N/A	ND	73	ND	130	ND	ND	82	ND	170	ND	ND	ND	88	ND	533
AND	CS53-002	05F0792-005	07/07/2005	10	ND	N/A	52	190	210	260	160	120	220	ND	510	ND	140	ND	280	ND	2137
AND	CS53-003	05F0792-006	07/07/2005	9	ND	N/A	ND	75	83	83	60	63	87	ND	190	ND	50	ND	110	ND	795
AND	SED60092	SD60000WC	10/29/1992	11	89	N/A	ND	270	310	420	210	200	350	ND	790	ND	200	ND	520	710	4065
AND	SED60192	SD60001WC	11/02/1992	9	ND	N/A	88	190	190	ND	ND	99	210	ND	590	ND	150	ND	480	430	2421
AND	SED60292	SD60002WC	10/29/1992	10	ND	N/A	68	220	240	300	150	180	270	ND	600	ND	ND	ND	390	550	2963
AND	SED60392	SD60003WC	10/29/1992	10	ND	N/A	ND	170	190	240	150	110	220	ND	510	ND	140	ND	300	420	2445
A-2	CV54-000	05F0600-001	07/19/2005	9	180	N/A	210	52	51	64	ND	ND	60	ND	89	ND	210	ND	190	ND	1100
A-2	CW53-000	05F0599-009	07/18/2005	4	ND	N/A	ND	ND	80	ND	ND	ND	81	ND	140	ND	ND	ND	99	ND	389
A-2	SED60792	SD60007WC	11/12/1992	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	71	57
A-2	SED60892	SD60008WC	11/12/1992	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	83	69
A-3	SED61092	SD60010WC	10/21/1992	6	ND	N/A	ND	ND	150	260	ND	ND	180	ND	400	ND	ND	ND	200	330	1511
A-3	SED61192	SD60011WC	10/21/1992	6	ND	N/A	ND	ND	240	370	ND	ND	250	ND	540	ND	ND	ND	260	460	2111
A-3	SED61292	SD60012WC	10/22/1992	6	ND	N/A	ND	ND	170	240	ND	ND	170	ND	390	ND	ND	ND	200	340	1501
A-3	SED61392	SD60013WC	10/21/1992	5	ND	N/A	ND	ND	ND	240	ND	ND	170	ND	360	ND	ND	ND	170	290	1220
Channel	10199	99A6847-001	04/20/1999	6	ND	N/A	20	55	ND	ND	ND	ND	74	ND	150	ND	ND	ND	120	150	560
Channel	10199	99A6848-001	04/20/1999	5	ND	N/A	ND	28	ND	ND	ND	ND	30	ND	75	ND	ND	ND	63	71	257
Channel	10299	99A6847-002	04/21/1999	5	ND	N/A	ND	61	ND	ND	ND	ND	82	ND	140	ND	ND	ND	92	130	495
Channel	10299	99A6848-002	04/21/1999	10	36	N/A	44	87	ND	61	ND	89	110	ND	240	30	ND	ND	230	260	1182
Channel	10399	99A6847-003	04/21/1999	11	48	N/A	56	130	110	90	ND	130	160	ND	350	33	ND	ND	310	340	1753
Channel	10399	99A6848-003	04/21/1999	10	ND	N/A	ND	40	49	47	35	53	49	ND	100	ND	29	ND	70	100	567
Channel	11199	99A6847-016	04/28/1999	14	210	N/A	370	1100	1200	1000	900	1200	1300	330	2600	170	890	ND	1900	2500	15669
Channel	11199	99A6848-032	04/20/1999	15	420	N/A	400	580	570	420	370	530	650	160	1700	330	390	320	2000	1500	10340
Channel	11199	99A6848-033	04/20/1999	12	25	N/A	30	66	68	52	47	66	76	ND	180	ND	43	ND	150	160	960
Channel	CG49-018	04F1603-002	05/24/2004	13	66	N/A	160	410	440	310	270	410	490	ND	880	ND	260	1.1	610	760	5065.1
Channel	CG49-021	04F1603-003	05/24/2004	14	240	N/A	240	360	360	290	240	320	410	ND	990	190	240	150	1100	1100	6229
Channel	CG49-021	04F1603-004	05/24/2004	14	230	N/A	250	370	410	290	270	400	440	ND	1100	180	260	130	1100	1100	6529
Channel	CH49-017	04F1373-014	05/25/2004	6	ND	N/A	85	290	ND	ND	ND	ND	410	ND	720	ND	ND	ND	460	660	2616
Channel	CH49-017	04F1373-015	05/25/2004	8	ND	N/A	170	880	760	ND	ND	ND	910	ND	1900	ND	ND	2.3	690	1900	7205.3
Channel	CH49-018	04F1373-016	05/25/2004	6	ND	N/A	79	210	ND	ND	ND	ND	210	ND	450	ND	ND	ND	350	500	1790
Channel	CH49-018	04F1373-017	05/25/2004	6	ND	N/A	61	130	ND	ND	ND	ND	160	ND	330	ND	ND	ND	260	340	1272
Channel	CH49-019	04F1373-005	05/25/2004	4	ND	N/A	ND	120	ND	ND	ND	ND	160	ND	260	ND	ND	ND	140	ND	669
Channel	CH49-019	04F1373-006	05/25/2004	7	86	N/A	120	240	ND	ND	ND	ND	270	ND	580	ND	ND	ND	520	590	2398
Channel	CH49-025	04F1594-004	06/02/2004	4	ND	N/A	ND	69	ND	ND	86	ND	110	ND	ND	ND	ND	ND	86	ND	340
Channel	CH49-025	04F1594-005	06/02/2004	6	ND	N/A	53	100	ND	ND	ND	ND	130	ND	220	ND	ND	ND	190	240	924
Channel	SED009	SD00241WC	08/27/1991	9	ND	N/A	79	160	150	160	ND	120	160	ND	240	ND	ND	ND	320	480	1863
Channel	SED03695	SDG0284JE	03/02/1995	7	ND	N/A	130	300	ND	650	ND	ND	730	ND	470	ND	ND	ND	130	460	2862
Channel	SED05195	SDG0321JE	03/16/1995	14	320	N/A	860	850	920	1200	630	ND	1300	200	2400	390	510	120	2200	2000	13899
Channel	SED05295	SDG0322JE	03/16/1995	8	ND	N/A	ND	34	31	25	ND	35	51	ND	96	ND	ND	ND	42	69	376
Channel	SED05395	SDG0244JE	02/21/1995	14	45	N/A	76	160	160	150	120	160	190	41	420	50	100	ND	300	350	2321
Channel	SED05795	SDG0213JE	02/15/1995	12	24	N/A	40	120	130	200	130	84	170	ND	370	ND	98	ND	200	200	1763
Channel	SED06095	SDG0238JE	02/24/1995	13	47	N/A	ND	45	62	56	47	79	74	ND	150	21	40	310	67	92	1088
Channel	SED06295	SDG0274JE	03/01/1995	11	ND	N/A	58	230	250	180	240	320	300	ND	620	ND	190	ND	220	400	3004
Channel	SED06695	SDG0253JE	02/22/1995	12	ND	N/A	81	270	290	240	230	320	310	96	670	ND	210	ND	330	490	3534
Channel	SED06895	SDG0276JE	03/01/1995	13	59	N/A	140	250	260	160	210	310	300	ND	740	59	170	ND	450	460	3566
Channel	SED06995	SDG0291JE	03/03/1995	10	ND	N/A	ND	26	33	26	37	36	37	ND	56	ND	23	ND	26	48	343
Channel	SED07095	SDG0268JE	03/15/1995	14	240	N/A	420	530	610	790	320	ND	800	130	1300	240	300	95	1500	1400	8674
Channel	SED07495	SDG0258JE	02/22/1995	10	ND	N/A	ND	100	120	110	98	120	130	ND	290	ND	79	ND	200	240	1482
Channel	SED07595	SDG0293JE	03/03/1995	12	26	N/A	33	88	91	82	110	85	110	ND	210	ND	88	ND	170	190	1280
Channel	SED07695	SDG0294JE	03/03/1995	10	64	N/A	70	190	ND	210	ND	220	360	ND	680	57	ND	ND	390	530	2766

**Table A6.28**  
**Total PAH Values by Sample for NW AEU Sediment**

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
Channel	SED07995	SDG0277JE	03/01/1995	11	ND	N/A	48	120	140	130	96	110	160	ND	330	ND	90	ND	170	210	1600
Channel	SED09195	SDG0319JE	03/15/1995	9	ND	N/A	24	57	96	70	ND	62	110	ND	170	ND	ND	ND	110	160	853
Channel	SED09295	SDG0278JE	03/02/1995	9	ND	N/A	30	71	71	130	ND	ND	79	ND	170	ND	61	ND	120	150	876
Channel	SED09395	SDG0279JE	03/02/1995	12	50	N/A	93	170	170	280	170	ND	190	ND	460	53	130	ND	450	380	2593
Channel	SED09495	SDG0280JE	03/02/1995	6	ND	N/A	ND	ND	23	36	ND	ND	22	ND	44	ND	ND	ND	40	37	193
Channel	SED09595	SDG0281JE	03/02/1995	12	34	N/A	50	160	180	310	170	ND	200	ND	360	24	140	ND	260	350	2235
Channel	SED117	SD00262WC	08/13/1991	14	250	N/A	350	690	570	510	210	660	650	ND	1500	220	230	110	1300	1700	8949
Channel	SED117	SD00287WC	12/04/1991	13	110	N/A	170	410	360	350	180	340	400	ND	880	100	170	ND	730	960	5158
Channel	SED117	SD00311WC	02/27/1992	14	620	N/A	970	1400	1300	1500	480	1100	1500	ND	3100	650	490	290	3300	3900	20599
Channel	SED118	SD00263WC	08/13/1991	6	ND	N/A	ND	49	ND	61	ND	ND	51	ND	110	ND	ND	ND	95	120	477
Channel	SED118	SD00286WC	12/04/1991	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	68	ND	ND	ND	ND	68	123
Channel	SED118	SD00310WC	02/27/1992	8	ND	N/A	ND	78	76	82	ND	96	88	ND	170	ND	ND	ND	120	190	893
Channel	SED120	SD00264WC	08/20/1991	10	56	N/A	68	190	210	230	ND	250	210	ND	440	ND	ND	ND	360	510	2519
Channel	SED60492	SD60004WC	11/02/1992	4	ND	N/A	ND	ND	ND	ND	ND	ND	73	ND	240	ND	ND	ND	170	170	642
Channel	SED60592	SD60005WC	11/12/1992	6	ND	N/A	ND	58	75	ND	ND	ND	71	ND	160	ND	ND	ND	120	130	605
Channel	SED61492	SD60014WC	10/22/1992	3	ND	N/A	ND	ND	ND	ND	ND	ND	77	ND	170	ND	ND	ND	ND	140	375
Channel	SED65092	SD60050WC	02/11/1993	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	93	ND	ND	ND	ND	64	144
Channel	SED65192	SD60051WC	02/11/1993	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	130	ND	ND	ND	81	92	291
Channel	SED65392	SD60053WC	02/11/1993	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	62	ND	ND	ND	ND	ND	48
Channel	SED65492	SD60054WC	02/11/1993	6	ND	N/A	ND	51	ND	110	ND	ND	74	ND	190	ND	ND	ND	94	120	630
Channel	SED65592	SD60055WC	02/11/1993	10	ND	N/A	ND	190	260	400	110	170	230	ND	560	ND	110	ND	290	370	2685
Channel	SED65792	SD60057WC	02/11/1993	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60	46
Channel	SED68492	SD60084WC	05/06/1993	6	ND	N/A	ND	ND	110	140	ND	ND	100	ND	180	ND	ND	ND	110	160	791
Channel	SED68592	SD60085WC	05/06/1993	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	45	ND	ND	ND	ND	ND	31
Channel	SED68692	SD60086WC	05/06/1993	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	87	ND	ND	ND	ND	ND	73
Channel	SED69492	SD60094WC	05/10/1993	6	ND	N/A	ND	78	79	ND	ND	ND	91	ND	160	ND	ND	ND	110	160	669
Channel	SED69692	SD60096WC	05/10/1993	10	ND	N/A	65	170	160	200	ND	74	180	ND	380	ND	66	ND	260	350	1900

**Table A6.29  
Total PAH Values for NW AEU Sediment**

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT	
A-1	CR53-000	5F0792-00	07/07/2005	15	205	N/A	205	120	150	180	100	100	150	415	300	415	90	415	140	415	3,400	
A-1	CS53-000	5F0348-00	12/21/2004	15	260	N/A	260	500	500	500	500	500	500	500	500	500	210	3,90	500	500	6,234	
A-1	CS53-001	5F0792-00	07/07/2005	15	255	N/A	255	92	110	120	77	72	110	500	200	500	62	500	87	500	3,440	
A-1	CS53-002	5F0792-00	07/07/2005	15	245	N/A	245	73	485	130	485	485	82	485	170	485	485	485	88	485	4,913	
A-1	CS53-002	5F0792-00	07/07/2005	15	250	N/A	52	190	210	260	160	120	220	500	510	500	140	500	280	500	4,392	
A-1	CS53-003	5F0792-00	07/07/2005	15	235	N/A	235	75	83	83	60	63	87	470	190	470	50	470	110	470	3,151	
A-1	CS53-003	5F0792-00	07/07/2005	15	215	N/A	215	430	430	430	430	430	430	430	430	430	430	430	430	430	6,020	
A-1	SED60092	SD60000WC	10/29/1992	15	89	N/A	310	270	310	420	210	200	350	310	790	310	200	310	520	710	5,309	
A-1	SED60192	SD60001WC	11/02/1992	15	305	N/A	88	190	190	305	305	99	210	305	590	305	150	305	480	430	4,257	
A-1	SED60292	SD60002WC	10/29/1992	15	310	N/A	68	220	240	300	150	180	270	310	600	310	310	310	390	550	4,518	
A-1	SED60392	SD60003WC	10/29/1992	15	300	N/A	300	170	190	240	150	110	220	300	510	300	140	300	300	420	3,950	
A-2	CV54-000	5F0600-00	07/19/2005	15	180	N/A	210	52	51	64	350	350	60	350	89	350	210	350	190	350	3,206	
A-2	CW53-000	5F0599-00	07/18/2005	15	415	N/A	415	850	850	850	850	850	850	850	850	850	850	850	850	850	11,880	
A-2	CW53-000	5F0599-00	07/18/2005	15	400	N/A	400	800	800	800	800	800	81	800	140	800	800	800	99	800	8,400	
A-2	CW54-000	5F0275-00	12/22/2004	15	700	N/A	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	1,450	18,811	
A-2	CW54-000	5F0275-00	12/22/2004	15	495	N/A	495	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	7.50	1,000	1,000	12,998
A-2	CW54-000	5F0275-00	12/22/2004	15	750	N/A	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	1,500	19,512	
A-2	CW54-002	5F0599-00	07/18/2005	15	900	N/A	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	1,750	24,550	
A-2	SED60692	SD60006WC	11/12/1992	15	240	N/A	240	240	240	240	240	240	240	240	240	240	240	240	240	240	3,600	
A-2	SED60792	SD60007WC	11/12/1992	15	320	N/A	320	320	320	320	320	320	320	320	320	320	320	320	320	71	4,551	
A-2	SED60892	SD60008WC	11/12/1992	15	385	N/A	385	385	385	385	385	385	385	385	385	385	385	385	385	83	5,473	
A-3	SED61092	SD60010WC	10/21/1992	15	290	N/A	290	150	260	290	290	180	290	400	290	290	290	290	200	330	4,130	
A-3	SED61192	SD60011WC	10/21/1992	15	295	N/A	295	295	240	370	295	295	250	295	540	295	295	295	260	460	4,775	
A-3	SED61292	SD60012WC	10/22/1992	15	275	N/A	275	275	170	240	275	275	170	275	390	275	275	275	200	340	3,985	
A-3	SED61392	SD60013WC	10/21/1992	15	295	N/A	295	295	295	240	295	295	170	295	360	295	295	295	170	290	4,180	
A-4	SED61592	SD60015WC	10/14/1992	15	240	N/A	240	240	240	240	240	240	240	240	240	240	240	240	240	240	3,600	
A-4	SED61692	SD60016WC	10/15/1992	15	320	N/A	320	320	320	320	320	320	320	320	320	320	320	320	320	320	4,800	
A-4	SED61792	SD60017WC	10/15/1992	15	235	N/A	235	235	235	235	235	235	235	235	235	235	235	235	235	235	3,525	
A-4	SED61892	SD60018WC	10/19/1992	15	495	N/A	495	495	495	495	495	495	495	495	495	495	495	495	495	495	7,425	
Channel	10199	9A6847-00	04/20/1999	15	190	N/A	20	55	190	190	190	190	74	190	150	190	190	190	120	150	2,279	
Channel	10199	9A6848-00	04/20/1999	15	210	N/A	210	28	210	210	210	210	30	210	75	210	210	210	63	71	2,367	
Channel	10299	9A6847-00	04/21/1999	15	205	N/A	205	61	205	205	205	205	82	205	140	205	205	205	92	130	2,555	
Channel	10299	9A6848-00	04/21/1999	15	36	N/A	44	87	185	61	185	89	110	185	240	30	185	185	230	260	2,112	
Channel	10399	9A6847-00	04/21/1999	15	48	N/A	56	130	110	90	230	130	160	230	350	33	230	230	310	340	2,677	
Channel	10399	9A6848-00	04/21/1999	15	205	N/A	205	40	49	47	35	53	49	205	100	205	29	205	70	100	1,597	
Channel	11199	9A6847-01	04/28/1999	15	210	N/A	370	1,100	1,200	1,000	900	1,200	330	330	2,600	170	890	1,350	1,900	2,500	17,020	
Channel	11199	9A6848-03	04/20/1999	15	420	N/A	400	580	570	420	370	530	650	160	1,700	330	390	320	2,000	1,500	10,340	
Channel	11199	9A6848-03	04/20/1999	15	25	N/A	30	66	68	52	47	66	76	220	180	220	43	220	150	160	1,623	
Channel	CG49-018	4F1603-00	05/24/2004	15	175	N/A	175	350	350	350	350	350	350	350	350	350	350	350	350	350	4,900	
Channel	CG49-018	4F1603-00	05/24/2004	15	66	N/A	160	410	440	310	270	410	490	365	880	365	260	1.10	610	760	5,797	
Channel	CG49-021	4F1603-00	05/24/2004	15	240	N/A	240	360	360	290	240	320	410	460	990	190	240	150	1,100	1,100	6,690	
Channel	CG49-021	4F1603-00	05/24/2004	15	230	N/A	250	370	410	290	270	400	440	435	1,100	180	260	130	1,100	1,100	6,965	
Channel	CH49-017	4F1373-01	05/25/2004	15	395	N/A	85	290	800	800	800	800	410	800	720	800	800	800	460	660	9,420	
Channel	CH49-017	4F1373-01	05/25/2004	15	300	N/A	170	880	760	600	600	600	910	600	1,900	600	600	2.30	690	1,900	11,112	
Channel	CH49-018	4F1373-01	05/25/2004	15	215	N/A	79	210	430	430	430	430	210	430	450	430	430	430	350	500	5,454	
Channel	CH49-018	4F1373-01	05/25/2004	15	205	N/A	61	130	410	410	410	410	160	410	330	410	410	0.820	260	340	4,357	
Channel	CH49-019	4F1373-00	05/25/2004	15	220	N/A	220	120	435	435	435	435	160	435	260	435	435	435	140	435	5,035	
Channel	CH49-019	4F1373-00	05/25/2004	15	86	N/A	120	240	445	445	445	445	270	445	580	445	445	0.802	520	590	5,522	
Channel	CH49-025	4F1594-00	06/02/2004	15	190	N/A	190	69	380	380	86	380	110	380	380	380	380	380	86	380	4,151	
Channel	CH49-025	4F1594-00	06/02/2004	15	190	N/A	53	100	380	380	380	380	130	380	220	380	380	0.806	190	240	3,784	
Channel	CL48-000	2E0219-00	08/23/2002	1		N/A													1.11		1.11	
Channel	SED008	SD00240WC	08/27/1991	15	355	N/A	355	355	355	355	355	355	355	355	355	355	355	355	355	355	5,325	
Channel	SED008	SD00284WC	12/04/1991	15	405	N/A	405	405	405	405	405	405	405	405	405	405	405	405	405	405	6,075	
Channel	SED008	SD00319WC	03/04/1992	15	240	N/A	240	240	240	240	240	240	240	240	240	240	240	240	240	240	3,600	

**Table A6.29  
Total PAH Values for NW AEU Sediment**

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT	
Channel	SED009	SD00241WC	08/27/1991	15	220	N/A	79	160	150	160	220	120	160	220	240	220	220	220	320	480	3,189	
Channel	SED009	SD00285WC	12/03/1991	15	190	N/A	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	2,850
Channel	SED009	SD00309WC	02/26/1992	15	230	N/A	230	230	230	230	230	230	230	230	230	230	230	230	230	230	230	3,450
Channel	SED03695	SDG0284JE	03/02/1995	15	235	N/A	130	300	235	650	235	235	730	235	470	235	235	235	130	460	4,750	
Channel	SED05195	SDG0321JE	03/16/1995	15	320	N/A	860	850	920	1,200	630	175	1,300	200	2,400	390	510	120	2,200	2,000	14,075	
Channel	SED05295	SDG0322JE	03/16/1995	15	195	N/A	195	34	31	25	195	35	51	195	96	195	195	195	42	69	1,748	
Channel	SED05395	SDG0244JE	02/21/1995	15	45	N/A	76	160	160	150	120	160	190	41	420	50	100	235	300	350	2,557	
Channel	SED05795	SDG0213JE	02/15/1995	15	24	N/A	40	120	130	200	130	84	170	235	370	235	98	235	200	200	2,471	
Channel	SED06095	SDG0238JE	02/24/1995	15	47	N/A	185	45	62	56	47	79	74	185	150	21	40	310	67	92	1,460	
Channel	SED06195	SDG0241JE	02/24/1995	15	190	N/A	190	190	190	190	190	190	190	190	190	190	190	190	190	190	2,850	
Channel	SED06295	SDG0274JE	03/01/1995	15	345	N/A	58	230	250	180	240	320	300	345	620	345	190	345	220	400	4,388	
Channel	SED06695	SDG0253JE	02/22/1995	15	470	N/A	81	270	290	240	230	320	310	96	670	470	210	470	330	490	4,947	
Channel	SED06895	SDG0276JE	03/01/1995	15	59	N/A	140	250	260	160	210	310	300	290	740	59	170	290	450	460	4,148	
Channel	SED06995	SDG0291JE	03/03/1995	15	180	N/A	180	26	33	26	37	36	37	180	56	180	23	180	26	48	1,248	
Channel	SED07095	SDG0268JE	03/15/1995	15	240	N/A	420	530	610	790	320	235	800	130	1,300	240	300	95	1,500	1,400	8,910	
Channel	SED07495	SDG0258JE	02/22/1995	15	500	N/A	500	100	120	110	98	120	130	500	290	500	79	500	200	240	3,987	
Channel	SED07595	SDG0293JE	03/03/1995	15	26	N/A	33	88	91	82	110	85	110	205	210	205	88	205	170	190	1,898	
Channel	SED07695	SDG0294JE	03/03/1995	15	64	N/A	70	190	240	210	240	220	360	240	680	57	240	240	390	530	3,971	
Channel	SED07995	SDG0277JE	03/01/1995	15	275	N/A	48	120	140	130	96	110	160	275	330	275	90	275	170	210	2,704	
Channel	SED09195	SDG0319JE	03/15/1995	15	180	N/A	24	57	96	70	180	62	110	180	170	180	180	180	110	160	1,939	
Channel	SED09295	SDG0278JE	03/02/1995	15	250	N/A	30	71	71	130	250	250	79	250	170	250	61	250	120	150	2,382	
Channel	SED09395	SDG0279JE	03/02/1995	15	50	N/A	93	170	170	280	170	230	190	230	460	53	130	230	450	380	3,286	
Channel	SED09495	SDG0280JE	03/02/1995	15	205	N/A	205	205	23	36	205	205	22	205	44	205	205	205	40	37	2,047	
Channel	SED09595	SDG0281JE	03/02/1995	15	34	N/A	50	160	180	310	170	220	200	220	360	24	140	220	260	350	2,898	
Channel	SED117	SD00262WC	08/13/1991	15	250	N/A	350	690	570	510	210	660	650	245	1,500	220	230	110	1,300	1,700	9,195	
Channel	SED117	SD00287WC	12/04/1991	15	110	N/A	170	410	360	350	180	340	400	265	880	100	170	265	730	960	5,690	
Channel	SED117	SD00311WC	02/27/1992	15	620	N/A	970	1,400	1,300	1,500	480	1,100	1,500	245	3,100	650	490	290	3,300	3,900	20,845	
Channel	SED118	SD00263WC	08/13/1991	15	240	N/A	240	49	240	61	240	240	51	240	110	240	240	240	95	120	2,646	
Channel	SED118	SD00286WC	12/04/1991	15	245	N/A	245	245	245	245	245	245	245	245	68	245	245	245	245	68	3,321	
Channel	SED118	SD00310WC	02/27/1992	15	325	N/A	325	78	76	82	325	96	88	325	170	325	325	325	120	190	3,175	
Channel	SED120	SD00264WC	08/20/1991	15	56	N/A	68	190	210	230	185	250	210	185	440	185	185	185	360	510	3,449	
Channel	SED60492	SD60004WC	11/02/1992	15	295	N/A	295	295	295	295	295	295	73	295	240	295	295	295	170	170	3,898	
Channel	SED60592	SD60005WC	11/12/1992	15	280	N/A	280	58	75	280	280	280	71	280	160	280	280	280	120	130	3,134	
Channel	SED60992	SD60009WC	11/12/1992	15	235	N/A	235	235	235	235	235	235	235	235	235	235	235	235	235	235	3,525	
Channel	SED61492	SD60014WC	10/22/1992	15	250	N/A	250	250	250	250	250	250	77	250	170	250	250	250	250	140	3,387	
Channel	SED61992	SD60019WC	10/15/1992	15	230	N/A	230	230	230	230	230	230	230	230	230	230	230	230	230	230	3,450	
Channel	SED65092	SD60050WC	02/11/1993	15	275	N/A	275	275	275	275	275	275	275	275	93	275	275	275	275	64	3,732	
Channel	SED65192	SD60051WC	02/11/1993	15	280	N/A	280	280	280	280	280	280	280	280	130	280	280	280	81	92	3,663	
Channel	SED65292	SD60052WC	02/11/1993	15	285	N/A	285	285	285	285	285	285	285	285	285	285	285	285	285	285	4,275	
Channel	SED65392	SD60053WC	02/11/1993	15	260	N/A	260	260	260	260	260	260	260	260	62	260	260	260	260	260	3,702	
Channel	SED65492	SD60054WC	02/11/1993	15	220	N/A	220	51	220	110	220	220	74	220	190	220	220	220	94	120	2,619	
Channel	SED65592	SD60055WC	02/11/1993	15	245	N/A	245	190	260	400	110	170	230	245	560	245	110	245	290	370	3,915	
Channel	SED65692	SD60056WC	02/11/1993	15	225	N/A	225	225	225	225	225	225	225	225	225	225	225	225	225	225	3,375	
Channel	SED65792	SD60057WC	02/11/1993	15	230	N/A	230	230	230	230	230	230	230	230	230	230	230	230	230	60	3,280	
Channel	SED68192	SD60081WC	02/19/1993	15	230	N/A	230	230	230	230	230	230	230	230	230	230	230	230	230	230	3,450	
Channel	SED68492	SD60084WC	05/06/1993	15	230	N/A	230	230	110	140	230	230	100	230	180	230	230	230	110	160	2,870	
Channel	SED68592	SD60085WC	05/06/1993	15	195	N/A	195	195	195	195	195	195	195	195	45	195	195	195	195	195	2,775	
Channel	SED68692	SD60086WC	05/06/1993	15	240	N/A	240	240	240	240	240	240	240	240	87	240	240	240	240	240	3,447	
Channel	SED68792	SD60087WC	05/06/1993	15	205	N/A	205	205	205	205	205	205	205	205	205	205	205	205	205	205	3,075	
Channel	SED69492	SD60094WC	05/10/1993	15	245	N/A	245	78	79	245	245	245	91	245	160	245	245	245	110	160	2,883	
Channel	SED69692	SD60096WC	05/10/1993	15	275	N/A	65	170	160	200	275	74	180	275	380	275	66	275	260	350	3,280	
Channel	SS30599	PA4136-00	12/14/1998	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.50	N/A	N/A	3.50	

Table A6.30  
Total PAH Values by Sample for SW AEU Sediment

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
B-4	DB47-001	05F0597-002	07/15/2005	10	ND	N/A	60	330	430	810	310	ND	470	ND	880	ND	250	N/A	430	870	4,836
B-4	DB47-001	05F0597-003	07/15/2005	8	ND	N/A	420	330	450	630	ND	ND	480	ND	1,000	ND	ND	N/A	420	920	4,644
B-4	DB47-002	05F0599-001	07/18/2005	12	ND	N/A	73	240	290	270	200	270	330	65	580	ND	150	N/A	370	580	3,416
B-4	DB47-002	05F0599-002	07/18/2005	12	ND	N/A	75	360	490	560	320	540	610	110	1,200	ND	280	N/A	550	1,000	6,093
B-4	DB47-002	05F0599-003	07/18/2005	10	ND	N/A	ND	98	150	180	95	200	210	ND	450	ND	84	N/A	160	310	1,933
B-4	DB47-003	05F0618-003	07/14/2005	8	ND	N/A	ND	100	100	180	90	ND	110	ND	230	ND	74	N/A	110	ND	988
B-4	DB47-004	05F0618-005	07/14/2005	4	ND	N/A	ND	80	ND	ND	ND	ND	74	ND	170	ND	ND	N/A	110	ND	424
B-4	DB47-004	05F0618-006	07/14/2005	9	ND	N/A	ND	200	270	530	230	ND	340	ND	690	ND	190	N/A	290	450	3,185
B-4	DB47-004	05F0618-007	07/14/2005	9	ND	N/A	ND	220	300	720	290	ND	460	ND	1,100	ND	260	N/A	370	530	4,245
B-4	DB47-005	05F0597-004	07/15/2005	14	110	N/A	140	300	320	230	270	310	350	92	750	94	200	N/A	630	700	4,496
B-4	SED63592	SD60035WC	10/22/1992	10	ND	N/A	79	350	420	660	200	280	490	ND	1,100	ND	ND	N/A	580	890	5,045
B-4	SED63592	SD60111WC	10/22/1992	10	ND	N/A	100	370	460	740	ND	350	530	ND	1,200	ND	200	N/A	760	1,000	5,706
B-4	SED63692	SD60036WC	10/26/1992	8	ND	N/A	ND	240	290	440	ND	200	330	ND	750	ND	ND	N/A	420	580	3,244
B-4	SED63792	SD60037WC	10/26/1992	9	ND	N/A	85	340	420	1,000	ND	290	500	ND	1,100	ND	ND	N/A	500	860	5,090
B-4	SED63792	SD60114WC	10/26/1992	11	ND	N/A	84	430	570	1,500	270	350	650	ND	1,400	ND	300	N/A	690	1,200	7,441
B-4	SED63892	SD60038WC	10/22/1992	7	ND	N/A	ND	ND	370	660	ND	220	470	ND	950	ND	ND	N/A	450	820	3,933
B-4	SED63892	SD60110WC	10/22/1992	7	ND	N/A	ND	ND	400	770	ND	360	520	ND	1,100	ND	ND	N/A	590	1,000	4,733
B-4	SED63992	SD60039WC	10/26/1992	9	ND	N/A	99	350	440	710	ND	290	490	ND	1,100	ND	ND	N/A	580	970	5,024
B-5	SED64292	SD60042WC	10/20/1992	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	84	ND	ND	N/A	ND	ND	71
B-5	SED64392	SD60043WC	10/20/1992	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	190	ND	ND	N/A	ND	160	338
Channel	CJ41-004	04F2195-001	09/16/2004	3	ND	N/A	ND	ND	ND	56	ND	ND	68	ND	47	ND	ND	N/A	ND	ND	160
Channel	CJ42-006	04F2195-002	09/16/2004	12	ND	N/A	67	300	370	350	250	340	410	71	1,000	ND	220	N/A	520	680	4,576
Channel	CJ42-007	04F2195-003	09/16/2004	9	ND	N/A	ND	63	79	75	55	66	94	ND	190	ND	48	N/A	120	ND	785
Channel	CJ42-008	04F2195-004	09/16/2004	10	ND	N/A	57	120	120	140	ND	110	190	ND	380	ND	72	N/A	250	260	1,695
Channel	CJ43-009	04F2195-005	09/16/2004	12	ND	N/A	50	150	190	180	130	180	210	44	510	ND	100	N/A	320	350	2,412
Channel	CJ43-010	04F2195-006	09/16/2004	12	ND	N/A	78	240	260	250	140	230	310	55	850	ND	130	N/A	510	530	3,581
Channel	CJ43-011	04F2128-001	09/28/2004	10	ND	N/A	ND	89	110	120	120	110	160	ND	260	ND	87	N/A	120	220	1,392
Channel	CP46-000	03F0049-013	11/12/2002	8	ND	N/A	ND	89	110	110	ND	84	120	ND	200	ND	ND	N/A	110	200	1,017
Channel	DC45-000	02E0055-003	04/16/2002	4	ND	N/A	ND	62	ND	ND	ND	ND	86	ND	190	ND	ND	N/A	ND	170	498
Channel	SED001900	00D1513-001	09/26/2000	13	35	N/A	50	150	170	150	140	130	170	ND	340	24	110	N/A	220	300	1,988
Channel	SED002900	00D1513-002	09/26/2000	2	ND	N/A	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	ND	N/A	ND	20	31
Channel	SED003900	00D1513-003	09/26/2000	14	34	N/A	160	530	450	430	330	280	500	160	810	43	280	N/A	620	960	5,587
Channel	SED004900	00D1513-004	09/26/2000	10	ND	N/A	ND	47	56	52	43	31	52	ND	77	ND	35	N/A	57	91	537
Channel	SED005900	00D1513-005	09/26/2000	10	ND	N/A	ND	42	41	46	44	32	59	ND	58	ND	30	N/A	35	70	453
Channel	SED00795	SDG0203JE	02/14/1995	14	69	N/A	320	1,100	1,000	1,400	730	660	1,200	250	2,300	95	650	N/A	1,400	1,400	12,574
Channel	SED01095	SDG0206JE	02/14/1995	14	26	N/A	45	190	210	210	170	210	230	51	590	21	160	N/A	240	340	2,693
Channel	SED011	SD00242WC	09/03/1991	10	56	N/A	ND	92	95	110	ND	67	94	ND	220	ND	74	N/A	240	240	1,284
Channel	SED011	SD00306WC	03/05/1992	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	61	ND	ND	N/A	53	95	198
Channel	SED011	SD00331WC	04/28/1992	8	ND	N/A	ND	95	ND	66	ND	97	120	ND	240	ND	61	N/A	190	200	1,063
Channel	SED01195	SDG0207JE	02/14/1995	14	51	N/A	250	820	810	1,000	670	590	850	230	1,800	74	550	N/A	990	1,000	9,685
Channel	SED01295	SDG0208JE	02/14/1995	14	180	N/A	430	1,400	1,300	1,500	1,100	920	1,400	360	2,700	180	910	N/A	1,800	1,700	15,880
Channel	SED02495	SDG0301JE	03/10/1995	4	ND	N/A	ND	ND	ND	37	ND	ND	34	ND	33	ND	ND	N/A	ND	27	121
Channel	SED02795	SDG0303JE	03/10/1995	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	34	ND	ND	N/A	38	31	92
Channel	SED03295	SDG0215JE	02/15/1995	10	ND	N/A	ND	65	60	79	55	50	95	ND	190	ND	39	N/A	96	110	835
Channel	SED03495	SDG0311JE	03/14/1995	5	ND	N/A	ND	25	ND	ND	ND	69	ND	100	ND	ND	N/A	45	79	309	
Channel	SED04395	SDG0209JE	02/27/1995	12	ND	N/A	25	110	120	110	99	130	150	21	320	ND	93	N/A	160	200	1,536
Channel	SED04495	SDG0267JE	02/27/1995	12	ND	N/A	59	350	420	450	380	460	490	150	1,100	ND	330	N/A	450	630	5,267
Channel	SED04795	SDG0256JE	03/15/1995	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	33	ND	ND	N/A	ND	32	53
Channel	SED04895	SDG0287JE	03/03/1995	11	ND	N/A	29	96	130	120	140	91	130	ND	220	ND	110	N/A	150	200	1,413
Channel	SED05095	SDG0242JE	03/16/1995	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND	99	ND	ND	N/A	60	95	243
Channel	SED07295	SDG0318JE	03/15/1995	11	ND	N/A	19	120	170	120	170	180	180	ND	330	ND	120	N/A	140	250	1,796
Channel	SED65992	SD60059WC	02/17/1993	8	93	N/A	ND	180	ND	280	ND	100	210	ND	560	ND	ND	N/A	510	400	2,327
Channel	SED66592	SD60065WC	02/18/1993	13	110	N/A	130	280	380	500	150	180	350	ND	900	80	190	N/A	720	610	4,579
Channel	SED69892	SD60098WC	05/10/1993	11	ND	N/A	110	360	410	550	120	190	430	ND	870	ND	150	N/A	600	760	4,547
Channel	SED70092	SD60100WC	05/10/1993	13	130	N/A	150	430	480	650	160	230	510	ND	1,000	89	180	N/A	750	960	5,718
Channel	SED80193	SDG0003JE	12/12/1994	10	ND	N/A	ND	94	100	140	79	50	110	ND	200	ND	83	N/A	85	190	1,127
Channel	SS9040400	00A1133-004	02/28/2000	9	ND	N/A	ND	78	100	86	ND	100	130	ND	180	ND	73	N/A	140	200	1,082
Channel	SW022	SW70213JE	06/21/1994	14	96	N/A	120	590	580	870	260	250	600	160	1,000	69	250	N/A	740	1,300	6,885

Table A6.31  
Total PAH Values for SW AEU Sediment

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
A-5	SED64592	SD60045WC	11/19/1992	14	265	N/A	265	265	265	265	265	265	265	265	265	265	265	N/A	265	265	3,710
A-5	SED64692	SD60046WC	11/19/1992	14	255	N/A	255	255	255	255	255	255	255	255	255	255	255	N/A	255	255	3,570
A-5	SED64792	SD60047WC	11/19/1992	14	300	N/A	300	300	300	300	300	300	300	300	300	300	300	N/A	300	300	4,200
A-5	SED64892	SD60048WC	11/19/1992	14	265	N/A	265	265	265	265	265	265	265	265	265	265	265	N/A	265	265	3,710
A-5	SED64992	SD60049WC	11/19/1992	14	255	N/A	255	255	255	255	255	255	255	255	255	255	255	N/A	255	255	3,570
B-4	DB47-001	05F0618-001	07/14/2005	14	600	N/A	600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	N/A	1,200	1,200	15,600
B-4	DB47-001	05F0597-001	07/15/2005	14	900	N/A	900	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	N/A	1,800	1,800	23,400
B-4	DB47-001	05F0597-002	07/15/2005	14	225	N/A	60	330	430	810	310	450	470	450	880	450	250	N/A	430	870	6,415
B-4	DB47-001	05F0597-003	07/15/2005	14	700	N/A	420	330	450	630	1,400	1,400	480	1,400	1,000	1,400	1,400	N/A	420	920	12,350
B-4	DB47-002	05F0599-001	07/18/2005	14	310	N/A	73	240	290	270	200	270	330	65	580	600	150	N/A	370	580	4,328
B-4	DB47-002	05F0599-002	07/18/2005	14	270	N/A	75	360	490	560	320	540	610	110	1,200	550	280	N/A	550	1,000	6,915
B-4	DB47-002	05F0599-003	07/18/2005	14	260	N/A	260	98	150	180	95	200	210	500	450	500	84	N/A	160	310	3,457
B-4	DB47-002	05F0599-004	07/18/2005	14	205	N/A	205	405	405	405	405	405	405	405	405	405	405	N/A	405	405	5,270
B-4	DB47-002	05F0599-005	07/18/2005	14	200	N/A	200	400	400	400	400	400	400	400	400	400	400	N/A	400	400	5,200
B-4	DB47-003	05F0618-003	07/14/2005	14	275	N/A	275	100	100	180	90	550	110	550	230	550	74	N/A	110	550	3,744
B-4	DB47-004	05F0618-006	07/14/2005	14	350	N/A	350	80	700	700	700	700	74	700	170	700	700	N/A	110	700	6,734
B-4	DB47-004	05F0618-005	07/14/2005	14	270	N/A	270	200	270	530	230	550	340	550	690	550	190	N/A	290	450	5,380
B-4	DB47-004	05F0618-007	07/14/2005	14	440	N/A	440	220	300	720	290	900	460	900	1,100	900	260	N/A	370	530	7,830
B-4	DB47-005	05F0597-004	07/15/2005	14	110	N/A	140	300	320	230	270	310	350	92	750	94	200	N/A	630	700	4,496
B-4	SED63592	SD60035WC	10/22/1992	14	235	N/A	79	350	420	660	200	280	490	235	1,100	235	235	N/A	580	890	5,989
B-4	SED63592	SD60111WC	10/22/1992	14	245	N/A	100	370	460	740	245	350	530	245	1,200	245	200	N/A	760	1,000	6,690
B-4	SED63692	SD60036WC	10/26/1992	14	235	N/A	235	240	290	440	235	200	330	235	750	235	235	N/A	420	580	4,660
B-4	SED63792	SD60037WC	10/26/1992	14	330	N/A	85	340	420	1,000	330	290	500	330	1,100	330	330	N/A	500	860	6,745
B-4	SED63792	SD60114WC	10/26/1992	14	295	N/A	84	430	570	1,500	270	350	650	295	1,400	295	300	N/A	690	1,200	8,329
B-4	SED63892	SD60038WC	10/22/1992	14	315	N/A	315	315	370	660	315	220	470	315	950	315	315	N/A	450	820	6,145
B-4	SED63892	SD60110WC	10/22/1992	14	315	N/A	315	315	400	770	315	360	520	315	1,100	315	315	N/A	590	1,000	6,945
B-4	SED63992	SD60039WC	10/26/1992	14	250	N/A	99	350	440	710	250	290	490	250	1,100	250	250	N/A	580	970	6,279
B-5	SED64092	SD60040WC	10/19/1992	14	235	N/A	235	235	235	235	235	235	235	235	235	235	235	N/A	235	235	3,290
B-5	SED64192	SD60041WC	10/19/1992	14	260	N/A	260	260	260	260	260	260	260	260	260	260	260	N/A	260	260	3,640
B-5	SED64292	SD60042WC	10/20/1992	14	285	N/A	285	285	285	285	285	285	285	84	285	285	285	N/A	285	285	3,789
B-5	SED64392	SD60043WC	10/20/1992	14	390	N/A	390	390	390	390	390	390	390	390	190	390	390	N/A	390	160	5,030
B-5	SED64492	SD60044WC	10/20/1992	14	245	N/A	245	245	245	245	245	245	245	245	245	245	245	N/A	245	245	3,430
Channel	CJ41-004	04F2195-001	09/16/2004	14	200	N/A	200	405	405	56	405	405	68	405	47	405	405	N/A	405	405	4,216
Channel	CJ42-006	04F2195-002	09/16/2004	14	200	N/A	67	300	370	350	250	340	410	71	1,000	395	220	N/A	520	680	5,173
Channel	CJ42-007	04F2195-003	09/16/2004	14	195	N/A	195	63	79	75	55	66	94	390	190	390	48	N/A	120	390	2,350
Channel	CJ42-008	04F2195-004	09/16/2004	14	205	N/A	57	120	120	140	415	110	190	415	380	415	72	N/A	250	260	3,149
Channel	CJ43-009	04F2195-005	09/16/2004	14	205	N/A	50	150	190	180	130	180	210	44	510	405	100	N/A	320	350	3,024
Channel	CJ43-010	04F2195-006	09/16/2004	14	190	N/A	78	240	260	250	140	230	310	55	850	375	130	N/A	510	530	4,148
Channel	CJ43-011	04F2128-001	09/28/2004	14	215	N/A	215	89	110	120	120	110	160	425	260	425	87	N/A	120	220	2,676
Channel	CP46-000	03F0049-013	11/12/2002	14	190	N/A	190	89	110	110	375	84	120	375	200	375	375	N/A	110	200	2,903
Channel	DC45-000	02E0055-003	04/16/2002	14	175	N/A	175	62	175	175	175	175	86	175	190	175	175	N/A	175	170	2,258
Channel	SED001900	00D1513-001	09/26/2000	14	35	N/A	50	150	170	150	140	130	170	185	340	24	110	N/A	220	300	2,174
Channel	SED002900	00D1513-002	09/26/2000	14	195	N/A	195	195	195	195	195	195	23	195	195	195	195	N/A	195	20	2,383
Channel	SED003900	00D1513-003	09/26/2000	14	34	N/A	160	530	450	430	330	280	500	160	810	43	280	N/A	620	960	5,587
Channel	SED004900	00D1513-004	09/26/2000	14	190	N/A	190	47	56	52	43	31	52	190	77	190	35	N/A	57	91	1,301
Channel	SED005900	00D1513-005	09/26/2000	14	190	N/A	190	42	41	46	44	32	59	190	58	190	30	N/A	35	70	1,217
Channel	SED00795	SDG0203JE	02/14/1995	14	69	N/A	320	1,100	1,000	1,400	730	660	1,200	250	2,300	95	650	N/A	1,400	1,400	12,574
Channel	SED01095	SDG0206JE	02/14/1995	14	26	N/A	45	190	210	210	170	210	230	51	590	21	160	N/A	240	340	2,693
Channel	SED011	SD00242WC	09/03/1991	14	56	N/A	250	92	95	110	250	67	94	250	220	250	74	N/A	240	240	2,288
Channel	SED011	SD00282WC	12/03/1991	14	195	N/A	195	195	195	195	195	195	195	195	195	195	195	N/A	195	195	2,730
Channel	SED011	SD00306WC	03/05/1992	14	270	N/A	270	270	270	270	270	270	270	61	270	270	270	N/A	53	95	3,179
Channel	SED011	SD00331WC	04/28/1992	14	220	N/A	220	95	220	66	220	97	120	220	240	220	61	N/A	190	200	2,389
Channel	SED011	SD00537WC	08/26/1992	14	220	N/A	220	220	220	220	220	220	220	220	220	220	220	N/A	220	220	3,080
Channel	SED01195	SDG0207JE	02/14/1995	14	51	N/A	250	820	810	1,000	670	590	850	230	1,800	74	550	N/A	990	1,000	9,685
Channel	SED01295	SDG0208JE	02/14/1995	14	180	N/A	430	1,400	1,300	1,500	1,100	920	1,400	360	2,700	180	910	N/A	1,800	1,700	15,880
Channel	SED02495	SDG0301JE	03/10/1995	14	175	N/A	175	175	175	37	175	175	34	175	33	175	175	N/A	175	27	1,881
Channel	SED02595	SDG0302JE	03/10/1995	14	205	N/A	205	205	205	205	205	205	205	205	205	205	205	N/A	205	205	2,870
Channel	SED02695	SDG0237JE	02/21/1995	14	200	N/A	200	200	200	200	200	200	200	200	200	200	200	N/A	200	200	2,800
Channel	SED02795	SDG0303JE	03/10/1995	14	200	N/A	200	200	200	200	200	200	200	200	34	200	200	N/A	38	31	2,303

**Table A6.31**  
**Total PAH Values for SW AEU Sediment**

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
Channel	SED03295	SDG0215JE	02/15/1995	14	210	N/A	210	65	60	79	55	50	95	210	190	210	39	N/A	96	110	1,679
Channel	SED03495	SDG0311JE	03/14/1995	14	180	N/A	180	25	180	180	180	180	69	180	100	180	180	N/A	45	79	1,938
Channel	SED04395	SDG0209JE	02/27/1995	14	205	N/A	25	110	120	110	99	130	150	21	320	205	93	N/A	160	200	1,948
Channel	SED04495	SDG0267JE	02/27/1995	14	205	N/A	59	350	420	450	380	460	490	150	1,100	205	330	N/A	450	630	5,679
Channel	SED04795	SDG0256JE	03/15/1995	14	245	N/A	245	245	245	245	245	245	245	245	33	245	245	N/A	245	32	3,005
Channel	SED04895	SDG0287JE	03/03/1995	14	225	N/A	29	96	130	120	140	91	130	225	220	225	110	N/A	150	200	2,091
Channel	SED05095	SDG0242JE	03/16/1995	14	345	N/A	345	345	345	345	345	345	345	345	99	345	345	N/A	60	95	4,049
Channel	SED07295	SDG0318JE	03/15/1995	14	175	N/A	19	120	170	120	170	180	180	175	330	175	120	N/A	140	250	2,324
Channel	SED65992	SD60059WC	02/17/1993	14	93	N/A	230	180	230	280	230	100	210	230	560	230	230	N/A	510	400	3,713
Channel	SED66492	SD60064WC	02/18/1993	14	245	N/A	245	245	245	245	245	245	245	245	245	245	245	N/A	245	245	3,430
Channel	SED66592	SD60065WC	02/18/1993	14	110	N/A	130	280	380	500	150	180	350	240	900	80	190	N/A	720	610	4,820
Channel	SED66692	SD60066WC	02/18/1993	14	200	N/A	200	200	200	200	200	200	200	200	200	200	200	N/A	200	200	2,800
Channel	SED66792	SD60067WC	02/18/1993	14	245	N/A	245	245	245	245	245	245	245	245	245	245	245	N/A	245	245	3,430
Channel	SED68892	SD60088WC	05/06/1993	14	200	N/A	200	200	200	200	200	200	200	200	200	200	200	N/A	200	200	2,800
Channel	SED69292	SD60092WC	05/07/1993	14	215	N/A	215	215	215	215	215	215	215	215	215	215	215	N/A	215	215	3,010
Channel	SED69392	SD60093WC	05/10/1993	14	200	N/A	200	200	200	200	200	200	200	200	200	200	200	N/A	200	200	2,800
Channel	SED69792	SD60097WC	05/10/1993	14	215	N/A	215	215	215	215	215	215	215	215	215	215	215	N/A	215	215	3,010
Channel	SED69892	SD60098WC	05/10/1993	14	230	N/A	110	360	410	550	120	190	430	230	870	230	150	N/A	600	760	5,240
Channel	SED69992	SD60099WC	05/10/1993	14	190	N/A	190	190	190	190	190	190	190	190	190	190	190	N/A	190	190	2,660
Channel	SED70092	SD60100WC	05/10/1993	14	130	N/A	150	430	480	650	160	230	510	175	1,000	89	180	N/A	750	960	5,894
Channel	SED80093	SDG0002JE	12/12/1994	14	185	N/A	185	185	185	185	185	185	185	185	185	185	185	N/A	185	185	2,590
Channel	SED80193	SDG0003JE	12/12/1994	14	210	N/A	210	94	100	140	79	50	110	210	200	210	83	N/A	85	190	1,971
Channel	SS9040400	00A1133-004	02/28/2000	14	360	N/A	360	78	100	86	360	100	130	360	180	360	73	N/A	140	200	2,887
Channel	SW022	SW70213JE	06/21/1994	14	96	N/A	120	590	580	870	260	250	600	160	1,000	69	250	N/A	740	1,300	6,885

Table A6.32  
Total PAH Values by Sample for WC AEU Sediment

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaphthene	Acenaphthylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
CND	CR31-005	05F0600-002	07/19/2005	10	ND	N/A	440	190	170	170	150	150	190	N/A	120	N/A	500	N/A	340	ND	2,418
CND	CR31-006	05F0600-003	07/19/2005	2	ND	N/A	450	ND	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	340	ND	780
CND	CR31-006	05F0600-004	07/19/2005	8	360	N/A	410	83	79	ND	ND	ND	81	N/A	130	N/A	400	N/A	350	ND	1,889
CND	CR31-007	05F0600-006	07/19/2005	8	320	N/A	350	69	66	ND	ND	ND	65	N/A	120	N/A	340	N/A	310	ND	1,636
CND	CR31-008	05F0630-001	07/20/2005	8	74	N/A	90	140	ND	180	ND	ND	130	N/A	330	N/A	ND	N/A	360	310	1,610
CND	CR31-008	05F0630-002	07/20/2005	4	ND	N/A	ND	59	ND	ND	ND	ND	60	N/A	120	N/A	ND	N/A	84	ND	315
C-2	SED511	SD50023WC	11/10/1992	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	140	N/A	ND	N/A	ND	ND	129
Channel	SED028	SD00254WC	08/28/1991	1	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	ND	N/A	ND	N/A	ND	61	50
Channel	SED029	SD00255WC	09/04/1991	8	ND	N/A	ND	64	110	120	ND	110	87	N/A	120	N/A	ND	N/A	66	140	813
Channel	SED037	SD00323WC	04/08/1992	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	120	N/A	ND	N/A	ND	100	210
Channel	SED038	SD00272WC	11/05/1991	2	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	70	N/A	ND	N/A	ND	87	147
Channel	SED039	SD00273WC	11/05/1991	2	ND	N/A	ND	ND	ND	ND	ND	ND	63	N/A	130	N/A	ND	N/A	ND	ND	183
Channel	SED039	SD00322WC	04/08/1992	6	ND	N/A	ND	ND	ND	190	ND	110	190	N/A	380	N/A	ND	N/A	190	310	1,364
Channel	SED08295	SDG0324JE	03/16/1995	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	280	N/A	400	N/A	N/A	N/A	220	310	1,210
Channel	SED08395	SDG0227JE	02/20/1995	8	ND	N/A	ND	33	39	ND	45	ND	55	N/A	88	N/A	24	N/A	51	67	398
Channel	SED08495	SDG0229JE	02/20/1995	7	ND	N/A	ND	22	37	ND	50	ND	140	N/A	50	N/A	ND	N/A	28	53	375
Channel	SED08895	SDG0325JE	03/16/1995	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	31	N/A	ND	N/A	24	45	91
Channel	SED125	SD00266WC	08/14/1991	12	510	N/A	470	1,200	970	1,500	630	690	1,200	N/A	2,900	N/A	440	N/A	2,900	3,100	16,510
Channel	SED126	SD00267WC	08/28/1991	8	ND	N/A	ND	53	57	84	ND	72	73	N/A	95	N/A	ND	N/A	94	130	654
Channel	SED51593	SD50000AS	07/08/1993	3	ND	N/A	ND	ND	ND	ND	ND	ND	ND	N/A	97	N/A	ND	N/A	82	97	267
Channel	SED51693	SD50001AS	07/08/1993	5	ND	N/A	ND	38	ND	ND	ND	ND	41	N/A	96	N/A	ND	N/A	76	73	317

Table A6.33  
Total PAH Values for WC AEU Sediment

Pond	Location Code	Sample Number	Collection Date	Record Count	Acenaph thene	Acenaph thylene	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	Naphthalene	Phenanthrene	Pyrene	TOTAL RESULT
C-1	CR31-005	05F0600-002	07/19/2005	12	360	N/A	440	190	170	170	150	150	190	N/A	120	N/A	500	N/A	340	700	3,480
C-1	CR31-006	05F0600-003	07/19/2005	12	395	N/A	450	800	800	800	800	800	800	N/A	800	N/A	800	N/A	340	800	8,385
C-1	CR31-006	05F0600-004	07/19/2005	12	360	N/A	410	83	79	700	700	700	81	N/A	130	N/A	400	N/A	350	700	4,693
C-1	CR31-007	05F0600-006	07/19/2005	12	320	N/A	350	69	66	600	600	600	65	N/A	120	N/A	340	N/A	310	600	4,040
C-1	CR31-008	05F0630-001	07/20/2005	12	74	N/A	90	140	700	180	700	700	130	N/A	330	N/A	700	N/A	360	310	4,414
C-1	CR31-008	05F0630-002	07/20/2005	12	205	N/A	205	59	410	410	410	410	60	N/A	120	N/A	410	N/A	84	410	3,193
C-1	SED510	SD50017WC	11/09/1992	12	500	N/A	500	500	500	500	500	500	500	N/A	500	N/A	500	N/A	500	500	6,000
C-2	SED511	SD50023WC	11/10/1992	12	700	N/A	700	700	700	700	700	700	700	N/A	140	N/A	700	N/A	700	700	7,840
C-2	SED512	SD50024WC	11/10/1992	12	1,050	N/A	1,050	1,050	1,050	1,050	1,050	1,050	1,050	N/A	1,050	N/A	1,050	N/A	1,050	1,050	12,600
Channel	CR32-001	02E0267-001	09/26/2002	12	205	N/A	205	205	205	205	205	205	205	N/A	205	N/A	205	N/A	205	205	2,460
Channel	SED001	SD00275WC	11/12/1991	12	220	N/A	220	220	220	220	220	220	220	N/A	220	N/A	220	N/A	220	220	2,640
Channel	SED001	SD00324WC	04/01/1992	12	250	N/A	250	250	250	250	250	250	250	N/A	250	N/A	250	N/A	250	250	3,000
Channel	SED002	SD00256WC	09/03/1991	12	175	N/A	175	175	175	175	175	175	175	N/A	175	N/A	175	N/A	175	175	2,100
Channel	SED002	SD00276WC	11/12/1991	12	235	N/A	235	235	235	235	235	235	235	N/A	235	N/A	235	N/A	235	235	2,820
Channel	SED002	SD00300WC	01/21/1992	12	265	N/A	265	265	265	265	265	265	265	N/A	265	N/A	265	N/A	265	265	3,180
Channel	SED002	SD00325WC	04/01/1992	12	200	N/A	200	200	200	200	200	200	200	N/A	200	N/A	200	N/A	200	200	2,400
Channel	SED016	SD00005JE	03/18/1993	12	280	N/A	280	280	280	280	280	280	280	N/A	280	N/A	280	N/A	280	280	3,360
Channel	SED016	SD00243WC	08/14/1991	12	230	N/A	230	230	230	230	230	230	230	N/A	230	N/A	230	N/A	230	230	2,760
Channel	SED016	SD00305WC	02/04/1992	12	385	N/A	385	385	385	385	385	385	385	N/A	385	N/A	385	N/A	385	385	4,620
Channel	SED016	SD00330WC	08/15/1992	12	215	N/A	215	215	215	215	215	215	215	N/A	215	N/A	215	N/A	215	215	2,580
Channel	SED016	SD00536WC	08/21/1992	12	315	N/A	315	315	315	315	315	315	315	N/A	315	N/A	315	N/A	315	315	3,780
Channel	SED017	SD00244WC	08/05/1991	12	500	N/A	500	500	500	500	500	500	500	N/A	500	N/A	500	N/A	500	500	6,000
Channel	SED024	SD00250WC	09/03/1991	12	205	N/A	205	205	205	205	205	205	205	N/A	205	N/A	205	N/A	205	205	2,460
Channel	SED024	SD00277WC	11/12/1991	12	245	N/A	245	245	245	245	245	245	245	N/A	245	N/A	245	N/A	245	245	2,940
Channel	SED024	SD00326WC	04/01/1992	12	330	N/A	330	330	330	330	330	330	330	N/A	330	N/A	330	N/A	330	330	3,960
Channel	SED025	SD00251WC	08/12/1991	12	410	N/A	410	410	410	410	410	410	410	N/A	410	N/A	410	N/A	410	410	4,920
Channel	SED026	SD00252WC	08/21/1991	12	335	N/A	335	335	335	335	335	335	335	N/A	335	N/A	335	N/A	335	335	4,020
Channel	SED027	SD00253WC	08/28/1991	12	305	N/A	305	305	305	305	305	305	305	N/A	305	N/A	305	N/A	305	305	3,660
Channel	SED027	SD00278WC	11/13/1991	12	245	N/A	245	245	245	245	245	245	245	N/A	245	N/A	245	N/A	245	245	2,940
Channel	SED027	SD00302WC	01/22/1992	12	245	N/A	245	245	245	245	245	245	245	N/A	245	N/A	245	N/A	245	245	2,940
Channel	SED027	SD00327WC	04/02/1992	12	245	N/A	245	245	245	245	245	245	245	N/A	245	N/A	245	N/A	245	245	2,940
Channel	SED028	SD00254WC	08/28/1991	12	245	N/A	245	245	245	245	245	245	245	N/A	245	N/A	245	N/A	245	245	2,756
Channel	SED029	SD00255WC	09/04/1991	12	190	N/A	190	64	110	120	190	110	87	N/A	120	N/A	190	N/A	66	140	1,577
Channel	SED029	SD00271WC	11/04/1991	12	375	N/A	375	375	375	375	375	375	375	N/A	375	N/A	375	N/A	375	375	4,500
Channel	SED029	SD00320WC	04/09/1992	12	285	N/A	285	285	285	285	285	285	285	N/A	285	N/A	285	N/A	285	285	3,420
Channel	SED029	SD00531WC	07/20/1992	12	325	N/A	325	325	325	325	325	325	325	N/A	325	N/A	325	N/A	325	325	3,900
Channel	SED030	SD00256WC	08/21/1991	12	285	N/A	285	285	285	285	285	285	285	N/A	285	N/A	285	N/A	285	285	3,420
Channel	SED031	SD00257WC	08/21/1991	12	185	N/A	185	185	185	185	185	185	185	N/A	185	N/A	185	N/A	185	185	2,220
Channel	SED037	SD00274WC	11/06/1991	12	250	N/A	250	250	250	250	250	250	250	N/A	250	N/A	250	N/A	250	250	3,000
Channel	SED037	SD00323WC	04/08/1992	12	285	N/A	285	285	285	285	285	285	285	N/A	120	N/A	285	N/A	285	100	3,070
Channel	SED038	SD00272WC	11/05/1991	12	270	N/A	270	270	270	270	270	270	270	N/A	70	N/A	270	N/A	270	87	2,857
Channel	SED039	SD00273WC	11/05/1991	12	285	N/A	285	285	285	285	285	285	63	N/A	130	N/A	285	N/A	285	285	3,043
Channel	SED039	SD00322WC	04/08/1992	12	435	N/A	435	435	435	190	435	110	190	N/A	380	N/A	435	N/A	190	310	3,980
Channel	SED039	SD00532WC	07/20/1992	12	280	N/A	280	280	280	280	280	280	280	N/A	280	N/A	280	N/A	280	280	3,360
Channel	SED040	SW70254WC	02/24/1992	12	280	N/A	280	280	280	280	280	280	280	N/A	280	N/A	280	N/A	280	280	3,360
Channel	SED041	SW70255WC	02/24/1992	12	205	N/A	205	205	205	205	205	205	205	N/A	205	N/A	205	N/A	205	205	2,460
Channel	SED08295	SDG0324JE	03/16/1995	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	280	N/A	400	N/A	N/A	N/A	220	310	1,210
Channel	SED08395	SDG0227JE	02/20/1995	12	190	N/A	190	33	39	190	45	190	55	N/A	88	N/A	24	N/A	51	67	1,162
Channel	SED08495	SDG0229JE	02/20/1995	12	200	N/A	200	22	37	200	50	200	140	N/A	50	N/A	200	N/A	28	53	1,380
Channel	SED08895	SDG0325JE	03/16/1995	12	240	N/A	240	240	240	240	240	240	240	N/A	31	N/A	240	N/A	24	45	2,260
Channel	SED125	SD00266WC	08/14/1991	12	510	N/A	470	1,200	970	1,500	630	690	1,200	N/A	2,900	N/A	440	N/A	2,900	3,100	16,510
Channel	SED126	SD00267WC	08/28/1991	12	180	N/A	180	53	57	84	180	73	N/A	95	N/A	180	N/A	94	130	1,378	
Channel	SED127	SD00006JE	03/18/1993	12	225	N/A	225	225	225	225	225	225	225	N/A	225	N/A	225	N/A	225	225	2,700
Channel	SED127	SD00551WC	12/08/1992	12	445	N/A	445	445	445	445	445	445	445	N/A	445	N/A	445	N/A	445	445	5,340
Channel	SED508	SD50014WC	11/09/1992	12	900	N/A	900	900	900	900	900	900	900	N/A	900	N/A	900	N/A	900	900	10,800
Channel	SED51593	SD50000AS	07/08/1993	12	190	N/A	190	190	190	190	190	190	190	N/A	97	N/A	190	N/A	82	97	1,986
Channel	SED51693	SD50001AS	07/08/1993	12	185	N/A	185	185	185	185	185	185	41	N/A	96	N/A	185	N/A	76	73	1,619
Channel	SED51793	SD50002AS	07/08/1993	12	190	N/A	190	190	190	190	190	190	190	N/A	190	N/A	190	N/A	190	190	2,280
Channel	SED51893	SD50003AS	07/08/1993	12	180	N/A	180	180	180	180	180	180	180	N/A	180	N/A	180	N/A	180	180	2,160
Channel	SW01793	SW70169JE	11/29/1993	12	215	N/A	215	215	215	215	215	215	215	N/A	215	N/A	215	N/A	215	215	2,580
Channel	SW030	SW70168JE	11/29/1993	12	390	N/A	390	390	390	390	390	390	390	N/A	390	N/A	390	N/A	390	390	4,680
Channel	SW036	SW70167JE	11/29/1993	12	260	N/A	260	260	260	260	260	260	260	N/A	260	N/A	260	N/A	260	260	3,120

**COMPREHENSIVE RISK ASSESSMENT**

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

**VOLUME 15B2: ATTACHMENT 7**

**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

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). For the purposes of the Comprehensive Risk Assessment (CRA), a review of the studies that focused on ecological exposure, effects, and community characteristics within the AEUs was completed. Lines of evidence from one or more of these studies are provided as the linkages between exposure (i.e., chemical concentrations) and effects (i.e., observed responses from laboratory toxicity testing or field documented changes in populations or communities). These lines of evidence help to determine if chemicals are causing effects to the aquatic ecosystem 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 processes. Bioaccumulation refers to the degree to which an organism takes up and retains a contaminant from all applicable exposure routes. Bioaccumulation of a contaminant is typically expressed in terms of a bioaccumulation factor (BAF) which is the tissue concentration divided by the chemical concentration in the surrounding media. These measures are useful in determining whether a given surface water or sediment ECOPC is bioavailable and, thus, potentially 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 composition of aquatic communities represents the sum of multiple physical, biological and chemical influencing factors. 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 (e.g., Woman Creek) as compared to a background or reference watershed component (e.g., 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.

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.

Kaiser-Hill, 1999. 1998 Annual Wildlife Survey for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, L.L.C., Rocky Flats Environmental Technology Site, Golden, Colorado. (three reports).

Kaiser-Hill, 2000. 1999 Annual Wildlife Survey for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, L.L.C., Rocky Flats Environmental Technology Site, Golden, Colorado.

Kaiser-Hill, 2001. 2000 Annual Wildlife Survey for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, L.L.C., Rocky Flats Environmental Technology Site, Golden, Colorado.

### **1.3 Bioassay Analyses**

Bioassays test the toxicity attributable to potentially contaminated media and provide a direct measure of chemical risk. Two studies completed bioassay analyses:

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.

Wolaver et al. 1993. Toxicity Monitoring in Rocky Flats Plant Surface Waters May 1991 – June 1992. Rocky Flats Plant, Environmental Protection Management, Surface Water Division.

### **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 2005) suggests that studies of these organisms may be useful lines of evidence within the CRA. For that purpose, these studies were evaluated in this attachment:

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, 2004. 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 biota 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 ( $\mu\text{g}/\text{kg}$ ) fresh weight (EPA 1980, as reported in Eisler 1986).

The recommended maximum body burden for trout is 400  $\mu\text{g}/\text{kg}$  fresh weight (Eisler 1986).

A reported value of 5,000  $\mu\text{g}/\text{kg}$  is protective of human health consumption (Hoeting 1983, as reported in Eisler 1986).

An observed typical body burden concentration for fish is 1,000  $\mu\text{g}/\text{kg}$  (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, B, and C 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 discharged into Pond B-2.

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. These results suggested that it was highly unlikely that RFETS contributed PCBs to 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).

Concentrations of Aroclor-1254 in crayfish samples collected from Ponds A-2, A-3, and A-4 were less than detection. Tissue samples collected from Pond A-1 were not large enough to support chemical analyses. Benthic tissues collected from Pond A-2 averaged 20 ug/kg while LMB tissue averaged 48 ug/kg. Pond A-3 samples only included crayfish. Pond A-4 included fathead minnows that averaged 17 ug/kg. Largemouth bass in Pond A-2 had a BSF of 0.6. The sediments within the upper 15 cm had generally lower PCB concentrations than the deeper sediments, suggesting a lower risk to aquatic life than indicated by the earlier data. The ponds with the highest tissue concentrations of PCBs were not the ponds with the highest sediment PCB concentrations.

Concentrations of Aroclor-1254 in tissue samples from the B-Series Ponds include data from Tiger Salamanders, fathead minnows, and crayfish. Tiger Salamander tissues from Pond B-1 averaged 33 ug/kg (n=2), while in Pond B-2 salamander tissues averaged 99.3 ug/kg (n=3). No tissue data from aquatic organisms were collected from Pond B-3. Fathead minnow tissues from Pond B-4 averaged 480.3 (n=3) while in Pond B-5, fathead minnow tissues residues averaged 159.3 (n=3) and crayfish tissues were generally less than detection (15 ug/kg).

Concentrations of Aroclor-1254 in tissue samples from the C-Series Ponds include data for crayfish, Bluegill sunfish and a single chub. Crayfish samples (n=3) were all less than detectable (15 ug/kg). Bluegill (n=2) tissues ranged from 36 to 69 (ug/kg) while the single chub tissue sample was 100 ug/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, and decreased in fathead minnows from B-4 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.

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.

Data from this study are subsequently used in DOE 1996 to assess risks to aquatic organisms and birds due to bioaccumulation (see Section 2.2).

### ***Application to the CRA and Uncertainties***

This study incorporated 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 collected from RFETS ponds 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 which suggested that PCBs were not migrating to offsite reservoirs.

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 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; see Section 2.1 above). DOE (1996) used the data collected in 1994 to assess potential risks to predatory birds exposed to PCBs. This exposure and analysis discussed in this section were based on results of the 1994 sampling.

DOE (1996) calculated the ratio of Aroclor-1254 content in biota to that in sediments 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 (Rasmussen, et al. 1990; Macdonald, et al. 1993).

### ***Application to the CRA and Uncertainties***

This study provided 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 generally low BSF ratios suggests 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 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. These samples were returned to the laboratory for taxonomic identification and quantification of benthic samples. Algal and periphyton samples were also collected. Samples were collected during the Spring and Fall seasons in 1991 during May-June and again in August-September. A-, B-, C-, and D- Series ponds were sampled. Stream samples were collected on Woman Creek, Rock Creek, and Walnut Creek downstream of the North and South Walnut Creek confluence.

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 (Table A7.5).

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 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 in the stream communities were the larvae of true flies (Diptera) and mayflies (Ephemeroptera). The most common dipteran taxa are blackflies (Simuliidae) 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*).

Comparisons of the watersheds were conducted. Findings indicate that seasonal fluctuations in availability of surface water would affect populations and species in each watershed. Water quality did not show great differences between the three watersheds, but did vary between pond and stream habitats. Of note, high concentrations nutrients were present in the fall. Of the watersheds evaluated, the Woman Creek watershed had the highest diversity of phytoplankton, periphyton, benthic macroinvertebrates, and fish. This was attributed to the greater diversity of habitats available in Woman Creek. Walnut Creek had similar diversity of the different communities evaluated to Rock Creek.

### ***Application to the CRA and Uncertainties***

This study documented the baseline conditions of aquatic organisms present at RFETS in 1991. The results of the population studies provide line of evidence for NW AEU, SW AEU, WC AEU, and NN AEU in regard to populations and overall ecosystem health.. The species composition is a reflection of the habitat condition; physical stressors such as fluctuating flow were a primary factor in determining the composition of the aquatic communities. 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. For instance, 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.

### **3.2 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**

This study was completed as a part of the ecological risk evaluation of aquatic life for OUs 5 and 6. The risk assessment used a Triad approach where chemistry, biology, and toxicity were all evaluated to assess potential risks. Using literature based effects values, hazard quotients (HQs) and hazard indices (HIs) were generated as a screening tool and indicated a relatively high potential for toxic effects in sediments.

It appears that the data used to assess the aquatic community dynamics in DOE (1996) are from the DOE (1993) and DOE (1995) Ecological Monitoring Program Annual Reports. Benthos samples were collected from all of the A-(North Walnut AEU), B-(South Walnut AEU), C-(Woman Ck AEU), and D-series (Southeast AEU) ponds during May through July 1994. Pond A-5 also known as Flume Pond is downstream of the confluence of North and South Walnut Creeks. Benthic communities for Ponds D-1 and D-2 were sampled to represent locations with no known contaminant input from RFETS. Five replicate multi-core composite samples were obtained from various submerged habitat types to ensure complete representation of the pond biota. Samples were analyzed for taxonomic composition and abundance. Taxa identifications were made to the lowest practical taxonomic level.

Descriptive data for community parameters such as richness, density, Simpson and Shannon-Weiner diversity measures, number of dominant taxa (Hill's N1) (Ludwig and Reynolds 1988), and abundance-based relationships for oligochaetes and dipterans were derived. The data represent a composite of data from the different pond habitat sampled. Conventional interpretation of the benthic community structure suggests that communities with low densities of organisms or reduced richness and diversity are subject to physical or chemical stress. Benthic communities with high densities of pollution tolerant species may be indicative of stress.

Pollution tolerance values were used to evaluate benthic community health and responses to pollution stress. A tolerance value of 0 equates to no pollution tolerance while a value of 10 equates to highly tolerant organisms.

A total of 81 different taxa representing all the major orders of benthic organisms were identified in the pond samples. A listing of identified taxa and mean abundance for each pond was compiled. Community description measures generated for each pond are summarized in Table A7.6. 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 fingernail clams (pelecypoda) 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.

Pond B-4 had the highest organism abundance of all of the ponds evaluated and the lowest species richness and diversity indices of the ponds sampled during this study.

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. Pollution tolerance values for the most commonly collected taxa from all ponds were relatively moderate (5) to high (10).

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.

Of the ponds affected by RFETS, the B-series ponds had organism densities (number/m<sup>2</sup>) of Ephemeroptera, Odonates, Coleoptera, Crustacea, and Gastropods, that were much higher than A or C series ponds (where these types of organisms were largely absent). Densities of representatives of these orders in the B series of ponds were also higher than those in the D series of ponds.

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 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 appears to account 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 are also strongly correlated with community composition. 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. 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 (e.g., removal of sediments from ponds B-1, B-2, and B-3) and likely represents worst-case conditions as compared to current conditions.

### **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. Except for one sample location, sampling was conducted at locations downstream of Great Western Reservoir. Site D1, located just west of Indiana Street is the only sample within the RFETS boundaries.

The study concluded that aquatic habitats and aquatic life in Walnut Creek are limited by stream flow, especially at the upper transition zone sites such as D1. Altered flow conditions due to water management are a primary limiting factor for habitats and the development of an aquatic community. Site D1 had the lowest overall habitat score due to low proportion of riffle habitat and high proportion of silt in the substrate, among other factors.

Benthic macroinvertebrate metrics from site D1 indicate the presence of environmental stress. Low taxa richness, low EPT index values, high percentage contribution from dominant taxa, and overall low number of organisms contribute to the above observation of stress. The document cites the lack of water as the primary factor for the reduced quality of the benthic community at site D1. The fish community at site D1 is described as transient, and again, it is considered to be due primarily to inadequate flows. .

The RFETS site (D-1) 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 periods 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 observed species in Walnut Creek 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. This study described 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 downstream of Standley Reservoir. 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 Oligochaeta (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 downstream 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 (i.e., transitional foothills-plains streams), as those in the upper portion of Big Dry Creek. Conclusions from this study that flows from RFETS via Walnut and Woman Creeks are not causing a risk to aquatic life in downgradient locations. This will be used as a line of evidence for the Walnut Creek and Woman Creek AEU's.

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 conducted 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. Ten stream locations within each drainage (40 over the entire site) were systematically surveyed in each drainage during May 1998 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 (Table A7.7). 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 dolomieu*), 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 on Rock Creek 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. Overall, fish species richness is very low at RFETS, and similar to what has been reported for other small streams in this semi-arid region.

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. 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 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.

#### ***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. Study sites included five locations on Walnut Creek, and four on Woman Creek and Rock Creek. Results are summarized herein for Walnut and Woman Creeks. One site (WC1) is located in the NW AEU, four sites are located in the SW AEU (WC2, WC3, WC4, and WC5), and four sites are located in the WC AEU (WO1, WO2, WO3, and WO4).

Habitat scores for each site are presented in Table A7.8. The lower scores at sites WC2, 3, 4, and 5 in Walnut Creek reflect the generally poor condition of the stream banks, and for WC4 and WC5 the condition is further diminished due to the periodic discharges from the terminal ponds. Habitat in Walnut Creek at WC1 was generally rated as higher and comparable to Woman Creek sites WO1 and WO2. Permanent water is found at sites WO1 and WO2, but flows are generally low and seasonally intermittent, and the habitat quality decreases primarily due to diminishing flows during the summer months.

Habitat data collected in 2001 and 2002 were compared to data from November 1994 and 1995 from Wright Water Engineers (1995). Aquatic Associates (2003) reported that the same general trends in scores were evident for the Walnut Creek drainage with the highest score reported for a North Walnut Creek site near WC1. Lower scores were found for several sites on South Walnut Creek near WC3) and the mainstem downstream to Indiana Street Pond (near WC4 and WC5). High scores were reported for WO1 and WO2 and WO3 from the earlier work.

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 were sampled from nine locations in Walnut, Woman, and Rock Creeks in August 2001 and found at 7 of the nine locations. Fish abundance and distribution in these streams is severely limited due to the lack of permanent water. Naturally self sustaining fish populations, defined as a number of age classes present, were found at four sites, WC3, WO1, WO2, and RC2 (Table A7.8). Fathead minnow was the only fish population found at WC3. A stable and healthy creek chub population was found at the upper two sites in Woman Creek. No fish were collected at WC1, WC2, or WC4 and only one fathead minnow was collected at site WC5. Resampling in October 2001 produced no additional fish at WC4 and WC5. Compared to studies conducted in 1991, similar results were found with fathead minnow being the only species found in Walnut Creek. In Woman Creek, creek chubs were found in 2001 and 1991, while in 1991 several additional species were collected (see Ebasco 1992).

Macroinvertebrates were collected in summer and fall 2001 and spring, summer, and fall 2002. The macroinvertebrate community was 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 species. 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.

The Hilsenhoff Biotic Index (HBI) values from the samples collected from each creek were typically greater than 6, which is suggestive of higher degrees of organic pollution. In Walnut Creek HBI values ranged from 5.07 to 9.45. HBI values were typically higher in Woman Creek than in Walnut Creek ranging from 5.63 at site WO1 (spring 2002) to 9.38 at site WO3 (fall 2002). The high HBI value at WO# was due to the highly tolerant tubificid worm which comprised nearly 96% of the entire macroinvertebrate sample in fall 2002.

Invertebrate Community Index (ICI) ratings were also used to rate invertebrate community conditions and quality. Scores greater than 46 are considered to represent exceptional community conditions, while 36 -45 represents good conditions, 13 – 35 represents fair conditions, and 12 or less represents poor conditions.

ICI scores for Walnut Creek indicated a moderately stressed benthic macroinvertebrate community. Mean ICI scores ranged from 14 to 29.6 for individual sites. The highest mean score was at site WC3 where stream flows are stable and consistently higher than at the upper two sites. Of all the sites, flows are most suitable at site WC3 providing the most favorable habitat. Sites WC4 and WC5 had the lowest mean ICI scores at 16 and 14, respectively, likely due to interrupted flow regime.

ICI scores in Woman Creek indicate a stressed macroinvertebrate community in 2001 and 2002. Six of 13 sampling events had scores in the poor. Site WO3 had the lowest ICI scores with a value of 2 in fall 2001 and 0 in fall 2002. Six of the scores were rated as fair, ranging from 14 to 34. Only one score was in the good category (40 at site WO1 in fall 2001). Mean ICI scores indicate the macroinvertebrate community in Woman Creek is the most stressed of the three drainages studied. Scores were 22.4, 15.6, 8.7 at sites WO1, WO2, and WO3, respectively, with the WO3 score indicating stress due to the lack of permanent water.

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. A combination of natural and anthropogenic influences on the hydrological regimes of these systems significantly influences the quality and quantity of habitat available for aquatic life. Aside from the flow limitations in all drainages, additional limitations on the physical habitat quality include effluent dominated and discharge dependent areas of South Walnut and Walnut Creeks, respectively, bank erosion and poor bank stability, and sediment inputs. Stream bank erosion is further aggravated by the periodic discharges from the terminal ponds.

A comparison of study results to earlier studies of Rocky Flats streams showed that community structure and abundance were generally 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. Like Wright Water Engineers (1994), Aquatics Associates (2003) concluded that intermittent flows were the major limiting factor for sustaining a healthy and balanced macroinvertebrate community in lower Walnut Creek.

### ***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 are comparable to communities found at other locations at RFETS and within the region. Only one fish species is prevalent (fathead minnows) and 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 recolonize 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 benthic communities comprised of 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 that was presented 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.

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 from surrounding urban land uses.

### 3.8 Wright Water Engineers, Inc., 1995

Bioassessment and Physical/Chemical Characterization of Walnut Creek and Woman Creek. Rocky Flats Environmental Technology Site

#### *Review*

A bioassessment and an analysis of the physical and chemical characteristics of Walnut and Woman Creeks within the boundaries of the Rocky Flats Environmental Technology Site (WETS) was conducted to compare the overall ecologic health of Walnut Creek between Pond A-4 and Indiana Street to an analogous reach of Woman Creek. The study quantified biological, chemical, and physical characteristics of the two streams and evaluated the potential causes of variations in the aquatic communities along these creeks. The study also evaluated whether unionized ammonia discharges from the WETS wastewater treatment plant could be impacting aquatic life in the receiving ponds or in the segment of Walnut Creek below the ponds. For this study, the methods and procedures for conducting a Rapid Bioassessment Protocol III for stream impairment assessment in Rapid Bioassessment Protocols for Use in Streams and Rivers (EPA 1989) were followed to the extent possible. Data included in this assessment came from the 1991 Baseline Assessment (Ebasco 1992) and surveys conducted by DOE in 1994.

The study found that the macroinvertebrate community in Walnut Creek downstream of the A and B-series ponds and upstream of Indiana Street is not as diverse or robust as that in Woman Creek above the Mower Diversion. Recent observations indicate that there is no macroinvertebrate community in this segment of Walnut Creek, except for the very downstream reach (approximately the last 500 feet upstream of Indiana Street), or in Woman Creek below the Mower Ditch, due to the lack of consistent flow. Fish species were not found in Walnut Creek below Pond A-4, due to a lack of flow. Only a single minnow species was found in any of the ponds tributary to lower Walnut Creek or in the pond at Walnut Creek and Indiana Street.

Habitat of Walnut Creek below the A- and B-series ponds is of lower quality than that of Woman Creek, and large differences exist in substrate, the presence of habitat types, and the diversity and productivity of the riparian zone. These habitat differences are persistent, and would not change significantly with a change in flow regime.

An analysis of water chemistry and benthic sampling data indicate that the macroinvertebrate community in Walnut Creek below Pond A-4, and continuing downstream to the confluence with Big Dry Creek, is not adversely affected by ammonia concentrations during periods of release from Pond A-4, particularly when flow ceases on this stream segment. Data also indicate that the characteristics of aquatic life in the pond in Walnut Creek at Indiana Street are generally similar to those in the A- and B-series ponds directly affected by wastewater discharges (Ponds B-3, B-4, B-5, and A-4), even though these upper ponds have experienced much higher un-ionized ammonia concentrations. While the biological health of the pond in Walnut Creek at Indiana Street

is primarily limited by flow considerations, the biological health of the A- and B-series ponds is impaired by operational practices and stratification phenomena. Large water fluctuations in these ponds impair the development of stable habitat, and previous water quality investigations have documented that these ponds experience wide swings in pH and significant oxygen depletion at depth during seasonal periods of stratification. These factors likely prevent a greater abundance or diversity of fish species.

Since aquatic life exists in reaches of Walnut Creek between Pond A-4 and Indiana Street where there is water, and aquatic life could be sustained in the reach with increased flow conditions, the study concludes that the current aquatic life classification for this reach is appropriate. The report also concludes that there are significant biological and physical differences between this reach and the corresponding reach of Woman Creek.

The report further concludes that the lack of fish species and the current impairment of the macroinvertebrate community in Walnut Creek between Pond A-4 and Indiana Street is primarily caused by a lack of flow and by poor habitat conditions, which would not improve to the level observed in Woman Creek even with increased flow. The study found no obvious correlations between un-ionized ammonia concentrations and calculated metrics. Furthermore, operational practices at the ponds result in frequent and severe fluctuations in water level and, combined with a seasonal and persistent depletion of oxygen, significantly limit the ability of these ponds to support fish life. For these reasons, existing ammonia concentrations are not considered a significant cause of impairment in the ponds or in the reach of Walnut Creek below the ponds.

### ***Application to the CRA***

This study can be used as a line of evidence for NN AEU, NW AEU, SW AUE, and WC AEU with regard to populations, habitats, and overall ecosystem health. The lack of fish species and the current impairment of the macroinvertebrate community in Walnut Creek between Pond A-4 and Indiana Street is primarily caused by a lack of flow and by poor habitat conditions. Operational practices at the ponds result in frequent and severe fluctuations in water level and, combined with a seasonal and persistent depletion of oxygen, significantly limit the ability of these ponds to support fish life.

## **4.0 BIOASSAY ANALYSES**

### **4.3 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 *Hyaella 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 *Hyaella 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 (2004) were based on information provided to the RFETS Surface Water Division in documents submitted by The Seacrest Group of Broomfield, Colorado. The DOE report (2004) 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 *Hyaella azteca* after 28 days of exposure (64 percent) was significantly lower than in controls (85 percent) ( $t=3.72$ ,  $t_{0.05}=2.18$ ). No toxic effects were observed for *Hyaella azteca* or *Chironomus tentans* in any other sediment exposures. Table A7.9 presents a summary of the bioassay test results.

Control survival for *H. azteca* was less than the acceptable 80 percent limit for tests of the A-1, A-2, A-5, C1, and C2 sample sediments. Despite control survival falling below the acceptable limit, sediments from these samples all exhibited relatively high organism survival, ranging from a low of 80 percent in C-1 sediments to 96 percent in C-2 sediments. Sediments from Pond B-5 had the lowest organism survival (e.g., 60%); however, data from the report suggests that survival for this test was not significantly different than control survival.

Overall, *H. azteca* survival in all tests, except for tests using sediments from B-2, B-5, and A-3 were 80 percent or higher. Treatment survival in tests using sediments from A-1, A-4, B-1, B-4, C-1, and C-2 was 90 percent or higher.

Growth data for *H. azteca* were not statistically evaluated. However, with the exception of one test for sediments from Pond B-3, all *H. azteca* mean weights in pond treatment sediments were higher than their corresponding control treatment weights.

Chironomus survival in those sediments tested ranged from 62 percent to 103 percent (sediment sample was not adequately screened to remove all “native” chironomid larvae) and comparisons to control survival indicated no significant reductions.

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. Table A7.10 presents a comparison of NW AEU contaminant EPCs and contaminant concentrations in sediments used for toxicity testing. The lack of toxicity, except for one site, and the relatively comparable concentrations of ECOPCs suggests that despite  $HI > 1$ , sediments from these ponds were not toxic.

### ***Application to the CRA***

This study determined that, despite predictive risk analysis of chemicals using HQs and HIs, the actual toxicity was low. It appears that the chemicals present within the sediment were not bioavailable and did not yield a toxic response. Furthermore, the HI for the Pond B-2 was the second lowest of the B-series ponds, containing lower concentrations of all sediment ECOPCs and PCOCs that exceeded sediment quality criteria than in Ponds B-1, B-3, or B-4. This points to the uncertainty inherent in using HQ and HI tools in determining realistic risk conditions. HQs and HIs may suggest a potential concern, whereas the actual risk in the 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.

### **4.4 Wolaver et al., 1993**

Toxicity Monitoring in Rocky Flats Plant Surface Waters May 1991 – June 1992

#### ***Review***

A Surface Water Toxicity Monitoring Program (SWTMP) was initiated in May 1991 by the Rocky Flats Plant (RFP) Environmental Protection Management Surface Water Division. The SWTMP was conducted from May 1991 to June 1992. Aside from the

need to meet regulatory requirements, the SWTMP was also conducted to establish a baseline water quality characterization using two independent toxicity tests for selected surface water locations, investigate correlations of toxicity measurements and water chemistry/weather data analyses, and develop a real-time water quality monitoring method by comparison of results from Microtox tests to the EPA-required WET tests.

Whole Effluent Toxicity (WET) testing were conducted on samples from the 995 effluent, terminal pond effluent (A-4 discharge and B-5 Trans), and terminal in-pond grab (A-3, A-4, B-5, and C-2). Incoming raw water, Protected Area and non protected area waste streams at the equalization basins, influent to the STP, A-1 bypass, and the A-, B-, and C-series pond samples were submitted for Microtox testing.

WET tests includes 48-h static acute Ceriodaphnia and 96-h static renewal acute *Pimphales promelas* exposures. The endpoint was mortality. Microtox tests include exposures of the marine bacterium *Photobacterium phospherum*, which is an illuminescient bacteria. Toxicity is based on reduced measurement of light output, thus the endpoint for the test is a 50% metabolic inhibition in a 15-minute acute test.

WET test results for Ceriodaphnia and *P. promelas* indicate no toxicity for samples from the A- and C-series ponds. In the B-series ponds sampled (Pond B-5), 7.7% and 15.4% of samples tested for Ceriodaphnia and fathead minnow exhibited toxicity; toxicity was identified to be due to ammonia. Toxicity tests for the B-5 transfer samples indicated slight toxicity in >80% effluent dilutions for fathead minnow only. Samples from the 995 effluent indicated toxicity in 14.3% and 46.2% of samples for Ceriodaphnia and fathead minnow, respectively. Toxicity to Ceriodaphnia was inversely correlated with COD while toxicity to fathead minnow was inversely correlated to toluene and acetone in surface waters.

Toxicity as measured by Microtox was observed at some point in time from each of the sampling locations except at Pond C-1 and Pond B-4. Following is a summary of the toxicity characterization presented in the report as it relates to Microtox testing:

#### *A-Series Ponds*

Microtoxicity observed in 25% of the Pond A-1 samples (n=12), 15.4% of the Pond A-2 samples (n= 13), 5.9% of the Pond A-3 samples (n=17), and 10.3% of the Pond A-4 samples (n= 29). The frequency of toxicity in Pond A-1 samples was statistically different than that in the raw water pond, while Ponds A-2, A-3, and A-4 were statistically no different from the raw water pond.

#### *B-Series Ponds*

Microtoxicity observed in 14.3% of the Pond B-1 samples (n=14), 42.9% of the Pond B-2 samples (n= 14), 7.7% of the Pond B-3 samples (n=13), 0% of the Pond B-4 samples (n= 13), and 11.1% of the Pond B-5 samples (n= 27). The frequency of toxicity in all B-Series ponds was statistically no different than that in the raw water pond.

### *C-Series Ponds*

Microtoxicity observed in 0% of the Pond C-1 samples (n=12) and 9.7% of the Pond C-2 samples (n= 32). The frequency of toxicity in all C-Series ponds was statistically no different than that in the raw water pond.

### **Application to the CRA**

At locations where ecological receptors are likely to be exposed to ECOPCs, primarily the A-, B-, and C-series ponds, WET testing indicates no toxicity for A- and C-Series pond samples during the course of the investigation. In the B-Series Ponds (Sample from Pond B-5 only) indicated WET which was later identified to be due to ammonia. These test results suggest that surface water in the A, B, and C series of ponds exhibited little or no toxicity to test organisms and were not likely to adversely impact specie inhabiting these locations.

## **5.0 WATERFOWL/WADING BIRD STUDIES**

### **5.3 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 generally more sensitive than mammals to organic contaminants because they lack the same capacity for detoxification and therefore represent a more conservative 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 pathways evaluated for both birds were the ingestion of food, surface water and sediment. 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.

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 are summarized in Table A7.11.

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 to the lack of prey species at the time of the study.

DOE (1996) indicated that birds and mammal feeding in aquatic habitat may experience higher contaminant exposures than their terrestrial-feeding counterparts, primarily due to three factors. The factors include; 1) erosion and groundwater transport may cause contaminants to accumulate and focus in watersheds; 2) patches of aquatic habitats are usually small relative to terrestrial areas and aquatic-feeding wildlife tend to concentrate in areas of suitable habitat; and 3) bioconcentration and bioaccumulation of chemicals in aquatic organisms can lead to toxic exposures even when concentrations in abiotic media are relatively non-toxic or when contact with the contaminated media is limited.

Adequate biota samples were collected in Ponds A-2, A-3 and A-4. Sampling was conducted in Pond A-1 but insufficient volumes of tissue for analytical analysis were obtained. All ponds were limited in the number of taxa available for collection. In pond A-2, largemouth bass were collected, but they were not available in pond A-3 or A-4 where either flathead minnows or crayfish were collected. Pond A-2 represented the most complete dataset with largemouth bass, crayfish and benthic macroinvertebrates.

Chemicals identified as ECOCs for aquatic feeding birds included di-n-butylphthalate, PCBs, mercury, and antimony. Potentially significant risks to the heron were predicted in all source areas evaluated in the initial screening-level risk assessment. Risks were driven by mercury, di-n-butylphthalate and antimony, primarily due to estimated tissue concentrations. For the mallard, screening-level risks were highest in the A, B and C-series ponds, primarily driven by estimated exposure to di-n-butylphthalate in invertebrate tissues.

Table A7.12 presents the Hazard Indices (HIs) calculated in the screening-level risk assessment. The HQs that were used to calculate the HIs are presented in Tables A7.13 and A7.14 along with their relative contribution to the HI.

The following specific objectives for the risk characterization for the heron and mallard were outlined based on the results of the screening-level risk assessment in DOE (1996) as follows:

- Estimate current exposure using chemical concentrations in sediment and biota. Exposures were estimated for each pond in which contaminants were detected.
- *Estimate site-specific biota:sediment PCB concentration ratios.* Lipid:sediment organic carbon ratios were used to estimate uptake and tissue concentrations in ponds that currently lack fish.
- *Develop remediation criteria for sediments.* Since it was determined to be the only bioaccumulative chemical with the potential to cause risk, concentrations of Aroclor-1254 in sediments intended to be protective of herons and mallards were estimated from site-specific concentration ratios. Multiple criteria were calculated for a range of site-use scenarios to aid in decisions on remedial actions.
- *Evaluate exposure of receptors in di-n-butylphthalate in aquatic prey.* Concentrations of di-n-butylphthalate in abiotic media were used in each pond where they were detected. Bioconcentration of di-n-butylphthalate was estimated for each pond using surface water data.

The risk characterization had two primary goals; 1) refine risk estimates through the use of less conservative and more realistic assumptions and characterize remaining uncertainty; and 2) identify areas, chemicals, and media contributing most to risk.

### ***Risks Characterized from Aroclor 1254***

Aroclor 1254 was detected in several of the biota samples but at concentrations much less than those predicted by generic log  $K_{ow}$ -based uptake models. In order to predict Aroclor 1254 concentrations in biota where samples were not available, the ratio of Aroclor 1254 in tissues to those found in sediments were calculated for each tissue type. Bioaccumulation factors ranged from 0.1 for salamander larvae in pond B-1 to 3.3 for fathead minnows in Pond B-4 (Table A7.4).

Risks were first assessed using measured PCB concentrations in fish and invertebrate tissues and were found to be negligible. As an additional step, the ratios of Aroclor 1254 in tissues and sediments were also used to estimate potential risk to the mallard and heron receptors. Protective sediment concentrations were calculated based on exposure models assuming varying degrees of site use. These sediment concentrations, which were termed environmental effects criteria (EECs), varied with the intensity of site use and the complexity of the food chains in each of the ponds. The lowest EECs were based on the highest level of site use and the longest food chains. All EEC calculations were based on organic carbon normalized sediment concentrations and lipid-normalized PCB concentrations in tissues and are presented in Table A7.15.

For mallards, all ponds had PCB concentrations less than the most restrictive EEC which assumed 100% use of that specific pond. This was assumed to indicate that risks to the mallard were low from PCBs.

For longer food chains, the risk evaluation indicated potential risks to the heron in Ponds B-1, B-2 and B-3. Maximum Aroclor 1254 concentrations exceeded the EECs for site use greater than 20 percent in Pond B-2 and 30 percent in Ponds B-1 and B-3. Mean Aroclor 1254 concentrations exceeded the 40 percent site use EEC in Pond B-2, 70 percent in Pond B-1 and 90 percent in Pond B-3.

For shorter food chains (forage fish only) no risks at even maximum concentrations were predicted for either herons or mallards in any pond. Additionally, herons were not expected to be at risk in the most contaminated pond (Pond B-2) unless more than 20 percent of their diet were composed of piscivorous fish from that pond using maximum exposures. Using mean exposures, herons were not predicted to be at risk unless they spent 45 percent of their time feeding exclusively on piscivorous fish at Pond B-2.

### ***Risks Characterized from Mercury***

Mercury was identified as a contaminant of concern in the B and C-series ponds as well as the old landfill area. In each area, mercury was included as a contaminant of concern due to measured or estimated concentrations in fish tissues. Mercury was detected in 2 of 13 fish collected in Pond C-1 with an MDC equal to 0.47 mg/kg. Mercury was identified as a contaminant of concern in the old landfill due to fish concentrations calculated from maximum detected concentrations in surface water. Pond sediments in Pond C-1 were assumed to be the likely source of mercury uptake into fish tissues, however, only 15 percent of the fish collected from the pond had detectable levels of mercury indicating some uncertainty in the measurement.

Risks were calculated assuming that herons feed exclusively from Pond C-1 and are exposed to the maximum detected concentrations. This is a highly conservative assumption since Pond C-1 is not large enough to support even one heron feeding exclusively. Considerably lower HQs ( $HQ = 2$ ) was calculated for the heron in the B-series ponds with the maximum detected concentration coming in Pond B-5.

### ***Risks Characterized from Di-n-butylphthalate***

Di-n-butylphthalate was identified as a contaminant of concern in Ponds A-2, A-3 and B-4 based on estimated bioconcentration from surface water. The following evidence was provided that suggests that di-n-butylphthalate may not be a persistent contaminant or represent unacceptable risk in the ponds:

The maximum concentration detected in surface water was 2 ug/L and all of the detectable quantities were estimated below the CRDL of 10 ug/L (all were J qualified).

Di-n-butylphthalate is a hydrophobic compound ( $\log K_{ow} = 4.57$ ) and would likely accumulate in the organic fraction of sediments if it were persistently present. Di-n-butylphthalate was not, however, detected in sediments from those ponds.

Di-n-butylphthalate is a common laboratory contaminant.

The risk estimate was based on an HQ equal to 2 calculated from maximum concentrations in surface water (from Pond A-3). All other detected concentrations were half as much as the MDC (1 ug/L) resulting in HQs equal to 1. Thus, the HQ > 1 was based on only 1 sample with all other HQs being equal to or less than 1.

### ***Risks Characterized from Antimony***

Antimony was identified as a contaminant of concern in Woman Creek sediments. A maximum HQ less than 2 was calculated based on 100 percent site use for a heron in the section of Woman Creek in the Old Landfill area. That segment of Woman Creek is seasonally intermittent and only supports a very minimal fish population. Herons have not been documented in that area and it is, therefore, unlikely that sufficient exposure needed to reach the calculated HQ would be possible.

### ***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 all AEUs in regards to populations and overall ecosystem health. For those EUs that were directly addressed in DOE (1996), comparisons of the concentrations discussed in the risk characterization to current media concentrations can be used to determine if the conclusions reached in DOE (1996) are applicable to current conditions. In all AEUs, including those not directly addressed in DOE (1996), EECs for PCBs can be used as concentrations predictive of risk. For other contaminants of concern, current concentrations can be compared to those used to draw conclusions in the DOE (1996) risk characterization.

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 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.

## **5.4 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 neither the PMJM nor predatory birds are threatened with PCB contamination from RFETS.

### ***Application to the CRA and Uncertainties***

This study incorporates several lines of evidence within its design. The sediment and tissue analysis will be used as a line of evidence for NW AEU, SW AEU, 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 evaluated the potential effects of PCBs in sediment to predatory birds that may feed on organisms that are exposed to PCB-contaminated sediment. This assessment was expanded upon by DOE (1996) and the results of this sampling effort were utilized in that risk assessment. The results of the DOE (1996) study are relied upon to help categorize current risk to waterfowl and wading birds.

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.

## **6.0 CHEMICAL LOADING ANALYSES**

### **6.3 DOE, 2004**

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 AEU. The methods, conclusions, and application to the CRA for water year 2003 are provided here.

The automated monitoring program is intended to meet 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 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. 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 necessarily 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.

The aquatic ecosystems are clearly limited by stressors other than chemicals related to RFETS activities. Habitat quality and quantity are limited, much of the time by inadequate flows. The studies above indicate that some nutrient pollution is and has occurred, which may have affected the aquatic ecology. While chemicals are present in these systems, physical factors such as interrupted flow, stream bank erosion, etc. were cited repeatedly by numerous authors as the primary factors influencing the RFETS aquatic communities. Accelerated action activities have been completed since these investigations took place; thus these study results represent a conservative, worse case scenario with respect to chemical contamination.

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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	Wolaver et al. 1993	DOE, 1996	
		Exponent, 1998			
		Aquatics Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
		WWE Inc., 2003			
		WWE Inc., 1995			
SW AEU	Stiger, 1994	Ebasco, 1992	DOE, 1996	Stiger, 1994	DOE, 2004
	DOE, 1996	DOE, 1996	Wolaver et al. 1993	DOE, 1996	
		Exponent, 1998			
		Aquatic Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
		WWE Inc., 2003			
		WWE Inc., 1995			
WC AEU	Stiger, 1994	Ebasco, 1992	DOE, 1996	DOE, 1996	DOE, 2004
		DOE, 1996	Wolaver et al. 1993		
		Aquatic Assoc., 1998			
		Kaiser-Hill, 1999, 2000 and 2001			
		Aquatic Assoc., 2003			
		WWE Inc., 1995			
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.

**Table A7.2**  
**Unvalidated Sediment Sampling Results (units ug/kg)**

<b>A Ponds</b>	<b>Mean* A-1254</b>	<b>Range</b>	<b>Mean A-1248</b>	<b>Range</b>
A 1	75.9	44-88	ND	20
A 2	83.8	20-160	ND	20
A 3	25	20-45	ND	20
A 4	ND	20	ND	20
B 1	868	320-1600	253.6	88-470
B 2	2,073	930-3800	589	20-1500
B 3	572	230-1300	ND	20
B 4	188	120-220	ND	20
B 5	ND	20	ND	20
C 1	ND	20	ND	20
C 2	ND	20	ND	20

(\*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**

<b>Pond</b>	<b>Biota Type</b>	<b>Number of Samples</b>	<b>Detection Frequency</b>	<b>Mean<sup>a</sup> (ug/kg)</b>	<b>Standard Deviation<sup>1</sup> (ug/kg)</b>
A-1	None	N/A	N/A	N/A	N/A
A-2	Benthic insect	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
C-1	Crayfish	3	0/3	N/A	N/A
C-1	Bluegill	2	2/2	52.5	23.33
C-1	Chub	100	1/1	100	N/A
C-2	Crayfish	2	0/2	N/A	N/A
C-2	Fathead minnow	2	2/2	43	14.14

<sup>a</sup> Mean and standard deviation values were calculated using the values reported for the "real" Aroclor-1254 detections.

N/A = Not applicable.

Source: DOE 1996; Stiger 1994.

**Table A7.4**  
**Aroclor-1254 Concentration Ratios in Sediment and Biological Tissues<sup>a</sup>**

Pond <sup>b</sup> (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 <sup>c</sup> (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	0.04	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

<sup>a</sup> Mean for pond.

<sup>b</sup> Data presented only for ponds in which Aroclor-1254 was detected in both sediment and biota.

<sup>c</sup> Assume 1% lipids.

Source: DOE 1996.

**Table A7.5**  
**Summary of Community Data from Ebasco 1992**

<b>Station</b>	<b>AEU</b>	<b>Type</b>	<b>Location</b>	<b>Phytoplankton Total Taxa</b>	<b>Periphyton Total Taxa</b>	<b>Benthic Invertebrates Total Taxa: Spring 1991</b>	<b>Benthic Invertebrates Total Taxa: Fall 1991</b>	<b>Fish Total Taxa</b>
SWA1	NW	Pond	A1	18	10		24	
SWA2	NW	Pond	A2	5	8			
SWA3	NW	Pond	A3	15	4			
SWA4	NW	Pond	A4	16	22			
SWB1	SW	Pond	B1		21		19	0
SWB2	SW	Pond	B2		18		8	0
SWB3	SW	Pond	B3		24		24	0
SWB4	SW	Pond	B4		25		18	1
SWB5	SW	Pond	B5				3	1
SWO3	SW	Pond	Flume	21	19	9	5	1
WAR11	SW	Stream	Walnut Creek			8		1
SWC1	WC	Pond	C1	48	41	6	10	7
SWC2	WC	Pond	C2	37	60	17	5	1
WOR12	WC	Stream	WC tributary		27	13	14	1
SW107	WC	Stream	WC tributary			15		1
SW39	WC	Stream	WC			18	19	1
SW33	WC	Stream	WC			17	33	2
SW104	WC	Stream	WC tributary			27	30	
WOR13	WC	Stream	WC			29	21	1
WOR11	WC	Stream	WC			25	29	4
SW26	WC	Stream	WC			15		5
WOPO1	WC	Stream	WC			11		2
WOPO2	WC	Stream	WC			6		5

**Table A7.6**  
**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. <sup>a</sup>	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
Density Weighted TV	5.2	8.9	5.6	6.1	6.9	6.9	8.4	8	7	5.7	6.1	6.9	5.6	8.3
Taxa Mean TV	6.7	7.8	7.5	7.5	7.3	7.8	8	8	7.7	7	7	8	7.5	7.9
Weighted TV Rank	1.0	14	2	6	7	8	13	11	10	4	5	9	3	12

<sup>a</sup> Maximum Shannon-Weiner Diversity based on richness.

TV - Tolerance Valaue

Source: DOE 1996.

**Table A7.7**  
**Fish Species Found During Pond Sampling in 1999**

<b>Stream Drainage</b>	<b>Sample Location</b>	<b>Common Name</b>
North Walnut Creeek	Pond A-2	Fathead Minnow
North Walnut Creeek	Pond A-3	Fathead Minnow
North Walnut Creeek	Pond A-4	Fathead Minnow
Walnut Creek	Indiana Pond	Fathead Minnow
South Walnut Creek	Pond B-4	Fathead Minnow
South Walnut Creek	Pond B-5	Fathead Minnow
Woman Creek	Pond C-1	Smallmouth Bass
Woman Creek	Pond C-1	Fathead Minnow
Woman Creek	Pond C-1	Creek Chub
Woman Creek	Pond C-2	Fathead Minnow
Smart Ditch	Pond D-1	Fathead Minnow
Smart Ditch	Pond D-2	Fathead Minnow

Source: Kaiser Hill 2000

**Table A7.8**  
**Summary of Aquatics Associates Sampling in 2001 and 2002**

Location	Habitat Score			Fish taxa and abundance
	Fall 2001	Fall 2002	Summer	2001
WC1	153	153	147	
WC2	130	130	120	
WC3	132	130	130	FHM - 298
WC4 (1)	144	141	n/a	FHM - 2
WC5 (1)	143	147	n/a	FHM - 1
WO1	157	157	147	CC - 11; LND - 1
WO2	158	158	148	CC - 46
WO3	**	**		
WO4	**	**		

\*\* Lack of water precluded assessment

(1) Habitat scores are based on conditions when discharges from terminal ponds occurring; otherwise channel is dry most of the year (total score - 0)

FHM - Fathead minnow

CC - Creek Chub

LND - Longnose dace

**Table A7.9  
Sediment Bioassay Test Results**

Test Media	Sample Date	<i>Hyalella azteca</i>							<i>Chironomus tentans</i>			
		Control % Survival	Test % Survival	Survival T Statistic	Survival T <sub>0.05</sub> Value	Control Mean Wt. <sup>a</sup>	Test Mean Wt.	Mean Wt. T Statistic	Control % Survival	Test % Survival	Survival T Statistic	Survival T <sub>0.05</sub> Value
Pond A-1	10/29/92	74 <sup>g</sup>	95	N/A	N/A	0.06	0.11	N/A	N/A <sup>d</sup>	N/A	N/A	N/A
Pond A-2	11/12/92	74 <sup>g</sup>	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 <sup>e</sup>	-2.618 <sup>f</sup>	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	38 <sup>g</sup>	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 <sup>h</sup>	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 <sup>b</sup>	11/9/92	74 <sup>g</sup>	80	N/A	N/A	0.06	0.14	N/A	N/A	N/A	N/A	N/A
Pond C-1 <sup>c</sup>	11/9/92	74 <sup>g</sup>	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 <sup>g</sup>	96	N/A	N/A	0.06	0.16	N/A	N/A	N/A	N/A	N/A

<sup>a</sup> Mean Weight in grams.

<sup>b</sup> Sediment material from.

<sup>c</sup> Sediment material from

<sup>d</sup> Tests not conducted.

<sup>e</sup> Sample showed evidence of reproduction.

<sup>f</sup> Statistically higher than control; attributed to resident *Chironomus* in test sediments.

<sup>g</sup> Control treatment below acceptable test limit of 80 percent survival.

<sup>h</sup> Statistically lower than control treatment.

N/A = Data not available.

Source: DOE 1996.

**Table A7.10**  
**Comparison of Surface Sediment ECOPCs in RFETS Ponds to Contaminant Concentrations in Sediments Used in Toxicity Testing**

ECOPC	NOEC ESL	LOEC	Units	Concentrations Measured in Sediments used for Toxicity Testing											Pond A-1		Pond A-2		Pond A-3		Pond
				Pond A1	Pond A-2	Pond A-3	Pond A-4	Pond B-1	Pond B-2	Pond B-3	Pond B-4	Pond B-5	Pond C-1	Pond C-2	Minimum Detect	Maximum Detect	Minimum Detect	Maximum Detect	Minimum Detect	Maximum Detect	Minimum Detect
<b>Inorganics (mg/kg)</b>																					
Aluminum	15,900	58,000	mg/kg	10300	7480	19900	22900	8330	7850	11990	14550	17900	N/A	12200	11000	25,000	7800	26000	25000	25000	14000
Antimony	2.00	3.20	mg/kg	<21.6	<27.5	<19.9	<37.4	<33.1	<27.4	13.45	17.83	<27.1	N/A	<12.8	ND	ND	ND	ND	ND	ND	1
Barium	189	287	mg/kg	173	158	172	206	198	157	176.5	193	194	N/A	226	64	220	73	260	200	200	140
Cadmium	0.990	4.98	mg/kg	<1.6	<2	<1.5	3.1	4.8	3.4	4.6	2.55	<2	N/A	<2.8	0	1.30	0	1	0	0	0
Copper	31.6	149	mg/kg	24.7	20.4	24.1	33.4	67.5	<34	66.2	34.3	29.9	N/A	35.9	11	25.0	7	26	25	25	17
Fluoride	0.010	7.00	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	18	27.00	9	30	24	24	15
Iron	20,000	280,000	mg/kg	17800	13800	22600	22900	13000	15800	14800	20100	21100	N/A	19600	8400	24,000	7700	28000	21000	21000	17000
Lead	35.8	128	mg/kg	39	29.4	26.8	35.9	113	44.4	51.5	47.1	36.8	N/A	34.6	21	29.0	8	33	29	29	18
Manganese	630	1,700	mg/kg	315	323	354	460	218	219	210	326	308	N/A	602	200	500	310	1100	520	520	240
Mercury	0.180	1.06	mg/kg	0.35	<0.12	<0.09	<0.17	0.31	0.47	0.288	0.14	<0.12	N/A	0.68	0	0.180	0	0	0	0	0
Nickel	22.7	48.6	mg/kg	17	28.3	<14.1	<26.4	<23.4	<19.4	28.25	16.45	23.8	N/A	17.1	9	22.0	6	22	20	20	15
Selenium	0.950	1.73	mg/kg	<0.76	<1	<0.72	1.9	<1.2	<0.99	<0.485	<0.38	<0.98	N/A	<1.8	1	1.800	ND	ND	ND	ND	2
Silver	1.00	1.60	mg/kg	<2.3	<3	<2.2	<4.1	124	207	173.5	51.58	<2.9	N/A	<1.9	1	0.81	0	0	ND	ND	ND
Zinc	121	459	mg/kg	93.2	63.9	146	169	314	140	235	248.5	174	N/A	201	55	140	33	110	540	540	66
<b>Organics (ug/kg)</b>																					
2-Methylnaphthalene	20.2	201	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND						
4-Methylphenol	12.3	670	ug/kg					<1467.5	<820	<390	<315	<780	N/A	<3000	ND						
4,4'-DDT	4.16	62.9	ug/kg	<29	<37	<28	<48	<46	<39	<18.75	<14.75		N/A	<150	ND						
Acenaphthene	6.71	89.0	ug/kg	<600	<770	<590	<990	1274.5	<820	<390	<315	<780	N/A	<3000	ND	ND	180	180	ND	ND	ND
Anthracene	57.2	845	ug/kg	<600	<770	<590	<990	1310	<820	<390	<315	<780	N/A	<3000	ND	ND	210	210	ND	ND	ND
Benzo(a)anthracene	108	1,050	ug/kg	170	<770	<590	<990	785	120	<390	<315	<780	N/A	<3000	73	120	52	52	ND	ND	ND
Benzo(a)pyrene	150	1,450	ug/kg	190	<770	<590	<990	1450	<820	<390	385	<780	N/A	<3000	83	150	51	51	ND	ND	ND
Benzo(g,h,i)perylene	13.0	280	ug/kg	150	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	60	100	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	240	750	ug/kg	110	<770	<590	<990	645	<820	<390	290	<780	N/A	<3000	63	100	ND	ND	ND	ND	ND
Bromomethane	3.43		ug/kg					<76	<25	<61	<19	<24	N/A	<46	ND						
Chrysene	166	1,290	ug/kg	220	<770	170	<990	1350	200	405	495	<780	N/A	<3000	82	150	60	60	ND	ND	ND
Dibenz(a,h)anthracene	33.0	240	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND						
Fluoranthene	423	2,230	ug/kg	510	<770	360	<990	2900	400	745	1025	190	N/A	<3000	170	300	89	89	ND	ND	ND
Fluorene	77.4	536	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND						
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	140	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	50	90	210	210	ND	ND	ND
Naphthalene	176	561	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND						
PCB-1254	40.0	300	ug/kg	350	<370	<280	<480	3005	6600	2150	625	<370	N/A	<1500	73	88	89	130	45	45	ND
PCB-1260	40.0		ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	204	1,170	ug/kg	300	<770	170	<990	1450	270	400	520	<780	N/A	<3000	87	140	190	190	ND	ND	ND
Pyrene	195	1,520	ug/kg	420	83	290	<990	1750	210	715	910	160	N/A	<3000	ND						
Total PAHs	1,610	22,800	ug/kg	4250	5858	4475	7920	23519	5710	7020	7175	<780	N/A	<3000	543	1,330	1106	1106	ND	ND	ND
Total PCBs	40.0	676	ug/kg	495	303.5	280	480	3450	6795	2652.5	772.5	370	N/A	1500	73	88	89	130	45	45	ND

**duplicates** duplicate values were averaged

< = Value is less than the reported value, less than detection

For duplicate values that were averaged, < indicates both duplicate measures were less than detection at the average of the non detect concentrations

Total PAHs and Total PCBs are summed values for the respective parameters

For Total PAHs and Total PCBs based on duplicate measures, average values for each respective parameter were summed.

For all non detect values that were averaged, 1/2 the detection limit value was used

<NOEC indicates that the parameter was not identified as an ECOPC

**Table A7.10**  
**Comparison of Surface Sediment ECOPCs in RFETS Ponds to Contaminant Concentrations in Sediments Used in Toxicity Testing**

ECOPC	NOEC ESL	LOEC	Units	Concentrations Measured in Sediments used for Toxicity Testing											Maximum Detect
				Pond A1	Pond A-2	Pond A-3	Pond A-4	Pond B-1	Pond B-2	Pond B-3	Pond B-4	Pond B-5	Pond C-1	Pond C-2	
				i A-4											
<b>Inorganics (mg/kg)</b>															
Aluminum	15,900	58,000	mg/kg	10300	7480	19900	22900	8330	7850	11990	14550	17900	N/A	12200	26000
Antimony	2.00	3.20	mg/kg	<21.6	<27.5	<19.9	<37.4	<33.1	<27.4	13.45	17.83	<27.1	N/A	<12.8	41
Barium	189	287	mg/kg	173	158	172	206	198	157	176.5	193	194	N/A	226	206
Cadmium	0.990	4.98	mg/kg	<1.6	<2	<1.5	3.1	4.8	3.4	4.6	2.55	<2	N/A	<2.8	3
Copper	31.6	149	mg/kg	24.7	20.4	24.1	33.4	67.5	<34	66.2	34.3	29.9	N/A	35.9	27
Fluoride	0.010	7.00	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	33
Iron	20,000	280,000	mg/kg	17800	13800	22600	22900	13000	15800	14800	20100	21100	N/A	19600	22900
Lead	35.8	128	mg/kg	39	29.4	26.8	35.9	113	44.4	51.5	47.1	36.8	N/A	34.6	36
Manganese	630	1,700	mg/kg	315	323	354	460	218	219	210	326	308	N/A	602	460
Mercury	0.180	1.06	mg/kg	0.35	<0.12	<0.09	<0.17	0.31	0.47	0.288	0.14	<0.12	N/A	0.68	0
Nickel	22.7	48.6	mg/kg	17	28.3	<14.1	<26.4	<23.4	<19.4	28.25	16.45	23.8	N/A	17.1	26
Selenium	0.950	1.73	mg/kg	<0.76	<1	<0.72	1.9	<1.2	<0.99	<0.485	<0.38	<0.98	N/A	<1.8	2
Silver	1.00	1.60	mg/kg	<2.3	<3	<2.2	<4.1	124	207	173.5	51.58	<2.9	N/A	<1.9	ND
Zinc	121	459	mg/kg	93.2	63.9	146	169	314	140	235	248.5	174	N/A	201	169
<b>Organics (ug/kg)</b>															
2-Methylnaphthalene	20.2	201	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
4-Methylphenol	12.3	670	ug/kg					<1467.5	<820	<390	<315	<780	N/A	<3000	ND
4,4'-DDT	4.16	62.9	ug/kg	<29	<37	<28	<48	<46	<39	<18.75	<14.75		N/A	<150	ND
Acenaphthene	6.71	89.0	ug/kg	<600	<770	<590	<990	1274.5	<820	<390	<315	<780	N/A	<3000	ND
Anthracene	57.2	845	ug/kg	<600	<770	<590	<990	1310	<820	<390	<315	<780	N/A	<3000	ND
Benzo(a)anthracene	108	1,050	ug/kg	170	<770	<590	<990	785	120	<390	<315	<780	N/A	<3000	ND
Benzo(a)pyrene	150	1,450	ug/kg	190	<770	<590	<990	1450	<820	<390	385	<780	N/A	<3000	ND
Benzo(g,h,i)perylene	13.0	280	ug/kg	150	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
Benzo(k)fluoranthene	240	750	ug/kg	110	<770	<590	<990	645	<820	<390	290	<780	N/A	<3000	ND
Bromomethane	3.43		ug/kg					<76	<25	<61	<19	<24	N/A	<46	ND
Chrysene	166	1,290	ug/kg	220	<770	170	<990	1350	200	405	495	<780	N/A	<3000	ND
Dibenz(a,h)anthracene	33.0	240	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
Fluoranthene	423	2,230	ug/kg	510	<770	360	<990	2900	400	745	1025	190	N/A	<3000	ND
Fluorene	77.4	536	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	140	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
Naphthalene	176	561	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND
PCB-1254	40.0	300	ug/kg	350	<370	<280	<480	3005	6600	2150	625	<370	N/A	<1500	ND
PCB-1260	40.0		ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND
Phenanthrene	204	1,170	ug/kg	300	<770	170	<990	1450	270	400	520	<780	N/A	<3000	ND
Pyrene	195	1,520	ug/kg	420	83	290	<990	1750	210	715	910	160	N/A	<3000	ND
Total PAHs	1,610	22,800	ug/kg	4250	5858	4475	7920	23519	5710	7020	7175	<780	N/A	<3000	ND
Total PCBs	40.0	676	ug/kg	495	303.5	280	480	3450	6795	2652.5	772.5	370	N/A	1500	ND

duplicates duplicate values were averaged  
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 Total PAHs and Total PCBs are summed values for the respective parameters  
 For Total PAHs and Total PCBs based on duplicate measures, average values for each respective parameter were summed.  
 For all non detect values that were averaged, 1/2 the detection limit value was used  
 <NOEC indicates that the parameter was not identified as an ECOPC

**Table A7.10**  
**Comparison of Surface Sediment ECOPCs in RFETS Ponds to Contaminant Concentrations in Sediments Used in Toxicity Testing**

ECOPC	NOEC ESL	LOEC	Units	Concentrations Measured in Sediments used for Toxicity Testing											Pond A-5 (Flume Pond)		Pond B-4		Pond B-5		Pond
				Pond A1	Pond A-2	Pond A-3	Pond A-4	Pond B-1	Pond B-2	Pond B-3	Pond B-4	Pond B-5	Pond C-1	Pond C-2	Minimum Detect	Maximum Detect	Minimum Detect	Maximum Detect	Minimum Detect	Maximum Detect	Minimum Detect
				<b>Inorganics (mg/kg)</b>																	
Aluminum	15,900	58,000	mg/kg	10300	7480	19900	22900	8330	7850	11990	14550	17900	N/A	12200	7710	21000	7800	29000	6500	20400	23000
Antimony	2.00	3.20	mg/kg	<21.6	<27.5	<19.9	<37.4	<33.1	<27.4	13.45	17.83	<27.1	N/A	<12.8	ND	ND	3	3	1	1	1
Barium	189	287	mg/kg	173	158	172	206	198	157	176.5	193	194	N/A	226	120	220	110	220	73	152	250
Cadmium	0.990	4.98	mg/kg	<1.6	<2	<1.5	3.1	4.8	3.4	4.6	2.55	<2	N/A	<2.8	ND	ND	1	2	0	1	1
Copper	31.6	149	mg/kg	24.7	20.4	24.1	33.4	67.5	<34	66.2	34.3	29.9	N/A	35.9	9	21	14	29	8	21	23
Fluoride	0.010	7.00	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	11	22	13	32	8	22	23
Iron	20,000	280,000	mg/kg	17800	13800	22600	22900	13000	15800	14800	20100	21100	N/A	19600	13000	22000	13000	24000	11000	18800	25000
Lead	35.8	128	mg/kg	39	29.4	26.8	35.9	113	44.4	51.5	47.1	36.8	N/A	34.6	13	21	15	39	10	22	26
Manganese	630	1,700	mg/kg	315	323	354	460	218	219	210	326	308	N/A	602	130	330	110	340	160	317	200
Mercury	0.180	1.06	mg/kg	0.35	<0.12	<0.09	<0.17	0.31	0.47	0.288	0.14	<0.12	N/A	0.68	ND	ND	0	0	0	0	0
Nickel	22.7	48.6	mg/kg	17	28.3	<14.1	<26.4	<23.4	<19.4	28.25	16.45	23.8	N/A	17.1	12	19	9	23	10	20	20
Selenium	0.950	1.73	mg/kg	<0.76	<1	<0.72	1.9	<1.2	<0.99	<0.485	<0.38	<0.98	N/A	<1.8	ND	ND	2	2	1	1	3
Silver	1.00	1.60	mg/kg	<2.3	<3	<2.2	<4.1	124	207	173.5	51.58	<2.9	N/A	<1.9	1	1	2	3	0	0	ND
Zinc	121	459	mg/kg	93.2	63.9	146	169	314	140	235	248.5	174	N/A	201	55	130	130	510	43	120	100
<b>Organics (ug/kg)</b>																					
2-Methylnaphthalene	20.2	201	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	12.3	670	ug/kg					<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	4.16	62.9	ug/kg	<29	<37	<28	<48	<46	<39	<18.75	<14.75		N/A	<150	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	6.71	89.0	ug/kg	<600	<770	<590	<990	1274.5	<820	<390	<315	<780	N/A	<3000	ND	ND	110	110	ND	ND	74
Anthracene	57.2	845	ug/kg	<600	<770	<590	<990	1310	<820	<390	<315	<780	N/A	<3000	ND	ND	73	140	ND	ND	90
Benzo(a)anthracene	108	1,050	ug/kg	170	<770	<590	<990	785	120	<390	<315	<780	N/A	<3000	ND	ND	80	300	ND	ND	69
Benzo(a)pyrene	150	1,450	ug/kg	190	<770	<590	<990	1450	<820	<390	385	<780	N/A	<3000	ND	ND	100	320	ND	ND	66
Benzo(g,h,i)perylene	13.0	280	ug/kg	150	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	90	270	ND	ND	150
Benzo(k)fluoranthene	240	750	ug/kg	110	<770	<590	<990	645	<820	<390	290	<780	N/A	<3000	ND	ND	270	310	ND	ND	150
Bromomethane	3.43		ug/kg					<76	<25	<61	<19	<24	N/A	<46	ND	ND	ND	ND	ND	ND	ND
Chrysene	166	1,290	ug/kg	220	<770	170	<990	1350	200	405	495	<780	N/A	<3000	ND	ND	74	350	ND	ND	65
Dibenz(a,h)anthracene	33.0	240	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	65	92	ND	ND	530
Fluoranthene	423	2,230	ug/kg	510	<770	360	<990	2900	400	745	1025	190	N/A	<3000	ND	ND	170	750	84	84	120
Fluorene	77.4	536	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	94	94	ND	ND	ND
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	140	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	74	200	ND	ND	340
Naphthalene	176	561	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND	ND	ND	ND	ND
PCB-1254	40.0	300	ug/kg	350	<370	<280	<480	3005	6600	2150	625	<370	N/A	<1500	ND	ND	120	220	ND	ND	94
PCB-1260	40.0		ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	204	1,170	ug/kg	300	<770	170	<990	1450	270	400	520	<780	N/A	<3000	ND	ND	110	630	ND	ND	310
Pyrene	195	1,520	ug/kg	420	83	290	<990	1750	210	715	910	160	N/A	<3000	ND	ND	580	700	ND	ND	310
Total PAHs	1,610	22,800	ug/kg	4250	5858	4475	7920	23519	5710	7020	7175	<780	N/A	<3000	ND	ND	434	4496	84	84	790
Total PCBs	40.0	676	ug/kg	495	303.5	280	480	3450	6795	2652.5	772.5	370	N/A	1500	ND	ND	120	220	ND	ND	94

duplicates duplicate values were averaged  
 < = Value is less than the reported value, less than detection  
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 <NOEC indicates that the parameter was not identified as an ECOPC

**Table A7.10**  
**Comparison of Surface Sediment ECOPCs in RFETS Ponds to Contaminant Concentrations in Sediments Used in Toxicity Testing**

ECOPC	NOEC ESL	LOEC	Units	Concentrations Measured in Sediments used for Toxicity Testing											Pond C-1			Pond C-2		
															Maximum Detect	Minimum Detect	Maximum Detect			
				Pond A1	Pond A-2	Pond A-3	Pond A-4	Pond B-1	Pond B-2	Pond B-3	Pond B-4	Pond B-5	Pond C-1	Pond C-2						
<b>Inorganics (mg/kg)</b>																				
Aluminum	15,900	58,000	mg/kg	10300	7480	19900	22900	8330	7850	11990	14550	17900	N/A	12200	31000	4460	22000			
Antimony	2.00	3.20	mg/kg	<21.6	<27.5	<19.9	<37.4	<33.1	<27.4	13.45	17.83	<27.1	N/A	<12.8	1	ND	ND			
Barium	189	287	mg/kg	173	158	172	206	198	157	176.5	193	194	N/A	226	330	74	226			
Cadmium	0.990	4.98	mg/kg	<1.6	<2	<1.5	3.1	4.8	3.4	4.6	2.55	<2	N/A	<2.8	1	0	0			
Copper	31.6	149	mg/kg	24.7	20.4	24.1	33.4	67.5	<34	66.2	34.3	29.9	N/A	35.9	30	7	25			
Fluoride	0.010	7.00	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	30	9	36			
Iron	20,000	280,000	mg/kg	17800	13800	22600	22900	13000	15800	14800	20100	21100	N/A	19600	31000	8090	29000			
Lead	35.8	128	mg/kg	39	29.4	26.8	35.9	113	44.4	51.5	47.1	36.8	N/A	34.6	38	11	35			
Manganese	630	1,700	mg/kg	315	323	354	460	218	219	210	326	308	N/A	602	970	260	602			
Mercury	0.180	1.06	mg/kg	0.35	<0.12	<0.09	<0.17	0.31	0.47	0.288	0.14	<0.12	N/A	0.68	0	0	1			
Nickel	22.7	48.6	mg/kg	17	28.3	<14.1	<26.4	<23.4	<19.4	28.25	16.45	23.8	N/A	17.1	24	5	21			
Selenium	0.950	1.73	mg/kg	<0.76	<1	<0.72	1.9	<1.2	<0.99	<0.485	<0.38	<0.98	N/A	<1.8	3	1	1			
Silver	1.00	1.60	mg/kg	<2.3	<3	<2.2	<4.1	124	207	173.5	51.58	<2.9	N/A	<1.9	ND	ND	ND			
Zinc	121	459	mg/kg	93.2	63.9	146	169	314	140	235	248.5	174	N/A	201	140	45	201			
<b>Organics (ug/kg)</b>																				
2-Methylnaphthalene	20.2	201	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND			
4-Methylphenol	12.3	670	ug/kg					<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND			
4,4'-DDT	4.16	62.9	ug/kg	<29	<37	<28	<48	<46	<39	<18.75	<14.75		N/A	<150	ND	ND	ND			
Acenaphthene	6.71	89.0	ug/kg	<600	<770	<590	<990	1274.5	<820	<390	<315	<780	N/A	<3000	320	ND	ND			
Anthracene	57.2	845	ug/kg	<600	<770	<590	<990	1310	<820	<390	<315	<780	N/A	<3000	450	ND	ND			
Benzo(a)anthracene	108	1,050	ug/kg	170	<770	<590	<990	785	120	<390	<315	<780	N/A	<3000	190	ND	ND			
Benzo(a)pyrene	150	1,450	ug/kg	190	<770	<590	<990	1450	<820	<390	385	<780	N/A	<3000	170	ND	ND			
Benzo(g,h,i)perylene	13.0	280	ug/kg	150	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	150	ND	ND			
Benzo(k)fluoranthene	240	750	ug/kg	110	<770	<590	<990	645	<820	<390	290	<780	N/A	<3000	150	ND	ND			
Bromomethane	3.43		ug/kg					<76	<25	<61	<19	<24	N/A	<46	ND	ND	ND			
Chrysene	166	1,290	ug/kg	220	<770	170	<990	1350	200	405	495	<780	N/A	<3000	190	ND	ND			
Dibenz(a,h)anthracene	33.0	240	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	530	ND	ND			
Fluoranthene	423	2,230	ug/kg	510	<770	360	<990	2900	400	745	1025	190	N/A	<3000	330	140	140			
Fluorene	77.4	536	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND			
Indeno(1,2,3-cd)pyrene	17.0	250	ug/kg	140	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	500	ND	ND			
Naphthalene	176	561	ug/kg	<600	<770	<590	<990	<1467.5	<820	<390	<315	<780	N/A	<3000	ND	ND	ND			
PCB-1254	40.0	300	ug/kg	350	<370	<280	<480	3005	6600	2150	625	<370	N/A	<1500	94	ND	ND			
PCB-1260	40.0		ug/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND			
Phenanthrene	204	1,170	ug/kg	300	<770	170	<990	1450	270	400	520	<780	N/A	<3000	360	ND	ND			
Pyrene	195	1,520	ug/kg	420	83	290	<990	1750	210	715	910	160	N/A	<3000	310	ND	ND			
Total PAHs	1,610	22,800	ug/kg	4250	5858	4475	7920	23519	5710	7020	7175	<780	N/A	<3000	2950	140	140			
Total PCBs	40.0	676	ug/kg	495	303.5	280	480	3450	6795	2652.5	772.5	370	N/A	1500	94	ND	ND			

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 For Total PAHs and Total PCBs based on duplicate measures, average values for each respective parameter were summed.  
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**Table A7.11  
Exposure Parameters for Heron and Mallard (DOE, 1996)**

Receptor	Total Ingestion Rate (kg/kg BW/day)	Intake Rate (kg/kg BW/day)				
		Fish	Benthic Macroinvertebrate	Vegetation	Sediment	Surface Water
Great Blue Heron	0.18	0.18 (100%)	0	0	0.004	0.045
Mallard	0.052	0	0.039 (75%)	0.013 (25%)	0.001	0.056

Ingestion Rates Taken From DOE (1996).

**Table A7.12**  
**Source Area Hazard Index for Mallard and Great Blue Heron**

<b>Source Area</b>	<b>Watershed</b>	<b>Mallard HI</b>	<b>GB Heron HI</b>
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

Based on screening-level risk estimates.

**Table A7.13**  
**Screening-Level Hazard Quotients Contributing to Initial Risk Estimates to Heron**

Source Area	ECOC	GB Heron HQ (% of HI)	Prey Est. Value Intake (mg/kg)	Sediment Concentration (mg/kg)	Total Intake Concentration <sup>a</sup> (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

<sup>a</sup> Total intake may be larger due to surface water contaminant intake, usually small portion.

ND = Not detected in laboratory samples.

Only presents those HQs that were greater than 1 in the screening-level risk assessment.

**Table A7.14**  
**Screening-Level Hazard Quotients Contributing to Initial Risk Estimates to Mallard**

Source Area	ECOC	Mallard HQ (% of HI)	Prey Est. Value Intake (mg/kg)	Sediment Concentration (mg/kg)	Total Intake Concentration <sup>a</sup> (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

<sup>a</sup> Total intake may be larger due to vegetation, soil or surface water contaminant intake, usually small portion.

ND = Not detected in laboratory samples.

Only presents those HQs that were greater than 1 in the screening-level risk assessment.

**Table A7.15  
Aroclor 1254 Sediment Concentrations Representative of NOAEL-Based HQs Equal to 1.**

Species	Trophic Levels Present	EEC <sup>1</sup> (mg/kg carbon)	Site Use Factor	TRV Used <sup>2</sup> (mg/kg BW day)
Mallard	Forage Fish Present	1230	0.1	0.17
		613	0.2	0.17
		409	0.3	0.17
		307	0.4	0.17
		245	0.5	0.17
		204	0.6	0.17
		175	0.7	0.17
		153	0.8	0.17
		136	0.9	0.17
		123	1	0.17
Heron	Forage Fish Present	1070	0.1	0.17
		537	0.2	0.17
		358	0.3	0.17
		268	0.4	0.17
		215	0.5	0.17
		179	0.6	0.17
		153	0.7	0.17
		134	0.8	0.17
		119	0.9	0.17
		107	1	0.17
Heron	Forage Fish and Aquatic Predators Present	221	0.1	0.14
		111	0.2	0.14
		73.8	0.3	0.14
		55.3	0.4	0.14
		44.3	0.5	0.14
		36.9	0.6	0.14
		31.6	0.7	0.14
		27.7	0.8	0.14
		24.6	0.9	0.14
		22.1	1	0.14

Full details are provided on Table N5-10 of DOE (1996)

<sup>1</sup> EECs are representative of sediment concentrations resulting in HQs = 1 using the TRVs provided.

- Maximum Biota to sediment transfer factors from site-specific data used.
- EECs are presented in mg PCB/kg carbon
- 1% lipid content in fish tissues is assumed,

<sup>2</sup> TRVs are NOAEL TRVs. The CRA Methodology NOAEL is 0.09 mg/kg BW/day.

The CRA Methodology LOAEL is 1.27 mg/kg BW/day.