Kootenai River Sediment Drilling: Contaminant Assessment Report (Report Prepared in Partial Fullfillment of Project Number 200200200: Restore Natural Recruitment of Kootenai River White Sturgeon)

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Executive Summary

The Kootenai Tribe of Idaho and partners are proposing a large-scale river restoration project for the Kootenai River between Ambush Rock (river mile 152) and Crossport (river mile159.2). Due to concern for potential effects of contaminants associated with dredge material, sediment contaminant analysis was required prior to project implementation. Contaminants of interest were identified and they included: 1) Organochlorine pesticides, 2) PCBs (congeners and aroclors), 3) metals, and 4) asbestos. Analysis of polyaromatic hydrocarbons (PAHs) was also conducted by the USGS, but data will be provided in a separate report. The US EPA and US Army Corps of Engineers' 1998 Inland Testing Manual was the primary source for sample design and guideline comparison; however, other sources were referenced to provide a more comprehensive review of results along with a consensus-based interpretation of data. A track-mounted sonic drill equipped with a 6-inch OD core barrel and a 7-inch OD outer casing was used to extract full-depth (surface to lacustrine clay or solid substrate; 30-70 feet) sediment cores from 20 sites within and below the potential restoration area. The results of sediment core sampling indicated the absence or minimal presence (<0.01%) of asbestos fibers. Therefore, it appears that asbestos is not a barrier to project implementation. Several metals, including arsenic, chromium, copper, lead and nickel exceeded screening criteria, indicating the potential for effects from dredged sediment. A total of nine organochlorine pesticide compounds were detected in the sediment samples. Concentrations of DDT in sediment from three sites between Ambush Rock and the US 95 bridge exceeded screening criteria, indicating a potential for effects from exposure to dredged sediment. The four dominant PCB congeners were from the Mono-, Tri-, and Penta- Biphenyl categories; howver, PCB congener concentrations were below recommended screeing criteria. Results indicate that potential bioaccumulation from dredged material would be similar to concentrations recently detected in Kootenai River fish tissues. However, bioaccumulation of organochlorine pesticides and PCBs could potentially increase in periphyton, plankton and macroinvertebrates following exposure to dredge material from some locations. Criteria established for individual chemical compounds do not address additive effects; however, assuming additive effects of organochlorine compounds (PCBs and pesticides), comparison of current tissue concentrations and potentially bioaccumulated concentrations with published literature suggests a potential for negative effects on salmonids and sturgeon. Sediment Quality Guidelines for some of the detected chemicals are either lacking or not established within ranges shown to potentially affect sturgeon; therefore, it is not possible to determine effects of these compounds in dredged sediments without further effects-based testing. In summary, although additive methods (TEQs, PECQs) indicate overall low toxicity of dredge sediment, criteria exceedances, potential for increased bioaccumulation, low organic carbon content, high method detection limits, and lack of comparative criteria preclude estimation of biological effects and suggest the need for biological testing with proposed dredge sediments prior to project implementation.

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Introduction

The Kootenai Tribe of Idaho and other partners are proposing a large-scale river restoration project for the Kootenai River between Ambush Rock (river mile 152) and Crossport (river mile159.2). Prior to the initiation of a large-scale restoration project that would require river bottom dredging and sediment disturbance, contaminant sampling is required in order to identify presence, bioavailability, and potential impacts of redistributed dredge material at the proposed restoration sites (EPA/USACE 1998).

The Kootenai River basin is a transboundary river system that traverses two of the lower 48 states (Montana/Idaho) and British Columbia, Canada (Kootenai River Network 2000). It is the second largest tributary to the Columbia River in terms of runoff volume and the third largest in terms of watershed area (Knudson 1994, Richards 1997). Multiple sources of historic contaminant input have been identified throughout the Kootenai River basin (Kruse 2000). Although implementation of reduction efforts has greatly reduced or eliminated many source inputs over the past 30 years, residual and current inputs remain throughout the watershed. Recent monitoring efforts have indicated the presence of organochlorine pesticides, PCBs and metals in the Kootenai River ecosystem within the Idaho and British Columbia reaches (Davidson and Kruse 2006, Kruse 2000, Kruse and Scarnecchia 2002, Kruse 2003, Kruse 2005, Kruse and Fernandez In Press). Several of the reported contaminant concentrations have been associated with levels that could potentially impact reproduction and physiological functions in aquatic organisms. Therefore, based on known historic input, recently documented presence, and significance in terms of potential effects resulting from sediment dredging activities, contaminants of interest have been identified and they include: 1) Organochlorine pesticides, 2) PCBs (congeners and aroclors), 3) metals, and 4) asbestos (tremolite). Analysis of polyaromatic hydrocarbons (PAHs) was also conducted by the USGS, but data will be provided in a separate report.

The Inland Testing Manual (EPA/USACE 1998) was the primary source for sample design and guideline comparison; however, other sources were referenced to provide a more comprehensive review of results along with a consensus-based interpretation of data. The ITM replaces a 1976 document titled "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual“. The new report provides a Tiered Approach to evaluating potential benthic impacts of deposited dredge material (Figure 1) and it contains up-to-date procedures for implementation of the Clean Water Act guidelines dealing with the evaluation of potential contaminant-related impacts associated with the discharge of dredged material in fresh, estuarine, and saline (near-coastal) waters.

Interpretations in this report are based on current Sediment Quality Guidelines (SQGs) established for both the United States and Canada. Although SQGs help to establish a level of understanding about contaminant effects associated with sediments, they should be used with caution. Ingersoll and MacDonald (2005) propose that SQG interpretations be used in the following manner:

- Historical data interpretation
- Problem chemical identification (before and after release)
- Decision tool for more detailed study
- Contaminant source link
- Regulatory action trigger

Interpretations for purposes of this report focus primarily on “Threshold Effects” (concentrations below which effects occur rarely and above which effects begin to occur) and “Probable Effects” (concentration above which effects occur frequently; Ingersoll and MacDonald 2005); however, in some cases, sub-criteria associated with each of these effects are also used for comparison (i.e. ER-L is considered a “Threshold Effect”). The established SQGs (referred to also as “regulatory criteria” or “criteria”) may be useful as initial screening values in Tier I and Tier II evaluations of dredged material as a part of the assessment for the presence of sediment contaminants, if appropriate consideration is given to the uncertainties associated with them (USACE 1998). All SQG derivation processes provide adequate assurance that contaminant concentrations below SQG values are unlikely to cause unacceptable adverse effects. However, due to uncertainties with derivation of SQGs, sediments that exceed SQGs (i.e. background, Threshold or Probably Effects criteria, etc.) cannot be regarded as likely to cause unacceptable adverse effects without further effects-based testing required in Tiers III and IV of the ITM. The following report fulfills all of the Tier I and part of the Tier II requirements indicated in the ITM.

Methods

Core Sampling

Restoration work is slated for the section between Ambush Rock (RM 152) and Crossport (RM 159; Figure 2). Sediment coring was conducted by Boart Longyear (Tualatin OR) and Crux Subsurface (Spokane WA), during July 2008. A track-mounted sonic drill equipped with a 6-inch OD core barrel and a 7-inch OD outer casing was used to extract representative continuous core samples. Full-depth (surface to lacustrine clay or solid substrate; 30-70 feet) sediment cores were collected from 20 sites within and below the potential restoration area of the Kootenai River.

Because coring disturbs the integrity of the outer core (MacDonald and Ingersoll 2002), a clean Teflon spatula was used to peel away sediments on the outer shell of the core for each layer except lacustrine clay layers. A scoop was used to remove the center of each core. Center core samples from each layer within individual cores were placed into a large clean glass container and homogenized thoroughly by mixing with a Teflon spoon. Two hundred gram samples of homogenate were collected for metals analysis, 200 grams for organochlorine pesticide and polychlorinated biphenyl (PCB) analysis, and 175 grams for tremolite analysis. Samples were labeled and stored in a freezer until analysis.

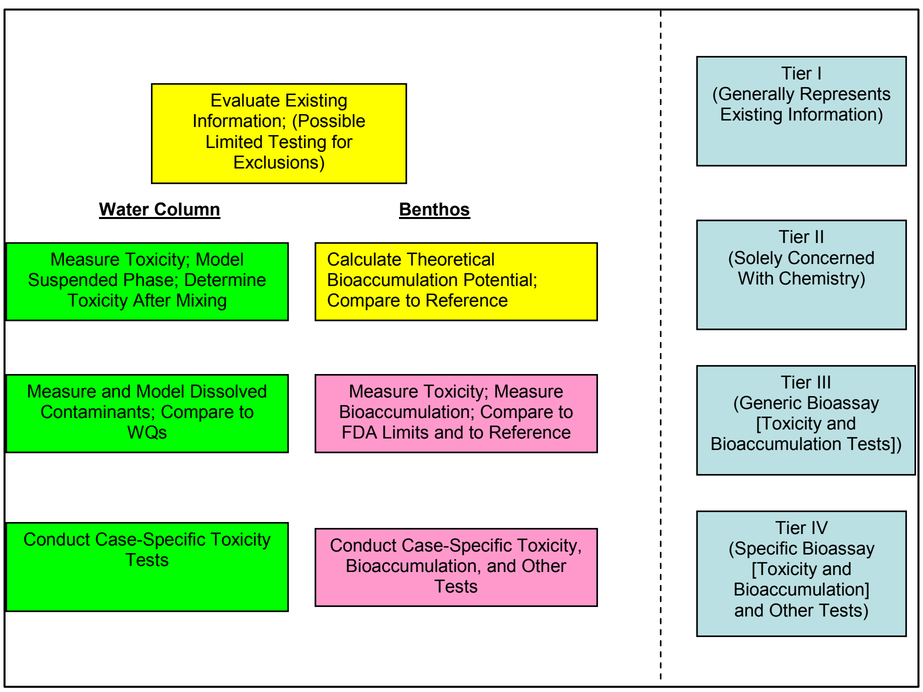

Figure 1. Tiered approach to evaluating potential benthic impacts of deposited dredged material. Yellow boxes are addressed in this report. The green boxes have not been considered but probably should be. The pink boxes would be addressed by sediment bioassay tests (thus this justification section).

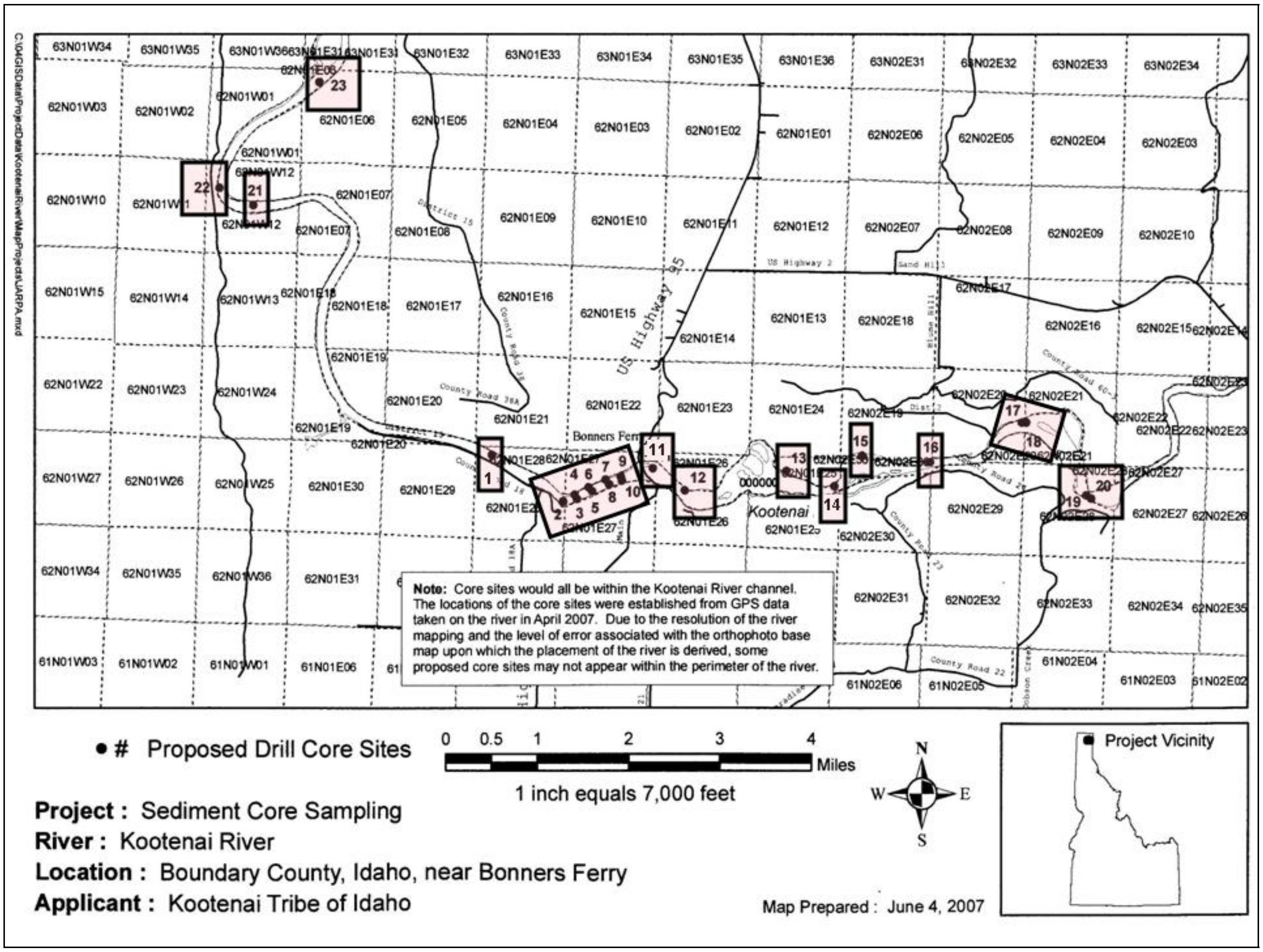

Figure 1. Sediment coring site map, Kootenai River Idaho, 2007.

Quality Assurance and Quality Control

Core Rinse Proofs: Prior to entering a new test hole, the interior of each surface casing was cleaned of any sediment in order to avoid cross-contamination between coring sites. A total of six core sampler rinse proofs were collected for metals analysis by collecting rinse water into a plastic jar as it flowed out the end of the barrel.

Equipment Rinse Proofs: Sample collection tools (spatula, spoon, homogenizing container, etc.) were rinsed between sample processing. At the beginning of sampling (each day) and between test cores, equipment was washed with DI water and Alconox detergent. Following Alconox wash, equipment was rinsed once with Acetone and then triple rinsed with distilled water. A total of 20 equipment rinse proofs were collected from the final distilled water rinse for metals analysis.

Trip Blanks: A total of three trip blanks were collected for analysis by exposing analyte-free water to the air during sample processing. Trip blanks were analyzed for metals.

Laboratory Analysis

Tremolite: Tremolite analysis was conducted by EMSL Analytical, Inc. in San Leandro California. Twenty soil samples were milled and prepped following CARB 435 guidelines (EPA2). Target analytical sensitivity was set to 0.1%. Each sample was analyzed by both Polarized Light Microscopy (PLM) and

Transmission Electron Microscopy (TEM). For each sample processed by PLM, samples were initially scanned by stereoscopic exam for properties and possible fibrous material. Following initial scan, samples were analyzed using a combination of 100X and 400X magnification, employing a 1,000 Point Count procedure following the EPA 600/R-93-116 method (EPA2). Transmission Electron Microscopy involved analysis using EPA 600/R-93-116, Section 2.5.5.2 method for asbestos percent by mass. Asbestos fibers are defined as having a 3:1 aspect ratio and were categorized based on length: (a) <5.0 microns and (b) ≥5.0 microns.

Metals: Analysis for metals was conducted by ALS Laboratory Group, Vancouver B.C., Canada. Sediment samples were analyzed for:

- Hardness
- CSR pH by 1:2 water leach
- Percent moisture
- Total mercury by CVAFS (cold vapour Fluorescent Atomic Spectrometry)
- ICPMS (Inductively Coupled Plasma - Mass Spectrometry) for thallium (Tl) by CSR SALM (Contaminated Sites Regulation Strong Acid Leachable Metals)
- Metals by ICP-OES (inductively coupled plasma-optical emission spectrometry)

Total Organic Carbon: ALS Laboratory Group analysed Total Organic Carbon (TOC) in sediment samples by high temperature combustion (APHA Method 5310; EPA2).

Organochlorine pesticides and PCBs: Organochlorine pesticides and PCB (aroclor and congener specific) analysis was conducted by Axys Analytical Services LTD., Sidney, B.C., Canada. Organochlorine pesticides and PCBs were analyzed by HRGC/LRMS (High-Resolution Gas Chromatography with detection by Low-Resolution Mass Spectrometry) and GC/ECD (Gas Chromatography with Electron Capture Detection).

***Results and Discussion* - Asbestos**

The history of asbestos loading in the Lower Kootenai River started during the early 1920's when the Universal Zonolite Insulation Company (Zonolite) began mining vermiculite at a site located approximately 7 miles northeast of Libby (MTDOT 2008). Full scale operations commenced later that decade with two Expansion/Export Plants; one located off Highway 37 where it crosses the Kootenai River and the other located at the end of Lincoln Road, near 5th Street. It has been reported that the dust from transporting vermiculite across the river periodically obscured the opposite river bank.

In 1963, the W.R. Grace Company bought the Zonolite Company and continued operations in a similar fashion. Grace added a wet milling process to the operation in 1975, which operated in tandem with the dry mill until the dry mill was taken offline in 1985. Expansion Plant operations ceased in Libby sometime prior to 1981, although workers still used this area to bag and export milled ore until mining operations were stopped in 1990. Because the vermiculite was transported across the river and bagged along the banks of the Kootenai River, there is a high probability that fibers entered the water column and were transported throughout the river, downstream of Libby.

Asbestos is the name applied to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite; MAAC 2008) that occur naturally in soil and rocks. Asbestos minerals come in various shapes and sizes but have no detectable odor or taste. Each belongs to one of two categories: 1) serpentine, which has curly fibers, and 2) amphibole asbestos which possesses thin, straight fibers in a chain-like sequence. Chrysotile is the only serpentine variety, while the other five - crocidolite, amosite, anthophyllite, tremolite, and actinolite - are of the amphibole variety. The amphibole variety is viewed as the more dangerous of the two.

Asbestos fibers do not evaporate into air or dissolve in water and they may build up in animals (MAAC 2008). Small fibers and fiber-containing particles may remain suspended in the air for extended periods of time and be carried long distances by wind or water currents before settling. Larger fibers and particles tend to settle more quickly due to their larger mass. Asbestos fibers are not able to move through soil; however, they are not broken down into other compounds in the environment either. Therefore, they can remain in the environment for decades or more. Dredging or other river bottom disturbances can redistribute these fibers into the water column, where they can become a risk factor for aquatic organisms. Analytical result of asbestos analysis is as follows:

PLM analysis: Samples contained very few or no structures. Some samples contained quartz, clay minerals, and small amounts of non-fibrous minerals. Of the 20 samples analyzed by PLM, there were no detectable levels of asbestos. Table 1 indicates the results of PLM analysis.

Table 1. Results of Polarized Light Microscopy (PLM) analysis conducted on core sediment samples collected from the Kootenai River, 2007.

Sample Number	Sample Appearance	% Fibrous	% Non-Fibrous	% Asbestos (type)
TB-1	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-2	Gray, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-3	Gray, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-3-2	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-5	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-6	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-7	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-8	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-9	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-11	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-12	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-13	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-15	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-16	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-17	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-20	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-21	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-22	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-23	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-231A/1=1	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-231B/1=1	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-23-L	Gray, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected
TB-24	Brown, Non-Fibrous, Homogenous	0	100% Non-Fibrous (other)	None Detected

TEM analysis: Most samples contained very few or no fibrous structures. A few samples contained non-asbestos material including Titanium fibers. Of the 20 samples analyzed, two (TB-3-2 & TB231B/1=1) contained small amounts (<0.1%) regulated asbestos with one sample containing Chrysotile and one sample containing Actinolite. In addition, two samples contained Ferro-Actinolite, which is an end member of the Actinolite-Tremolite solid solution series. Table 2 indicates the results of TEM analysis.

Table 2. Results of Transmission Electron Microscopy (TEM) analysis conducted on core sediment samples collected from the middle Kootenai River, 2007. Orange highlighted boxes indicate a sample that contained regulated asbestos fibers. Yellow highlighted boxes indicate a sample that contained unregulated asbestos fibers.

Sample Number	USGS Sample ID	Asbestos Type	Number of Asbestos Structures Detected	Analytical Sensitivity (%)	Asbestos Weight (%)
TB-1	484156116202001	None Detected	None Detected	0.01	<0.01
TB-2	484141116194901	None Detected	None Detected	0.01	<0.01
TB-3	484143116194201	None Detected	None Detected	0.01	<0.01
TB-3-2	484143116194202	Chrysotile	1	0.01	<0.01
TB-5	484150116192601	None Detected	None Detected	0.01	<0.01
TB-6	484148116192601	None Detected	None Detected	0.01	<0.01
TB-7	484154116190301	None Detected	None Detected	0.01	<0.01
TB-8	484151116191601	None Detected	None Detected	0.01	<0.01
TB-9	484153116190501	None Detected	None Detected	0.01	<0.01
TB-11	484201116184001	None Detected	None Detected	0.01	<0.01
TB-12	484202116172301	None Detected	None Detected	0.01	<0.01
TB-13	484202116164501	None Detected	None Detected	0.01	<0.01
TB-15	484210116153301	None Detected	None Detected	0.01	<0.01
TB-16	484209116143501	None Detected	None Detected	0.01	<0.01
TB-17	484234116131901	None Detected	None Detected	0.01	<0.01
TB-20	484154116120401	Ferro-Actinolite	N/A	0.01	<0.01
TB-21	484421116242401	None Detected	None Detected	0.01	<0.01
TB-22	484427116245501	Ferro-Actinolite	N/A	0.01	<0.01
TB-23	484532116233101(02)	None Detected	None Detected	0.01	<0.01
TB-231A/1=1		None Detected	None Detected	0.01	<0.01
TB-231B/1=1		Actinolite	1	0.01	<0.01
TB-23-L	484532116233101(02)	None Detected	None Detected	0.01	<0.01
TB-24	484145116193601	None Detected	None Detected	0.01	<0.01

Asbestos is regulated at >1% of total sample volume. The results of sediment core sampling at the proposed restoration sites indicated the absence or minimal presence (<0.01%) of asbestos fibers. Therefore, it appears that asbestos is not an issue at any of the sites sampled.

Results and Discussion **- Metals**

Metal concentrations in sediment core samples (Table 3) were compared with regulatory screening criteria (i.e. TEC, MEC, PEC) to determine toxicity and site prioritization. Several metal concentrations exceeded screening criteria and should be considered for further effects-based testing. Following is a summary of results for metals detected above the method detection limit:

Arsenic: Arsenic concentrations at site TB-13 exceeded background criteria by nearly 600%. The concentration of arsenic at TB-13 also exceeded established criteria for Threshold Effects (TEL and LEL) by 25%.

Chromium: Chromium concentrations at all sites exceeded lower background criteria by 3-537%. Chromium concentrations exceeded upper background criteria by 23-243% at sites TB-9, TB-11, TB-12, and TB-15. At site TB-9, the detected concentration of chromium also exceeded Threshold Effects (TEC, TEL, and LEL), as well as Probable Effects (HA-28) concentrations by 3-72%.

Copper: Concentrations of copper in sediment from sites TB-3, TB-9, TB-12, TB-13, TB-15, TB-16, TB-17, and TB-20 exceeded lower level background criteria by 4-166%. Copper in sediment from site TB-15 exceed upper level background criteria by 6%. In addition, copper concentrations in sediment from sites TB-12, TB-13, and TB-15 exceeded Threshold Effects criteria (LEL) by 11-66%.

Mercury: Detected concentrations of mercury exceeded lower level background criteria by 45-763% in all sites except TB-16. Mercury was highest in sample TB-12 (0.0345 ppm).

Nickle: Nickle in sediment from sites TB-9, TB-12, and TB-15 exceeded upper background criteria by 24-93%. Nickle in sediment from site TB-12 also exceeded criteria for Threshold Effects (TEL and LEL) by 6-20%.

Lead: Lead concentrations were below method detection limit in all samples except TB-9. The concentration of lead in sediment from site TB-9 exceeded upper background criteria by 112%. This sample also contained a concentration of lead that exceeded Threshold Effects (TEC, TEL and LEL) by 1-16%.

Zinc: Detected concentrations of zinc exceeded lower level background criteria by 247-1,060%. Sediment from eight of the 20 sample sites exceeded upper level background criteria by 5-114%.

Table 3. Metals concentrations (ppm; mg/kg; dry weight) in sediment core samples collected from the Kootenai River, 2007 compared with established background, TEC, MEC and PEC criteria [a b c d e]. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit. The number that follows is the sample detection limit). Yellow highlighted boxes indicate lower level background exceedance and Green highlighted boxes indicate upper level background exceedance for compounds with a range of allowable concentrations. Orange highlighted boxes indicate both background and TEC exceedances. PEL – Probable Effects Level; *H. azteca* PEL is based on bioassay results.

Sample ID	Percent Moisture	pH	Total Organic Carbon	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	Sn	V	Zn
TB-1	19.8	8.47	0.2	<10	<5.0	36.2	<0.50	<0.50	7.3	4.5	7.9	<30	0.0080	<4.0	7.7	<2.0	<2.0	<1.0	<5.0	13.1	45.2
TB-2	17.7	8.53	<0.1	<10	<5.0	36.7	<0.50	<0.50	8.6	4.9	8.0	<30	0.0068	<4.0	8.1	<2.0	<2.0	<1.0	<5.0	15.5	35.3
TB-3	23.1	8.45	0.2	<10	<5.0	49.4	<0.50	<0.50	9.1	5.2	10.6	<30	0.0088	<4.0	9.1	<3.0	<2.0	<1.0	<5.0	16.8	37.9
TB-3-2	29.4	8.29	0.2	<10	<5.0	41.6	<0.50	<0.50	7.6	4.9	9.0	<30	0.0072	<4.0	7.9	<2.0	<2.0	<1.0	<5.0	14.8	60.2
TB-5	11.8	8.79	<0.1	<10	<5.0	29.8	<0.50	<0.50	8.4	5.2	9.9	<30	0.0172	<4.0	8.2	<2.0	<2.0	<1.0	<5.0	17.2	32.0
TB-6	21.2	8.59	0.2	<10	<5.0	34.8	<0.50	<0.50	8.3	4.5	7.5	<30	0.0074	<4.0	7.3	<2.0	<2.0	<1.0	<5.0	15.8	46.0
TB-7	27.3	8.46	0.2	<10	<5.0	43.7	<0.50	<0.50	8.6	4.6	9.9	<30	0.0106	<4.0	8.4	<2.0	<2.0	<1.0	<5.0	15.3	34.1
TB-8	17.7	8.68	<0.1	<10	<5.0	40.9	<0.50	<0.50	7.8	4.1	8.6	<30	0.0073	<4.0	6.9	<2.0	<2.0	<1.0	<5.0	15.9	26.6
TB-9	33.3	8.17	1.3	<10	<5.0	78.2	<0.50	<0.50	44.6	7.6	10.4	36	0.0181	<4.0	15.8	<2.0	<2.0	<1.0	<5.0	14.8	81.2
TB-11	29.0	8.41	0.4	<10	<5.0	61.0	<0.50	<0.50	16.1	5.7	9.4	<30	0.0066	<4.0	8.9	<2.0	<2.0	<1.0	<5.0	18.4	71.6
TB-12	18.6	8.36	0.7	<10	<5.0	177	0.64	<0.50	17.0	9.2	22.2	<30	0.0345	<4.0	19.1	<2.0	<2.0	<1.0	<5.0	26.2	69.8
TB-13	27.4	8.56	<0.1	<10	7.5	36.2	<0.50	<0.50	9.1	7.1	17.8	<30	0.0089	<4.0	9.9	<2.0	<2.0	<1.0	<5.0	15.3	35.9
TB-15	23.0	8.75	0.1	<10	<5.0	72.4	<0.50	<0.50	16.0	7.8	26.6	<30	0.0061	<4.0	12.3	<2.0	<2.0	<1.0	<5.0	26.3	42.3
TB-16	23.0	8.39	<0.1	<10	<5.0	57.8	<0.50	<0.50	7.8	4.6	12.9	<30	<0.0050	<4.0	7.7	<2.0	<2.0	<1.0	<5.0	16.1	32.1
TB-17	20.5	8.56	0.2	<10	<5.0	29.3	<0.50	<0.50	9.0	5.2	11.0	<30	0.0063	<4.0	7.7	<2.0	<2.0	<1.0	<5.0	16.0	29.2
TB-20	23.8	8.67	<0.1	<10	<5.0	37.1	<0.50	<0.50	10.6	4.8	13.5	<30	0.0058	<4.0	7.9	<2.0	<2.0	<1.0	<5.0	16.4	39.7
TB-21	24.4	8.65	<0.1	<10	<5.0	34.3	<0.50	<0.50	7.2	4.1	6.5	<30	0.0141	<4.0	7.6	<2.0	<2.0	<1.0	<5.0	12.6	30.7
TB-22	20.8	8.77	<0.1	<10	<5.0	36.2	<0.50	<0.50	7.3	4.1	7.1	<30	0.0096	<4.0	7.3	<2.0	<2.0	<1.0	<5.0	12.5	30.4
TB-23	30.8	8.80	0.8	<10	<5.0	23.0	<0.50	<0.50	8.1	3.4	7.8	<30	0.0146	<4.0	7.0	<2.0	<2.0	<1.0	<5.0	9.3	24.3
TB-24	29.5	8.67	0.4	<10	<5.0	37.9	<0.50	<0.50	7.5	4.3	8.1	<30	0.0078	<4.0	7.8	<2.0	<2.0	<1.0	<5.0	12.9	30.4
Background[a]				1.6	1.1	0.7		0.1-0.3	7-13	10	10-25	4-17	0.004-0.051		9.9	0.29	<0.5		5	50	7-38
TEC[b] (Geometric Mean of "Threshold Criteria")				2.0	9.8			0.99	43.4		31.6	35.8	0.18		22.7		1.6				121
MEC[b] (Geometric mean of Threshold and Probable Criteria)				13.5	21.4			3.0	76.5		91.0	83.0	0.64		36.0		1.9				290
PEC[b] (Geometric mean of "Probable Criteria")				25.0	33.0			4.98	111		149.0	128	1.06		48.6		2.2				459
***LEL* ("Threshold Effects")**				2.0[d]	6.0[e]			0.6[e]	26[e]		16[e]	31[e]	0.15[d]		16[e]		1.0[d]				120[deg]
***TEL[b]* ("Threshold Effects")**					5.9			0.596	37.3		35.7	35	0.174		18						123.1
***ER-L* ("Threshold Effects")**					8.2[c]; 33[b]			1.2[c]	81[c]; 80[b]		34[c]; 70[b]	46.7[c]; 35[b]	0.15[c b]		20.9[c]; 30[b]		1.0[c]				150[c]; 120[b]
***PEL[b]* ("Probable Effects")**					17			3.53	90.0		197	91.3	0.486		36.0						315
***SEL* ("Probable Effects")**				25.0[d]	33[e]			10.0[d]	110[e]		110[e]	110[e]	1.3[d]		50[d]		2.2[d]				270[d]
***ER-M[c]* ("Probable Effects")**					70.0			9.6	370		370	218	0.71		51.6		3.7				410
***H. azteca PEL[b]* ("Probable Effects")**					11			0.58	36		28	37			20						98

[a] Source: NOAA 2004; [b] Source: MacDonald et al. 2000: [c] Source: Long et al. 1995; [d] Source: Long and Morgan 1990; [e] Source: Persaud et al. 1993

Probable Effect = Frequently Occur - 50 Percentile; Threshold Effect = Rarely occur – 15th Percentile

Results and Discussion **- Organochlorine Pesticides**

Many organochlorine pesticides bind readily to soil, require breakdown by microorganisms, and are not broken down over a reasonable period of time (usually decades or more); therefore, they tend to build up in the environment or are bioaccumulated and/or biomagnified in the food chain (Encyclopedia of Public Health 2007). The most persistent and troublesome of these chemicals are classified as "PBTs (Persistent, Bioaccumulative, & Toxic; USEPA PBT Profiler; EPA3) or "POPs" (Persistent Organic Pollutants; EPA2). These chemicals are toxic to humans and wildlife, are semivolatile and mobile, are persistant and resist breaking down, are known inducers of cytochrome P-450, and in many cases are carcinogenic. Having high lipid solubility, they accumulate in the body fat of people, marine mammals, and other wildlife and are found at higher concentrations further up the food chain. They are also easily passed on to offspring. The effects of "POPs" and "PBTs" can include nervous system damage, diseases of the immune system, reproductive and developmental disorders, as well as cancers.

Results from sediment samples containing $\geq$0.2% TOC were carbon normalized based on percent TOC in each sample (detected PCB concentrations divided by %TOC expressed as a whole number). Normalization of concentrations in samples containing <0.2%TOC is not valid because at TOC concentrations less than 0.2%, other factors that influence partitioning to the sediment pore waters (e.g., particle size and sorption to nonorganic mineral fractions) become relatively more important (Di Toro et al.1990*)*. Where TOC is very low (i.e. <0.2%), biological testing should be considered in evaluating the extent of organic non-polar chemical contamination and potential biological effects (Michelsen 1992).

A total of nine organochlorine pesticide compounds were detected in the sediment samples. Table 4 displays TOC normalized concentrations. Raw data are presented in Appendix 1. Four of the nine organochlorine compounds detected (hexachlorobenzene, heptachlor, mirex, and DDT and its metabolites) are classified as "POPs" (Stockholm Convention 2001; EPA2). Seven of the nine organochlorine pesticides that were detected above method detection limits are classified as "PBTs" (EPA3). The organochlorine pesticide DDT exceeded several suggested guidance criteria (Table 4).

Table 4. Organochlorine concentrations detected in sediment core samples, Kootenai River, Idaho - **NORMALIZED TO 1% TOTAL ORGANIC CARBON (detected concentration divided by TOC% as a whole number)**. Non-detects are indicated by "<mdl"; see Appendix 1 for detection limits. Orange highlighted boxes indicate compounds classified as "POPs" (persistent organic pollutants). Green highlighted cells indicate comparative criteria based on 1% carbon content – blank spaces within green highlighted data indicate lack of established criteria. Yellow highlighted text indicated values that exceed one or more criteria (based on 1% TOC) in green highlighted section. Pink highlighted text indicates samples with <0.2%TOC – Due to low or below mdl TOC, raw data for these samples were **NOT** carbon normalized to 1% TOC.

Sample Number	Organochlorine Pesticide Compound (ng/g; ppb dry weight)												
	Total Organic Carbon (TOC %)	Methoxychlor	Hexachlorobenzene	Alpha-Hexachlorocyclohexane	Heptachlor	Oxychlordane	Mirex	o,p-DDE	p,p-DDE	p,p-DDD	o,p-DDT	p,p-DDT	**Total DDT + Metabolites**
TB-1	0.2	1.05 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	2.500 (E)	**2.500**
TB-1 Duplicate	0.2	1.265 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.220 (E)	**0.220**
TB-2	<0.1	0.100 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**

Table 4 continued. Organochlorine concentrations detected in sediment core samples, Kootenai River, Idaho

Sample Number	Organochlorine Pesticide Compound (ng/g; ppb dry weight)												
	Total Organic Carbon (TOC %)	Methoxychlor	Hexachlorobenzene	Alpha-Hexachlorocyclohexane (α-HCH)	Heptachlor	Oxychlordane	Mirex	o,p-DDE	p,p-DDE	p,p-DDD	o,p-DDT	p,p-DDT	**Total DDT + Metabolites**
TB-3	0.2	0.615 (E)	0.175 (E)	<mdl	<mdl	<mdl	0.430 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-3-2	0.2	0.605 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	12.0 (E)*	**12.000**
TB-5	<0.1	0.022 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-6	0.2	0.245 (E)	0.235 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	0.150 (E)	0.210 (Q)	<mdl	0.225 (E)	**0.585**
TB-7	0.2	0.570 (E)	0.195 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-8	<0.1	0.030 (E)	0.050 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-9	1.3	0.323 (E)	0.045 (E)	<mdl	0.461 (E)	3.92 (E)	3.75 (E)	0.652 (Q)	<mdl	<mdl	<mdl	<mdl	**0.652**
TB-11	0.4	0.388 (E)	0.103 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-13	<0.1	0.025 (E)	0.033 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	0.023 (E)	<mdl	<mdl	<mdl	**0.460**
TB-15	0.1	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.021 (E)	<mdl	<mdl	<mdl	**0.201**
TB-16	<0.1	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.021 (E)	<mdl	<mdl	<mdl	**0.420**
TB-17	0.2	0.200 (E)	0.270 (E)	0.290 (E)	<mdl	<mdl	<mdl	<mdl	0.130 (E)	<mdl	<mdl	<mdl	**0.130**
TB-20	<0.1	0.043 (E)	0.044 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-21	<0.1	0.090 (E)	0.062 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-22	<0.1	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.021 (E)	<mdl	<mdl	<mdl	**0.420**
TB-23	0.8	0.286 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-23 Duplicate	0.4	0.194 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	**0.000**
TB-24	0.4	0.400 (E)	0.058 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.388 (E)	5.98 (E)*	**6.368**
Comprehensive screening Criteria (Includes Threshold and Probable Effects)													
TEC				**6.0[b]**			**7.0[e]**	**3.16[a]**		**4.88[a]**	**4.16[a]**		**5.28[a]**
MEC				**53.0[b]**			**10.5[ej]**	**17.0[j]**		**16.5[j]**	**33.6[j]**		**289[j]**
PEC				**100.0[b]**			**14[e]**	**31.3[a]**		**28.0[a]**	**62.9[a]**		**572[a]**
Threshold Effects Criteria – occurrence of <25% adverse effects when exceeded													
LEL			**20[f]**	**6[f]**			**7[g]**	**5[a]**		**8[a]**	**8[a]**		**7[a]**
TEL				**0.32[j]**	**10[f]**			**1.42[ai]**		**1.22[h]; 3.54[ai]**	**3.89[cj]**		**6.98[k]; 7[a]**
ER-L								**2[a]**		**1.58[h]; 2[a]**	**1.0[da]; 1.58[h]**		**3[a]**
Probable Effects Criteria – occurrence of >50% adverse effects when exceeded													
PEL					**2.74[i]**			**6.75[afi]**		**7.81[h]; 8.51[gi]**	**4.77[g]**		**4450[afi]**
SEL			**240[f]**	**100[f]**			**1300[f]**	**190[a]**		**60[a]**	**710[a]**		**120[a]**
ER-M								**15.0[da]**		**27.0[h]; 20[a]**	**7.0[da];46.1[h]**		**350.0[da]**

[a] Source: Consensus-based sediment quality guildeline (CBSQ); MacDonald et. al 2000
[b] Regulatory Agency: Ontario Ministry of the Environment Sediment Quality Criteria, 1993
[c] Regulatory Agency: Environment Canada National Sediment Quality Criteria, 1995
[d] Regulatory Agency: NOAA Benchmark Guidelines, Long and Morgan, 1990
[e] Source: BCMOE; MacDonald and MacFarlane 1999
[f] Source: BCMOE Working Guidelines for Sediments, 2005
[g] Source: Canadian Environmental Quality Guidelines, 1999; Environment Canada 2003
[h] Source: Florida Department of Environmental Protection 1994; Long et. al 1995 as cited in the National Sediment Quality Survey Appendix D.
[i] Source: NOAA SQUIRTS; NOAA 2004
[j] Source: Wisconsin DNR 2003

TEC=Threshold Effects Concentration; LEL=Lowest Effects Level; TEL=Threshold Effects Level; ER-L=Lowest Effects Range; MEC=Median Effects Concentration; PEC=Probable Effects Concentration; PEL=Probable Effects Level; SEL=Severe Effects Level; ER-M=Effects Range Median; * = potential cross-contamination during transport.

Methoxychlor: Methoxychlor was detected in the sediment from all but three of the sample sites. The highest concentration was detected at site TB-1 (1.265 ppb). The second highest concentration was detected in the duplicate sample from TB-1 (1.05 ppb). No regulatory criteria are available for Methoxychlor; however, the EPA has recently issued a request to cease production of this chemical; therefore, further investigation is warranted for this chemical.

Methoxychlor has historically been used as a pesticide or fumigant for (EPA3). If released to water, Methoxychlor may be removed or transported by several different mechanisms. Methoxychlor may adsorb to suspended solids and sediments. It may undergo direct photolysis (half-life 4.5 months) or indirect "sensitized" photolysis (half-life <5 hours) depending upon the presence of photosensitizers (EPA3). Based on the Henry's law constant, volatilization of Methoxychlor may be significant (half-life 4.5 days from a shallow river). Methoxychlor can significantly bioconcentrate in some living organisms, including algae, bacteria, snails, clams, and some fish; however, most fish and animals metabolize Methoxychlor into other substances that are rapidly released from their bodies, so Methoxychlor does not usually build up in the food chain (EPA1).

Hexachlorobenzene (HCB): Hexachlorobenzene was detected in 11 of the 21 samples collected. Its presence is likely the result of its persistent nature. The highest concentration was detected at site TB-17 (0.270 ppb). None of the detected concentrations exceeded existing screening critieria for sediment. However, the fact that screening criteria are sparse for this compound, and that HCB is classified as a "PBT" by the USEPA suggest that further investigation is warranted for this chemical.

HCB was widely used as a pesticide until 1965 to protect the seeds of onions, sorghum, wheat, and other grains against fungus. It was also used to make fireworks, ammunition, and synthetic rubber. Although it is still incidentally produced, HCB has not been manufactured in the United States for commercial use since the late 1970s. HCB is highly persistent, bioaccumulative, and toxic due to its chemical stability and resistance to biodegradation (EPA1; EPA3). If released to water, the majority of HCB will partition from the water column to sediment and suspended matter. Because HCB binds readily with soil, it is likely that redistribution by dredging would be followed by rapid settling and binding with soil particles. Volatilization from the water column is rapid (half-life of about 8 hrs has been measured in the laboratory); however, the strong adsorption to sediment can result in long periods of persistence and HCB is known to bioconcentrate in fish and aquatic organisms entering into the food chain.

Alpha-Hexachlorocyclohexane (α-HCH): Alpha-Hexachlorocyclohexane was detected in only one of the samples from site TB-17 (0.290 ppb). The concentration detected did not exceed existing screening criteria for sediment; therefore it is not likely that redistribution of this chemical through dredging will impact aquatic biota.

Alpha-Hexachlorocyclohexane was historically used as a pesticide in the United States but has been banned from use for over 20 years. Hexachlorocyclohexane (HCH) isomers are highly persistent and moderately toxic, with half lives generally greater than 1 and 2 years, respectively (EPA1; EPA3). Hexachlorocyclohexane is much less bioaccumulative than other organochlorines of concern because of its relatively low liphophilicity. Hexachlorocyclohexane is moderately toxic for invertebrates and fish and has been shown to cause endocrine disrupting activity.

Heptachlor: Heptachlor was only detected in the sample collected from site TB-9 (0.461 ppb). This concentration did not exceed existing BCMOE screeing criteria of "Probable Effects Level" or "Threshold Effects Level" (BCMOE 2005). However, the fact that screening criteria are sparse for Heptachlor and that it is classified as both a "POP" and a "PBT" suggest that further investigation is warranted for this chemical.

Heptachlor was manufactured and used as an insecticide in the United States until 1988. Currently it can only be used for fire ant control in underground power transformers. It is a persistent chemical and is, therefore, still found in the environment. Heptachlor epoxide is highly persistent and bioaccumulative, as it adsorbs strongly to soil and is extremely resistant to biodegradation (EPA1; EPA3). Some volatilization or photolysis loss may occur. Release of heptachlor to water will result in hydrolysis to 1-hydroxychlordene (half-life of about 1 day) and volatilization. Adsorption to sediments may occur. Biodegradation of heptachlor may occur, but is expected to be slow compared to hydrolysis. Direct and photosensitized photolysis may occur but are not expected to occur at a rate comparable to that of hydrolysis. Heptachlor epoxide will adsorb strongly to suspended and bottom sediment when released to water. Little biodegradation is expected. Bioconcentration of heptachlor may be significant: bioconcentration factors average around 12,000 in various fish species. Bioconcentration may be limited, however, by the rapidity of heptachlor hydrolysis in water and the adsorption of heptachlor to sediments.

Oxychlordane: Oxychlordane was detected in only one of the 21 samples. The concentration of this chemical was 3.92 ppb at TB-9. No screening criteria are available specific to oxychlordane, however, it is classified as a "PBT" by the USEPA. Therefore, further investigation of this chemical and its potential impacts at concentrations detected in sediment from site TB-9 is warranted.

Oxychlordane is a breakdown product of its parent chemical, Chlordane. Chlordane was historically used as an insecticide but its use was banned in the United States in 1988. Oxychlordane is considered a highly persistent and bioaccumulative chemical (EPA3). If released to water, chlordane is not expected to undergo significant hydrolysis, oxidation or direct photolysis. The volatilization half-life from a representative environmental pond, river and lake are estimated to be 18-26, 3.6-5.2 and 14.4-20.6 days, respectively. However, adsorption to sediment significantly attenuates the importance of volatilization. Biodegradation does not seem to be an important process. Sensitized photolysis in the water column may be possible. Adsorption to sediment is expected to be a major fate process based on soil adsorption data, estimated Koc values (15,500-24,600), and extensive sediment monitoring data. The presence of chlordane in sediment core samples suggests that chlordane may be very persistent in the adsorbed state in the aquatic environment. Oxychlordane has been shown to cause disruption of the endocrine system and is toxic to fish and zooplankton. Bioconcentration in fish is expected to be important based on experimental BCF values which are generally above 3,200, although there is some evidence that accumulation is reversible over time in the absence of further exposures.

Mirex: Mirex was detected at two of the 21 sample sites. Concentrations were highest at TB-9 (3.75 ppb). Neither of the detected concentrations exceeded existing screening criteria for sediment; therefore, it is not likely that redistribution of this chemical alone will impact aquatic biota.

Mirex was used to control fire ants, and as a flame retardant in plastics, rubber, paint, paper, and electrical goods. This chemical has not been manufactured or used in the United States since 1978. Mirex is listed as both a "POP" and a "PBT" (EPA3, Stockholm Convention 2001). This chemical possesses a half-life in soils of up to 10 years (EPA1; EPA3). Bioconcentration factors of 2600 and 51,400 have been observed in pink shrimp and fathead minnows, respectively. It is capable of undergoing long-range transport due to its relative volatility (VPL = 4.76 Pa; H = 52 Pa m 3 /mol). Mirex has been shown to be toxic to fish and crustaceans. There is also evidence of its potential for endocrine disruption.

DDE: Two forms of DDE were detected in core samples: o'p'-DDE was detected in only one of the 21 samples (0.652 ppb at TB-9), and p',p'-DDE was detected in six of the 21 samples (highest at TB-6, 0.150 ppb. None of the detected DDE concentrations exceeded existing screening criteria for sediment.

Dichlorodiphenyldichloroethylene (DDE) is a breakdown product of DDT and it has no commercial use. Although DDT was banned for use in the United States in 1977, it is still produced here, exported and commonly used in other countries. DDE is a highly persistent and bioaccumulative pesticide (EPA3). DDE has been shown to result in increased mortality and physiological damage in aquatic organisms.

DDD: DDD was only detected in sediment from site TB-6 (0.210 ppb) and this concentration did not exceed existing screening criteria for sediment; therefore it is not likely that redistribution of this chemical through dredging will impact aquatic biota..

Dichlorodiphenyldichloroethane (DDD) was historically used to kill pests and one form of DDD has been used medically to treat cancer of the adrenal gland. Its use was banned in the United States in 1977. DDD is a highly persistent and bioaccumulative pesticide (EPA3). It is highly toxic to aquatic organisms and has been shown to cause endocrine disruption and/or general physiological damage.

DDT: Two forms of DDT were detected in sediment core samples: o'p'-DDT was detected in only one of the 21 samples (0.0388 ppb at TB-24) and p',p'-DDT was detected in five of the 21 samples (highest at TB-3-2, 12.0 ppb). Concentrations of p',p'-DDT in TB-1 exceeded Threshold Effects criteria (ER-L) and concentrations in TB-3-2 and TB-24 exceeded both Threshold and Probable Effects criteria. All three of these samples were collected in the reach between Ambush Rock and the US 95 bridge, suggesting a localized issue with DDT. It should be noted here that although the analytical peak for these samples occurred at a point concurrent with DDT, it is not certain that the chemical causing the peak was actually DDT because damage during shipping resulted in potential contact between the sediment samples and the plastic bag which sample jars were individually wrapped in. The chemical makeup and reactions with the plastic are unknown. Results indicate potential effects on aquatic organisms as a result of dredging, redistribution and incidental ingestion.

Dichlorodiphenyltrichloroethane (DDT) was historically used as a pesticide. Although this chemical is still produced in and exported from the United States, its use has been banned in this country for 30 years. DDT is highly persistent and bioaccumulative, with a soil half-life of about 1.1 to 3.4 years and high bioconcentration factors (in the order of 50,000 for fish and 500,000 for bivalves; EPA3). In the environment, the product is metabolized mainly to DDD and DDE (EPA1).

Total DDT + Metobolites: One of the most common methods for assessing toxicity of DDT and its metabolites (DDE, DDD, and DDT) is to add their perspective concentrations and evaluate them as "Total DDT". Total DDT concentrations at 2 of the 21 sample sites (TB-3-2 and TB-24) exceeded recommended Threshold Effects screening criteria; however, results for both of these samples are questionable due to possible cross-contamination during transport to the lab (see previous section on DDT). Although individual DDT concentrations at site TB-1 exceeded the ER-L, the Total DDT concentration at this sample site was slightly below criteria. Therefore, exceedances at TB-3-2 and TB-24 as well as the potential cross-contamination of samples warrant further investigation.

Dieldrin and Endrin: For a majority of the samples, method detection limits (mdls) for these organochlorine compounds were higher than existing sediment ER-L (Lowest Effects Range) criteria. Therefore, results for dieldrin (Sites TB-3, 3-2, 2, 5, 7, 8, 9, 11, 23, 24) and endrin (Sites TB-1, 3, 3-2, 5, 7, 8, 9, 11, 23, 24) are inconclusive, indicating that further investigation for these chemicals is warranted.

From the 1950s until 1970, dieldrin and endrin were widely used pesticides for agricultural purposes. Because of concerns about damage to the environment and potentially to human health, EPA banned the use of dieldrin in 1974, except to control termites. In 1987, EPA banned all uses. Endrin has not been produced or sold for general use in the United States since 1986. Both of these highly persistent and bioaccumulative chemicals are listed as "POPs" and "PBTs" (EPA3).

Results and Discussion **- PCBs**

If released in water, adsorption to sediment and suspended matter are an important fate process for PCBs; concentrations in sediment and suspended matter have been shown to be greater than in the associated water column (EPA1). Although adsorption can immobilize PCBs (especially the higher chlorinated congeners) for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of the PCBs. PCBs have been shown to bioconcentrate significantly in aquatic organisms. Average log BCFs of 3.26 to 5.27, reported for various congeners in aquatic organisms, show increasing accumulation with the more highly chlorinated congeners.

Results of PCB congener screening are displayed in Table 5. Raw data are presented in Appendix 2. As with results in the organochlorine pesticide section, results from sediment samples containing $\geq$0.2% TOC were carbon normalized based on percent TOC in each sample (detected PCB concentrations divided by %TOC expressed as a whole number). Normalization of concentrations in samples containing <0.2%TOC is not valid because at TOC concentrations less than 0.2%, other factors that influence partitioning to the sediment pore waters (e.g., particle size and sorption to nonorganic mineral fractions) become relatively more important (Di Toro et al.1990*)*. Where TOC is very low (i.e. <0.2%), biological testing should be considered in evaluating the extent of organic non-polar chemical contamination and potential biological effects (Michelsen 1992).

The four dominant detected PCB congeners were from the Mono-, Tri-, and Penta- Biphenyl categories (based on the number of chlorine atoms attached to the molecules benzene ring). Of these, PCB 126 was the most abundant congener, followed by PCB 37, PCB 38, PCB 36, and PCB 1. Only four of 12 dioxin-like PCBs were detected. Samples containing dioxin-like PCBs were as follows: PCB 77 at TB-9; PCB 105 at TB-1; PCB 114 at TB-1, TB-3, and TB-20; PCB 126 at TB-11. Sites TB-11 (5.066 ppb) and TB-23 (5.885 ppb) contained the highest concentrations of total PCBs. The dioxin-like PCB 126 congener which is considered the most toxic of the dioxin-like PCBs was only detected above the method detection limit at site TB-11 and the total PCB concentration in sediment from TB-11 were well below the recommended 50 ng/g lower Effects Range (Long and Morgan 1990). Total PCB concentrations were derived by adding all estimated (E) maximum and quantifiable (Q) concentrations within a sample, substituting ½ method detection limit for samples that did not exceed method detection limit.

Table 5. Sediment core samples containing quantifiable (Q) and estimated maximum (E) concentrations (ng/g; ppb dry weight) of PCB congeners (Results are NORMALIZED TO 1% TOC when TOC>0.2%). Orange highlighted boxes indicate dioxin-like PCB congeners. "<mdl" indicates a concentration that was less than the method detection limit. Method detection limits for individual samples can be found in Appendix 2. Samples TB-5, TB-7 and TB-8 are not included in this table because results from these samples were below method detection limits for all congeners. Pink highlighting indicates samples containing <0.2 % TOC – these samples were **NOT** normalized to 1%TOC.

PCB Congener (ng/g; ppb dry weight)	Sample Number																	
	TB-1	TB-1 (Dup)	TB-2	TB-3	TB-3-2	TB-6	TB-9	TB-11	TB-13	TB-15	TB-16	TB-17	TB-20	TB-21	TB-22	TB-23	TB-23 (Dup)	TB-24
% TOC	0.2	0.2	<0.1	0.2	0.2	0.2	1.3	0.4	<0.1	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.8	0.8	0.4
PCB 1	<mdl	<mdl	<mdl	<mdl	0.245 (E)	<mdl	<mdl	0.118 (E)	0.016 (E)	<mdl	<mdl	0.085 (E)	<mdl	0.051 (E)	<mdl	<mdl	0.039 (E)	0.058 (E)
PCB 12/13	<mdl	0.375 (E)	<mdl	0.065 (E)	<mdl	<mdl	0.032 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 15	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.062 (E)	0.138 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 20/21/33	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.095 (E)
PCB 35	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.016 (E)	<mdl	<mdl	<mdl
PCB 36	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.030 (E)	0.031 (E)	0.108 (E)	0.535 (E)	0.092 (E)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 37	0.130 (E)	0.200 (E)	<mdl	0.130 (Q)	0.195 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.470 (E)	0.052 (E)	0.290 (E)
PCB 38	<mdl	0.125 (E)	<mdl	<mdl	0.850 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.198 (Q)	0.056 (E)	0.210 (E)
PCB 39	<mdl	<mdl	<mdl	<mdl	0.270 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 41/64/68/71	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.048 (E)	0.053 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 42/59	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.038 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 46	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.090 (E)	0.020 (E)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 47/48/75	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.020 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 50	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.045 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 51	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.310 (E)	<mdl	0.018 (E)	<mdl	<mdl	<mdl	<mdl
PCB 53	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.140 (E)	0.026 (E)	0.014 (E)	<mdl	<mdl	<mdl	<mdl
PCB 61/74	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.105 (E)	0.051 (E)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 62/65	<mdl	<mdl	0.012 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.230 (E)	0.037 (E)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 66/80	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.042 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 72	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.042 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 77	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.052 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 87/115/116	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	K 0.066	<mdl	<mdl	<mdl
PCB 89/90/101	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.038 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl

Table 5 continued. Sediment core samples containing quantifiable (Q) and estimated maximum (E) concentrations (ng/g; ppb dry weight) of PCB congeners. Orange highlighted boxes indicate dioxin-like PCB congeners. Additional dioxin-like PCB congeners 81, 118, 123, 156, 157, 167, 169, and 189 are not included in this table because concentrations in all samples were below the method detection limit (<mdl). Method detection limits for individual samples can be found in Appendix 2. Samples TB-5, TB-7 and TB-8 are not included in this table because results from these samples were below method detection limits for all congeners.

PCB Congener (ng/g; ppb dry weight)	TB-1	TB-1 (Dup)	TB-2	TB-3	TB-3-2	TB-6	TB-9	TB-11	TB-13	TB-15	TB-16	TB-17	TB-20	TB-21	TB-22	TB-23	TB-23 (Dup)	TB-24
PCB 93/95	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.040 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 105/127	0.170 (E)	0.115 (E)	<mdl	0.150 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.070 (E)	<mdl	0.188 (E)
PCB 110	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.014 (E)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 114	0.085 (E)	<mdl	<mdl	<mdl	0.055 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.013 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 122	0.460 (E)	<mdl	<mdl	0.505 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 126	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	2.155 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 137	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.040 (E)	0.038 (E)	0.044 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 138/163/164	0.012 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.045 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 139/149	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.016 (Q)	0.053 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 153	0.075 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.225 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 170/190	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.022 (E)	0.028 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 179	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.080 (E)	0.025 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 180	<mdl	0.055 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	0.043 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 182/187	0.055 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.030 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 196/203	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.028 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 199	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.028 (E)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 206	0.110 (E)	<mdl	<mdl	0.060 (E)	<mdl	<mdl	<mdl	0.158 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 207	<mdl	<mdl	<mdl	<mdl	0.090 (E)	0.125 (E)	<mdl	0.283 (E)	<mdl	<mdl	<mdl	0.100 (E)	0.017 (E)	<mdl	<mdl	<mdl	0.041 (K)	<mdl
PCB 208	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.058 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
PCB 209	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	0.190 (Q)	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl	<mdl
TOTAL PCBs[a]	9.290	11.660	1.957	9.640	14.150	8.205	4.105	14.385	1.937	2.039	2.496	12.055	3.451	3.275	3.641	9.086	3.944	6.958

TEC [b]	**59.8**
MEC [c]	**368**
PEC [b]	**676**

TEC=Threshold Effects Criteria – geometric mean of "Threshold Effects Criteria"; MEC=Median Effects Criteria – geometric mean of "Threshold" and "Probable Effects" Criteria; PEC=Probable Effects Concentrations – geometric mean of "Probable Effects" criteria

[a]This total includes substitution of ½ mdl for non-detects; values are carbon normalized when TOC>0.2%

[b] Source: MacDonald et al. 2000; [c] Source: WDNR 2003

Results - Screening Tools

Toxic Equivalencies (TEQs)

Coplanar PCB congeners may be responsible for much of the observed toxicity of PCB mixtures present in the environment (Cleverly 2005). Coplanar PCBs have similar chemical structures to dioxins, have a common mechanism of toxicity, and invoke a similar battery of toxic responses as 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). One method used to determine additive toxic effects of dioxin-like compounds is the TEF/TEQ concept (Tillit 1999). The World Health Organization (Van den Berg et al. 1998) has assigned dioxin and dioxin-like compounds with Toxic Equivalency Factors (TEFs) for humans/mammals, fish, and birds, indicating their toxicity relative to TCDD. Toxic Equivalencies (TEQs) are calculated as the product of the concentration (C) of an individual dioxin or dioxin-like compound and the corresponding TCDD toxicity equivalency factor (TEF). All TEQs in a sample are added to express the relative toxicity of dioxin and dioxin-like compounds in a sample. Where chemicals were below the method detection limit, ½ of the MDL was substituted for the <mdl value (Clarke 1995). Six of the PCB congeners detected in sediment core samples from 7 of 15 sites are considered dioxin-like compounds. The TEQs for these sites have been calculated for purposes of expressing possible exposure to fish (Table 6).

Table 6. Toxic Equivalents (TEQs) for sediment based on fish TEFs and dioxin-like PCB congeners detected in sediment core samples. Total TEQ was calculated only for sites containing detectable concentrations of dioxin-like PCBs (calculated using concentrations normalized to 1% TOC when TOC≥0.2%; ½ mdl was substituted when concentration was <mdl).

Sample Site	Total TEQ
TB-1	2.97-05
TB-1 Duplicate	3.41-05
TB-2	3.52-05
TB-3	2.96-05
TB-3-2	3.03-05
TB-5	2.90-05
TB-6	3.50-05
TB-7	2.88-05
TB-8	3.80-05
TB-9	1.18-04
TB-11	1.08-02
TB-13	3.01-05
TB-15	3.19-05
TB-16	4.14-05
TB-17	3.46-05
TB-20	6.48-05
TB-21	3.59-05
TB-22	5.34-05
TB-23	7.74-05
TB-23 Duplicate	4.26-04
TB-24	2.39-05

Probable Effects Quotients (PEC-Qs)

Mean Probable Effects Ouotients (PEC-Q) provide a mechanism for comparing the concentrations of contaminant mixtures against effects-based biota data (Rachol and Button 2006). They indicate the degree to which substances exceed Probable Effects guidelines. Mean Probable Effect Concentration Quotients are calculated by dividing the concentration of each individual chemical by its corresponding Probable Effects

Concentration (PEC), summing all products, and then dividing the total by the number of chemicals used in the formula. This formula is as follows:

Step 1) Individual chemical PEC-Q = $\frac{\text{Chemical Concentration (dry weight)}}{\text{Corresponding PEC value}}$

Step 2) Mean PEC-Q = $\frac{\Sigma \text{ Individual Chemical PEC-Qs}}{N}$

Where chemicals were below the method detection limit, ½ of the MDL was substituted for the <mdl value (Clarke 1995). The results are displayed in Table 7. The toxicity-range categories used for comparison in this study were: highest priority (PEC-Q≥1.0), intermediate priority sites (0.5≤ PEC-Q<1.0), low priority sites (PEC-Q <0.5; Ingersoll 2001).

Table 7. Probable Effects Quotients (PEC-Qs) for sediment samples (Ingersoll et al. 2000; calculated using concentrations normalized to 1% TOC when TOC≥0.2%).

Sample Site	PEC-Q
TB-1	0.050
TB-2	0.064
TB-3	0.052
TB-3-2	0.089
TB-5	0.079
TB-6	0.045
TB-7	0.049
TB-8	0.067
TB-9	0.174
TB-11	0.093
TB-13	0.182
TB-15	0.096
TB-16	0.064
TB-17	0.049
TB-20	0.074
TB-21	0.058
TB-22	0.049
TB-23	0.056
TB-24	0.075

Theoretical Bioaccumulation Potential (TBP)

The Theoretical Bioaccumulation Potential (TBP) is an approximation of the equilibrium concentration in organism tissues if the dredged material in question were the only source of contamination (Clarke 1995). This calculation can be applied as a coarse screen to predict the magnitude of bioaccumulation likely to be associated with nonpolar organic contaminants in the dredged material. Calculation of TBP is only valid when TOC content is greater than 0.2% (EPA/USACE 1998). The formula for calculating TBP is as follows:

TBP = BSAF(C_s/%TOC) x %L where:
BSAF (Biota Sediment Accumulation Factor) = 4
C_s = Concentration of nonpolar organic chemical in dredged material
%TOC = Total organic carbon content of the dredged material expressed as a decimal fraction (i.e. 2% = 0.02)
%L = Organism lipid content expressed as a decimal fraction (i.e. 3% = 0.03) of whole-body wet weight

TBPs were calculated for juvenile sturgeon, macroinvertebrates, and periphyton/plankton. Results are displayed in Table 8. Lipid data for these organisms was derived from several sources, including Kruse and Fernandez In Press, Kruse 2003, and Davidson and Kruse 2006.

Table 8. Theoretical Bioaccumulation Potential (TBP) of nonpolar organic compounds (organochlorine pesticides and PCBs) for sediment samples containing >0.2% TOC (Clarke 1995).

Sample Site	TBP – Juvenile Sturgeon (ppb; based on 4% body lipid content)	TBP – Macroinvertebrates (ppb; based on 3% body lipid content)	TBP – Periphyton and Plankton (ppb; based on 0.2% body lipid content)
TB-9	380.26	285.2	19.01
TB-11	295.12	221.34	14.76
TB-23	194.1	145.58	9.71
TB-23 Duplicate	86.1	64.58	2.44
TB-24	235.76	176.82	11.79

In order to compare TBPs with actual current conditions, Table 9 summarizes total organochlorine and total PCB concentrations in tissue, sediment, and suspended sediment (all organic matter) recently collected in the Kootenai River. Data are summarized from current sampling efforts conducted by Davidson and Kruse 2006, Kruse 2003, and Kruse and Fernandez In Press. Results indicate that potential bioaccumulation from dredged material would be similar to current concentrations detected in fish. Bioaccumulation of organochlorine pesticides and PCBs would potentially increase in periphyton, plankton and in macroinvertebrates (TB-9) following dredging.

Table 9. Concentrations of Total Organochlorine Pesticides and PCBs in Kootenai River fish, macroinvertebrate, periphyton, and plankton tissues.

Tissue Type	Year Sampled	Total Non-polar Organics (ppb)
Northern Pikeminnow/Largescale Sucker Muscle Fillet (Lipid normalized wet weight; Davidson and Kruse 2006)	2001	337-9780 Mean = 3498.3
Juvenile Sturgeon Muscle Tissue (Lipid normalized wet weight: Kruse and Fernandez In Press)	2002/2003	494-2133 Mean = 942.72
Macroinvertebrate Whole Body Tissue (Lipid normalized wet weight; Kruse 2003)	2001	51.4-419.9 Mean = 222.54
Plankton Cell Tissue (Lipid normalized wet weight; Davidson and Kruse 2006)	2000/2001	0.265-16.83 Mean = 2.32
Periphyton Cell Tissue (wet weight; Davidson and Kruse 2006)	2000/2001	2.052 (n=1)

[a] Total PCBs measured as Total Aroclors, rather than individual congeners

Table 10 displays reported results from the few studies reporting low-level bioaccumulated tissue concentration. This table is provided as a means for comparison between calculated theoretical bioaccumulation (TBPs; Table 8) and published effects data for these chemicals. Most effects tests have been conducted using individual chemicals at much higher concentrations than those detected in Kootenai River sediment samples. No published effects data are available for cumulative effects resulting from presence of both PCBs and organochlorine pesticides together. However, assuming additive effects of organochlorine compounds (PCBs and pesticides) results suggest a potential for effects on salmonids and sturgeon at current and potentially bioaccumulated tissue concentrations.

Table 10. Organism effects data for bioaccumulated tissue concentrations of organochlorine pesticides and PCBs. Results are based on laboratory studies and published literature.

Chemical	Organism	Tissue Concentration (ppb)	Observation	Reference
PCBs	White Sturgeon	160-1300[a]	Altered sex steroid levels	Kruse and Scarnecchia 2002
DDE	Lake Trout	290 [c]	Decreased Survival	Berlin et al. 1981
Total DDT	Brook Trout	464-485 [c]	90% Decreased Survival	Cuerrier et al. 1967
	Brook Trout	890 [c]	Survival Reduced	Macek 1968
	Rainbow Trout Fry	567 [c]	30% Decreased Survival	Cuerrier et al. 1967
Total Organochlorine Pesticides	White Sturgeon	22-1800 [a]	Altered sex steroid levels	Kruse and Scarnecchia 2002

[a] Mature (stage 3-4) ova
[b] Whole Body

Summary

Sample Sites

Following is a summary of results by sample (proposed dredge) site. Bullets indicate exceedances or areas of concern for each site. In review, the Inland Testing Manual (EPA/USACE 1998) recommends further effects-based testing when the following issues arise with data results: 1) SQGs do not exist for all contaminants of concern, or there is concern about potential interactive effects of multiple contaminants, and 2) some contaminant concentration(s) exceed SQGs. Both of these situations apply to the results presented in this report and are bulleted under each individual site summary when applicable.

TB-1 (KTOI Hatchery):

- Organochlorine pesticide DDT exceeded Threshold Effects criteria (LEL)
- Duplicate sample contained a substantially lower concentration of DDT that did not exceed regulatory criteria
- Chromium and mercurcy exceeded lower background criteria
- Zinc exceeded upper background criteria

TB-2 (Ambush Rock to US 95 Bridge):

- Chromium, mercury, and zinc exceeded lower background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing
- Low Total Organic Carbon (TOC<0.2%) also warrants prioritization for biological testing

TB-3 (Ambush Rock to US 95 Bridge):

- Chromium, copper, mercury, and zinc exceeded upper background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB3-2 (Ambush Rock to US 95 Bridge):

- Chrysotile asbestos detected (<0.1%)
- Chromium and mercury exceeded lower level background criteria
- Zinc exceeded upper level background criteria
- Organochlorine pesticide DDT exceeded both Threshold and Probable Effects criteria

- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-5 (Ambush Rock to US 95 Bridge):

- Chromium, mercury, and zinc exceeded lower background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing
- Low Total Organic Carbon (TOC<0.2%) also warrants prioritization for biological testing

TB-6 (Ambush Rock to US 95 Bridge):

- Chromium and mercury zinc exceeded lower background criteria
- Zinc exceeded upper background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-7 and **TB-8 (Ambush Rock to US 95 Bridge):**

- Chromium, mercury, and zinc exceeded lower background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing
- Low Total Organic Carbon (TOC<0.2%) at site TB-8 also warrants prioritization for biological testing

TB-9 (Ambush Rock to US 95 Bridge):

- Sediment cores from TB-9 contained the highest carbon content (1.3%)
- Lead, nickel, and zinc exceeded upper background criteria
- Chromium and lead were detected above the recommended Threshold Effects criteria
- Theoretical Bioaccumulation Potential calculations (TBPs; Table 9) ranked highest for this site
- TBPs indicate that bioaccumulation potential of dredge material is lower than mean concentrations of non-polar organic compounds found in Kootenai River fish tissue but higher than concentrations found in macroinvertebrates, periphyton, and plankton
- The calculated PEC-Q was second hishest for this sample
- Methoxychlor and oxychlordane detected – lack of regulatory criteria for these chemicals, their potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-11 (Above US 95 Bridge/Across from KR Inn):

- PCB126 (the most toxic of the dioxin-like PCB congeners) detected
- Mercury exceeded lower background criteria
- Chromium and zinc exceeded upper background criteria
- Theoretical Bioaccumulation Potential (TBPs; Table 9) for juvenile sturgeon, macroinvertebrates, and periphyton/phytoplankton ranked second highest at this site
- TBP calculations (Table 9) for site TB-11 indicate that bioaccumulation potential of contaminants associated with dredge material is lower than mean concentrations of non-polar organic compounds found in Kootenai River fish and macroinvertebrate tissue but higher than concentrations found in periphyton and plankton

- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-12 (Across from Pumphouse/Upstream of Kootenai River Inn):
- Mercury exceeded lower background critieria
- Chromium and zinc exceeded upper background criteria
- Copper and nickle exceeded the recommended Threshold Effects criteria

TB-13 (Braided Reach):
- Chromium, mercury, and zinc exceeded lower background criteria
- Nickle exceeded upper background criteria
- Arsenic and copper exceeded recommended Threshold Effects criterial (TEL)
- The calculated PEC-Q was highest for this site, indicating greatest potential for cumulative chemical effects
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing
- Low Total Organic Carbon (TOC<0.2%) also warrants prioritization for biological testing

TB-15 (Braided Reach):
- Mercury exceeded lower background criteria
- Chromium, nickle and zinc exceeded upper background criteria
- Copper exceeded Threshold Effects criteria (TEL)
- The caluculated PEC-Q was third highest for this site
- Low Total Organic Carbon (TOC<0.2%) at this site warrants prioritization for biological testing

TB-16 (Braided Reach):
- Chromium, copper and zinc exceeded lower background criteria
- Low Total Organic Carbon (TOC<0.2%) warrants prioritization for biological testing

TB-17 (Braided Reach/Crossport):
- Chromium, copper and zinc exceeded lower background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-20 (Braided Reach/Crossport):
- Chromium, copper, and mercury exceeded lower background criteria
- Zinc exceeded upper background criteria
- The calculated TEQ was second highest for this site
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing
- Low Total Organic Carbon (TOC<0.2%) also warrants prioritization for biological testing

TB-21 (Myrtle Creek – Below Proposed Restoration Site):
- Chromium, mercury, and zinc exceeded lower background criteria
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

- Low Total Organic Carbon (TOC<0.2%) also warrants prioritization for biological testing.

TB-22 (Myrtle Creek - Below Proposed Restoration Site):
- Chromium, mercury, and zinc exceeded lower background criteria
- The calculated TEQ was third highest for this site
- Low Total Organic Carbon (TOC<0.2%) warrants prioritization for biological testing

TB-23 (Shorties Island - Below Proposed Restoration Site):
- Actinolite asbestos detected (<0.1%) in one of three duplicates from this site
- Theoretical Bioaccumulation Potentials (TBPs; Table 9) for site TB-23 and TB-23 duplicate indicate that bioaccumulation potential of contaminants associated with dredge material is lower than mean concentrations on non-polar organic compounds found in Kootenai River fish and macroinvertebrate but higher than mean concentrations found in periphyton and plankton.
- The calculated TEQ was highest for this site, indicating greatest potential for effects on fish (Calculation of TEQ for the duplicate sample resulted in a slightly lower value; however, the duplicate value still ranked fourth highest)
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

TB-24 (Ambush Rock to US 95 Bridge):
- DDT exceeded Threshold and Probable Effects criteria (due to issues with shipping, this sample may have been contaminated and this result may not be reliable)
- These results warrant repeat sampling and/or biological testing
- Theoretical Bioaccumulation Potentials (TBPs; Table 9) for site TB-24 ranked third highest
- TBPs indicate that bioaccumulation potential of contaminants associated with dredge material is lower than mean concentrations of non-polar organic compounds found in Kootenai River fish and macroinvertebrate tissue but higher than concentrations found in periphyton and plankton
- Methoxychlor detected – lack of regulatory criteria for this chemical, its potential for bioaccumulation in lower food chain organisms and known negative physiological effects warrant biological testing

Quality Assurance and Quality Control

The QA/QC results indicate the potential for trace contamination of copper (0.002-0.008 ppm; TB-3 and TB-9) and zinc (0.0057-0.0226 ppm; TB-3, TB-8. TB-9, TB-11, TB-21, TB-22) from coring and sampling equipment (Appendix 3a-c). However, the amount of contaminantion contributed through equipment use was so low that it would not likely have contributed enough of either metal to change their rankings in relation to sediment quality criteria. Laboratory QA/QC results of spiked samples indicate good quality data results for this project. Although sample TB-1 arrived intact at the analytical lab, cross contamination with at DDT-like substance may have occurred in samples TB-3 and TB-24 during shipping. All sample jars were wrapped in plastic bags for shipping but during transport, the jars from TB-3 and TB-24 were cracked and the sediment sample may have come into contact with the plastic bag; thereby cross contaminating with some compound that was similar to DDT (thus the anomalously high DDT results for these two samples that required lab staff to report results as an ‘estimated maximum’).

General Summary

When potential contaminant effects of sediments are being considered in a dredged material evaluation, the following situations may warrant further effects-based testing: 1) SQGs do not exist for all contaminants of concern, or there is concern about potential interactive effects of multiple contaminants, and 2) some contaminant concentration(s) exceed SQGs. Both of these situations apply to the results presented in this report.

Sediment Quality Guidelines for some of the detected chemicals are either lacking or not established within ranges shown to potentially affect sturgeon (Kruse 2000). For example, barium was detected in all of the samples, at 23-177 ppm and no SQGs have been established for this metal. As with barium, SQGs are not currently available for the organochlorine pesticides Methoxychlor and Oxychlordane, which were both detected in sediment core samples. Due to lack of SQGs, it is not possible to determine potential effects of dredged sediments on aquatic organisms without further effects-based testing.

Several limitations are presented by screening criteria, and these include the fact that false positive and false negative predictions are frequently in the 20% to 30% range for many chemicals and higher for others (Burton 2004). In addition, criteria established for individual chemical compounds do not address additive effects of these compounds. Although concentrations of individual compounds don't exceed criteria, additive concentrations of similar organochlorine compounds may result in greater effect if found together.

Probable Effects Criteria provide the most accurate indication of concentrations above which effects are most likely to occur. However, "Threshold Effects" represent the lower range for potential effects and they are generally protective of the most sensitive species. Several metals, including arsenic, chromium, copper, lead and nickel, as well as the organochlorine pesticide DDT exceeded one or both of these screening criteria, indicating a potential for effects from dredged sediment. Therefore, further investigation of these compounds in dredge material should be conducted.

Asbestos was not detected in large amounts in any of the core samples; however, it was present in small amounts in samples TB-3, TB-3-2, and TB-23. Effects data pertaining to asbestos in aquatic systems is completely lacking; therefore, its potential effects on aquatic biota are virtually unknown and this compound should be retained as a contaminant of concern.

Some of the method detection limits employed by the analytical labs exceeded lower level guidance criteria (i.e. antimony, silver, Dieldrin, Aldrin). Therefore, these metals should be retained as contaminants of concern (Chris Ingersol, USGS Columbia MO, personal communication).

Sediment total organic carbon is considered to be the primary sediment phase accounting for sorption of neutral organic chemicals and can affect the amount of non-polar chemicals that are biologically available for uptake by organisms (USACE 1996). Due to low TOC (<0.2%) and the presence of non-polar organic compounds, biological testing is recommended for sediment from sites TB-2, TB-5 and TB-8, TB-13, TB-15, TB16, TB-20, TB-21, and TB-22 (Michelsen 1992, USACE 1996).

Several currently available methods can be used to account for both the presence and the concentrations of multiple chemicals in sediments relative to their effects-based guidelines (Fairey et al. 2001; Long et al. 2006). Three additive methods including Toxicity Equivalencies (TEQs), Probably Effects Quotients (PEC-Qs), and Theoretical Bioaccumulation Potential (TBP) were used to determine toxicity potential of dredged material.

Dioxin-like PCB congeners were used to calculate TEQs, which indicate relative toxicity of a sediment mixture. Calculated TEQs indicate that impacts resulting from the presence of dioxin-like compounds are likely to be minimal.

Probable Effects Ouotients (PEC-Qs) indicate the degree to which substances exceed Probable Effects guidelines and provide a mechanism for 1) determining potential incidence of toxicity, and 2) comparing the concentrations of contaminant mixtures against effects-based biota data (Rachol and Button 2006). Calculated PEC-Qs indicate that all of the sample sites ranked as low priority and low incidence of toxicity.

The two above-mentioned screening guidelines (TEQs and PEC-Qs) were developed based on benthic community studies and do not directly address biomagnification (food chain toxicity) within the aquatic system. Sediment chemical analyses currently cannot be used to directly evaluate the biological effects of any contaminants which may be present in dredged material because such potential effects are a limitation of bioavailability (Clarke 1995). Field-collected data suggest that bioaccumulated zinc, copper, lead, chromium, PCBs, and DDT in tissues may be contributing to adverse physiological effects (i.e. higher egg mortality, decreased egg size, decreased steroid production, decreased brain enzyme production) in Kootenai River White Sturgeon (Kruse 2000). TBP calculations estimate bioaccumulation potential resulting from exposure to dredged sediments. Results indicate that dredge material is not likely to increase bioaccumulation in fish above current conditions; however, macroinvertebrates, periphyton and plankton will likely be susceptible to higher rates of bioaccumulation as a result of dredging at site TB-9.

Toxicity ratings based on additive methods (TEQs, PEC-Qs) indicate overall low toxicity of dredge sediment. However, criteria exceedances and TBPs suggest the potential for increased bioaccumulation and negative physiological effects. Therefore, criteria exceedances, potential for increased bioaccumulation, low organic carbon content, high method detection limits, and lack of comparative criteria, therefore, preclude estimation of biological effects and suggest the need for biological testing with proposed dredge sediments. Following is a list of recommendations to provide guidance with future steps to assure minimal impact due to sediment dredging in the proposed Kootenai River restoration area.

Recommendations

- Based on the above site summaries, sites should be prioritized for biological effects-based testing (i.e. measurement of direct effects of dredge material on sturgeon, macroinvertebrates, and periphyton/phytoplankton; physiological endpoints should include sex steroids, acetylcholinesterase, hepatic cytochrome P450, condition factor, growth, survival, and measurements of whole-body, liver, and possibly gonad tissue residues).

- Sediment at TB-1, TB-3-2, and TB-24 should be re-sampled and re-tested for DDT. These three samples were located between Ambush Rock and the US 95 bridge, suggesting a potentially localized DDT issue.

- If repeat analysis of core samples or sediments used for effects-based testing occurs, analysis of dioxins and Furans should be included in the analytical matrix

- Results of PAH analysis (conducted by USGS) should be incorporated into this report

- Coordinate with USFWS for water sampling during the summer of 2008 and summarize water quality data from upstream sites in order to evaluate water column contribution of similar contaminants (Tier II Inland Testing Manual Tiered Approach, EPA/USACE 1998)

- Peer review of this report should be conducted

"The weight of evidence required should depend on the weight of the decision"
- Dave Mount, USEPA, Duluth, MN, SETAC short course, November 1997

Appendices

Appendix 1. Raw organochlorine pesticide data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration. "Q" indicates that in a dual column ECD analysis, peaks from the dual columns did not confirm one another and the number following this flag represents the estimated maximum possible concentration.

CLIENT ID	AXYS ID	UNITS	delta-HCH	Heptachlor epoxide	Dieldrin	Endrin	Methoxy-chlor	alpha-Endosulphan	beta-Endosulphan	Endosulphan sulphate	HexaCB	alpha-HCH	beta-HCH	gamma-HCH	Heptachlor	Aldrin	trans-Chlordane	cis-Chlordane	Oxy-chlordane	Mirex	o,p'-DDE	p,p'-DDE	o,p'-DDD	p,p'-DDD	o,p'-DDT	p,p'-DDT
TB-1	L10239-1 (A)	ng/g (dry weight basis)	< 0.0200	< 0.0879	< 0.0200	< 0.0226	**Q 0.210**	< 0.0200	< 0.0200	< 0.0200	< 0.0248	< 0.100	< 0.212	< 0.133	< 0.202	< 0.0512	< 0.0123	< 0.0148	< 0.274	< 0.247	< 0.0224	< 0.0900	< 0.0525	< 0.150	< 0.150	**K 0.500**
TB-1 (Duplicate)	WG23262-106 (DUP L10239-1)	ng/g (dry weight basis)	< 0.0454	< 0.0360	< 0.0200	< 0.0200	**Q 0.253**	< 0.0200	< 0.0200	< 0.0200	< 0.0335	< 0.0828	< 0.118	< 0.0939	< 0.322	< 0.0656	< 0.0125	< 0.0151	< 0.370	< 0.607	< 0.0305	< 0.130	< 0.0369	< 0.140	< 0.140	**K 0.440**
TB-11	L10239-10	ng/g (dry weight basis)	< 0.0294	< 0.123	< 0.0739	< 0.0811	**Q 0.155**	< 0.0350	< 0.0427	< 0.0435	**K 0.041**	< 0.400	< 0.176	< 0.160	< 0.394	< 0.0468	< 0.0122	< 0.0147	< 0.556	< 0.333	< 0.0568	< 0.0678	< 0.350	< 0.750	< 0.830	< 0.980
TB-2	L10239-2	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**Q 0.100**	< 0.0200	< 0.0200	< 0.0200	< 0.0408	< 0.126	< 0.146	< 0.129	< 0.295	< 0.0614	< 0.0116	< 0.0140	< 0.262	< 0.189	< 0.0309	< 0.0600	< 0.0456	< 0.120	< 0.120	< 0.120
TB-3	L10239-3	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0210	< 0.0230	**Q 0.123**	< 0.0227	< 0.0261	< 0.0266	**K 0.035**	< 0.103	< 0.0831	< 0.0610	< 0.203	< 0.0800	< 0.0131	< 0.0159	< 0.105	**0.086**	< 0.0204	< 0.0800	< 0.0445	< 0.0741	< 0.0823	< 0.0969
TB-3-2	L10239-4	ng/g (dry weight basis)	< 0.0258	< 0.118	< 0.0846	< 0.0928	**Q 0.121**	< 0.0372	< 0.0462	< 0.0470	< 0.0199	< 0.123	< 0.247	< 0.145	< 0.900	< 0.0860	< 0.0358	< 0.0432	< 1.46	< 0.329	< 0.100	< 0.250	< 0.0987	< 0.294	< 0.327	**K 2.40**
TB-5	L10239-5	ng/g (dry weight basis)	< 0.0517	< 0.0380	< 0.0310	< 0.0340	**Q 0.022**	< 0.0200	< 0.0350	< 0.0229	< 0.0456	< 0.110	< 0.195	< 0.0935	< 0.117	< 0.0537	< 0.0130	< 0.0157	< 0.217	< 0.0964	< 0.0279	< 0.0333	< 0.0226	< 0.0271	< 0.0301	< 0.0354
TB-6	L10239-6	ng/g (dry weight basis)	< 0.0327	< 0.0720	< 0.0200	< 0.0200	**Q 0.049**	< 0.0200	< 0.0200	< 0.0200	**K 0.047**	< 0.107	< 0.162	< 0.101	< 0.640	< 0.0489	< 0.0188	< 0.0227	< 0.338	< 0.0859	< 0.0207	**K 0.030**	< 0.0360	0.042	< 0.0276	**K 0.045**
TB-7	L10239-7	ng/g (dry weight basis)	< 0.0200	< 0.0711	< 0.0596	< 0.0653	**Q 0.114**	< 0.0330	< 0.0369	< 0.0376	**K 0.039**	< 0.131	< 0.112	< 0.0957	< 0.162	< 0.0705	< 0.0159	< 0.0193	< 0.361	< 0.163	< 0.0378	< 0.0451	< 0.0713	< 0.0381	< 0.210	< 0.160
TB-8	L10239-8	ng/g (dry weight basis)	< 0.0204	< 0.0200	< 0.0236	< 0.0258	**Q 0.030**	< 0.0200	< 0.0281	< 0.0200	**K 0.050**	< 0.132	< 0.145	< 0.0835	< 0.116	< 0.0629	< 0.0191	< 0.0231	< 0.164	< 0.0817	< 0.0260	< 0.0310	< 0.0257	< 0.0343	< 0.0381	< 0.0449
TB-9	L10239-9	ng/g (dry weight basis)	< 0.170	< 0.201	< 0.0381	< 0.0418	**Q 0.420**	< 0.0200	< 0.0219	< 0.0223	**K 0.059**	< 0.609	< 0.754	< 0.760	**K 0.600**	< 0.236	< 0.0153	< 0.0185	**K 5.10**	**K 4.87**	**K 0.874**	< 2.00	< 2.40	< 6.00	< 6.70	< 7.80
TB-13	L10239-11	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**Q 0.025**	< 0.0300	< 0.0200	< 0.0200	**K 0.033**	< 0.0595	< 0.0413	< 0.0449	< 0.0645	< 0.0711	< 0.0151	< 0.0183	< 0.169	< 0.0450	< 0.0118	**K 0.023**	< 0.0117	< 0.0109	< 0.0121	< 0.0142
TB-15	L10239-12	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0415	< 0.0475	< 0.0626	< 0.0732	< 0.129	< 0.0828	< 0.0167	< 0.0202	< 0.212	< 0.0171	< 0.0094	**K 0.021**	< 0.0075	< 0.0072	< 0.0080	< 0.0094
TB-16	L10239-13	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**K 0.044**	< 0.0652	< 0.0748	< 0.0863	< 0.227	< 0.0847	< 0.0230	< 0.0278	< 0.204	< 0.0419	< 0.0086	**K 0.021**	< 0.0088	< 0.0108	< 0.0120	< 0.0141
TB-17	L10239-14	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**Q 0.040**	< 0.0400	< 0.0200	< 0.0200	**K 0.054**	**K 0.058**	< 0.0780	< 0.0676	< 0.279	< 0.0774	< 0.0114	< 0.0138	< 0.226	< 0.0662	< 0.0188	**K 0.026**	< 0.0181	< 0.0146	< 0.0162	< 0.0191
TB-20	L10239-15	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**Q 0.043**	< 0.0210	< 0.0200	< 0.0200	**K 0.044**	< 0.0509	< 0.0437	< 0.0600	< 0.212	< 0.179	< 0.0166	< 0.0200	< 0.918	< 0.0359	< 0.0353	< 0.0421	< 0.0660	< 0.0500	< 0.0560	< 0.0670
TB-21	L10239-16	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	**Q 0.090**	< 0.0200	< 0.0200	< 0.0200	**K 0.062**	< 0.0757	< 0.0837	< 0.0964	< 0.128	< 0.0859	< 0.0170	< 0.0205	< 0.362	< 0.274	< 0.0604	< 0.0720	< 0.0700	< 0.166	< 0.185	< 0.220
TB-22	L10239-17	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.0200	< 0.103	< 0.0897	< 0.139	< 0.0804	< 0.220	< 0.115	< 0.0347	< 0.0419	< 0.349	< 0.0407	< 0.0151	**K 0.021**	< 0.0220	< 0.0347	< 0.0386	< 0.0454
TB-23	L10239-18 (A)	ng/g (dry weight basis)	< 0.0200	< 0.0206	< 0.0290	< 0.0318	**Q 0.229**	< 0.0446	< 0.0541	< 0.0551	< 0.0826	< 0.308	< 0.307	< 0.245	< 0.433	< 0.200	< 0.0419	< 0.0507	< 1.25	< 1.35	< 0.101	< 0.120	< 0.277	< 0.634	< 0.704	< 0.829
TB-23 (Duplicate)	WG23263-103 (DUP L10239-18)	ng/g (dry weight basis)	< 0.0200	< 0.0381	< 0.0200	< 0.0200	**Q 0.155**	< 0.0200	< 0.0200	< 0.0200	< 0.0515	< 0.130	< 0.0941	< 0.120	< 0.181	< 0.195	< 0.0381	< 0.0461	< 0.591	< 0.765	< 0.0474	< 0.0565	< 0.126	< 0.251	< 0.279	< 0.329
TB-24	L10239-19	ng/g (dry weight basis)	< 0.0200	< 0.0200	< 0.0276	< 0.0302	**Q 0.160**	< 0.0200	< 0.0235	< 0.0240	**K 0.023**	< 0.138	< 0.0799	< 0.0807	< 0.280	< 0.0602	< 0.0170	< 0.0205	< 0.422	< 0.219	< 0.0326	< 0.0389	< 0.0668	< 0.121	**K 0.155**	**K 2.39**

Appendix 2. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	UNITS	PCB 1	PCB 2	PCB 3	PCB 4/10	PCB 5/8	PCB 6	PCB 7/9	PCB 11	PCB 12/13	PCB 14	PCB 15	PCB 16/32	PCB 17	PCB 18	PCB 19	PCB 20/21/33	PCB 22	PCB 23/34	PCB 24/27	PCB 25	PCB 26	PCB 28	PCB 29	PCB 30
TB-1	ng/g (dry weight basis)	< 0.0263	< 0.0272	< 0.0272	< 0.0352	< 0.0186	< 0.0186	< 0.0186	< 0.0186	< 0.0186	< 0.0186	< 0.0201	< 0.0149	< 0.0149	< 0.0149	< 0.0163	< 0.0194	< 0.0194	< 0.0100	< 0.0149	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0149
TB-1 (Duplicate)	ng/g (dry weight basis)	< 0.0467	< 0.0484	< 0.0484	< 0.0557	< 0.0294	< 0.0294	< 0.0294	< 0.0294	**K 0.075**	< 0.0294	< 0.0319	< 0.0253	< 0.0253	< 0.0253	< 0.0276	< 0.0165	< 0.0165	< 0.0150	< 0.0253	< 0.0150	< 0.0150	< 0.0156	< 0.0150	< 0.0253
TB-11	ng/g (dry weight basis)	**K 0.047**	< 0.0193	< 0.0193	< 0.0335	< 0.0177	< 0.0177	< 0.0177	< 0.0177	< 0.0177	< 0.0177	**K 0.055**	< 0.126	< 0.126	< 0.126	< 0.138	< 0.0789	< 0.0789	< 0.0750	< 0.126	< 0.0750	< 0.0750	< 0.0777	< 0.0750	< 0.126
TB-2	ng/g (dry weight basis)	< 0.0459	< 0.0475	< 0.0475	< 0.0501	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0265	< 0.0287	< 0.0233	< 0.0233	< 0.0233	< 0.0254	< 0.0328	< 0.0328	< 0.0138	< 0.0233	< 0.0138	< 0.0138	< 0.0143	< 0.0138	< 0.0233
TB-3	ng/g (dry weight basis)	< 0.0244	< 0.0252	< 0.0252	< 0.0219	< 0.0116	< 0.0116	< 0.0116	< 0.0116	**K 0.013**	< 0.0116	< 0.0125	< 0.0239	< 0.0239	< 0.0239	< 0.0261	< 0.0181	< 0.0181	< 0.0142	< 0.0239	< 0.0142	< 0.0142	< 0.0147	< 0.0142	< 0.0239
TB-3-2	ng/g (dry weight basis)	**K 0.049**	< 0.0284	< 0.0284	< 0.0309	< 0.0163	< 0.0163	< 0.0163	< 0.0163	< 0.0163	< 0.0163	< 0.0177	< 0.0703	< 0.0703	< 0.0703	< 0.0769	< 0.0215	< 0.0215	< 0.0418	< 0.0703	< 0.0418	< 0.0418	< 0.0433	< 0.0418	< 0.0703
TB-5	ng/g (dry weight basis)	< 0.0342	< 0.0354	< 0.0354	< 0.0405	< 0.0214	< 0.0214	< 0.0214	< 0.0214	< 0.0214	< 0.0214	< 0.0232	< 0.0201	< 0.0201	< 0.0201	< 0.0220	< 0.0133	< 0.0133	< 0.0120	< 0.0201	< 0.0120	< 0.0120	< 0.0124	< 0.0120	< 0.0201
TB-6	ng/g (dry weight basis)	< 0.0231	< 0.0239	< 0.0239	< 0.0524	< 0.0277	< 0.0277	< 0.0277	< 0.0277	< 0.0277	< 0.0277	< 0.0299	< 0.0625	< 0.0625	< 0.0625	< 0.0684	< 0.0544	< 0.0544	< 0.0372	< 0.0625	< 0.0372	< 0.0372	< 0.0385	< 0.0372	< 0.0625
TB-7	ng/g (dry weight basis)	< 0.0256	< 0.0265	< 0.0265	< 0.0447	< 0.0236	< 0.0236	< 0.0236	< 0.0236	< 0.0236	< 0.0236	< 0.0255	< 0.0336	< 0.0336	< 0.0336	< 0.0368	< 0.0316	< 0.0316	< 0.0200	< 0.0336	< 0.0200	< 0.0200	< 0.0207	< 0.0200	< 0.0336
TB-8	ng/g (dry weight basis)	< 0.0260	< 0.0269	< 0.0269	< 0.0529	< 0.0280	< 0.0280	< 0.0280	< 0.0280	< 0.0280	< 0.0280	< 0.0303	< 0.0351	< 0.0351	< 0.0351	< 0.0384	< 0.0260	< 0.0260	< 0.0209	< 0.0351	< 0.0209	< 0.0209	< 0.0216	< 0.0209	< 0.0351
TB-9	ng/g (dry weight basis)	< 0.0298	< 0.0309	< 0.0309	< 0.0230	< 0.0122	< 0.0122	< 0.0122	< 0.0122	**K 0.042**	< 0.0122	**K 0.080**	< 0.0757	< 0.0757	< 0.0757	< 0.0827	< 0.0482	< 0.0482	< 0.0450	< 0.0757	< 0.0450	< 0.0450	< 0.0466	< 0.0450	< 0.0757
TB-13	ng/g (dry weight basis)	**K 0.016**	< 0.0112	< 0.0112	< 0.0213	< 0.0113	< 0.0113	< 0.0113	< 0.0113	< 0.0113	< 0.0113	< 0.0122	< 0.0288	< 0.0288	< 0.0288	< 0.0315	< 0.0226	< 0.0226	< 0.0171	< 0.0288	< 0.0171	< 0.0171	< 0.0177	< 0.0171	< 0.0288
TB-15	ng/g (dry weight basis)	< 0.0277	< 0.0287	< 0.0287	< 0.0455	< 0.0241	< 0.0241	< 0.0241	< 0.0241	< 0.0241	< 0.0241	< 0.0260	< 0.0268	< 0.0268	< 0.0268	< 0.0293	< 0.0223	< 0.0223	< 0.0159	< 0.0268	< 0.0159	< 0.0159	< 0.0165	< 0.0159	< 0.0268
TB-16	ng/g (dry weight basis)	< 0.0136	< 0.0141	< 0.0141	< 0.0219	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0125	< 0.0378	< 0.0378	< 0.0378	< 0.0413	< 0.0234	< 0.0234	< 0.0224	< 0.0378	< 0.0224	< 0.0224	< 0.0232	< 0.0224	< 0.0378
TB-17	ng/g (dry weight basis)	**K 0.017**	< 0.0165	< 0.0165	< 0.0451	< 0.0238	< 0.0238	< 0.0238	< 0.0238	< 0.0238	< 0.0238	< 0.0258	< 0.0339	< 0.0339	< 0.0339	< 0.0370	< 0.0234	< 0.0234	< 0.0201	< 0.0339	< 0.0201	< 0.0201	< 0.0209	< 0.0201	< 0.0339
TB-20	ng/g (dry weight basis)	< 0.0134	< 0.0139	< 0.0139	< 0.0248	< 0.0131	< 0.0131	< 0.0131	< 0.0131	< 0.0131	< 0.0131	< 0.0142	< 0.0514	< 0.0514	< 0.0514	< 0.0562	< 0.0537	< 0.0537	< 0.0305	< 0.0514	< 0.0305	< 0.0305	< 0.0316	< 0.0305	< 0.0514
TB-21	ng/g (dry weight basis)	**K 0.051**	< 0.0325	< 0.0325	< 0.0293	< 0.0155	< 0.0155	< 0.0155	< 0.0155	< 0.0155	< 0.0155	< 0.0167	< 0.0934	< 0.0934	< 0.0934	< 0.102	< 0.0922	< 0.0922	< 0.0555	< 0.0934	< 0.0555	< 0.0555	< 0.0575	< 0.0555	< 0.0934
TB-22	ng/g (dry weight basis)	< 0.0900	< 0.0932	< 0.0932	< 0.0582	< 0.0308	< 0.0308	< 0.0308	< 0.0308	< 0.0308	< 0.0308	< 0.0333	< 0.0481	< 0.0481	< 0.0481	< 0.0526	< 0.0143	< 0.0143	< 0.0286	< 0.0481	< 0.0286	< 0.0286	< 0.0296	< 0.0286	< 0.0481
TB-23	ng/g (dry weight basis)	< 0.108	< 0.112	< 0.112	< 0.131	< 0.0691	< 0.0691	< 0.0691	< 0.0691	< 0.0691	< 0.0691	< 0.0747	< 0.0775	< 0.0775	< 0.0775	< 0.0847	< 0.0594	< 0.0594	< 0.0460	< 0.0775	< 0.0460	< 0.0460	< 0.0477	< 0.0460	< 0.0775
TB-23 Duplicate	ng/g (dry weight basis)	**K 0.031**	< 0.0286	< 0.0286	< 0.0404	< 0.0213	< 0.0213	< 0.0213	< 0.0213	< 0.0213	< 0.0213	< 0.0231	< 0.0426	< 0.0426	< 0.0426	< 0.0466	< 0.0268	< 0.0268	< 0.0253	< 0.0426	< 0.0253	< 0.0253	< 0.0262	< 0.0253	< 0.0426
TB-24	ng/g (dry weight basis)	**K 0.023**	< 0.0170	< 0.0170	< 0.0380	< 0.0201	< 0.0201	< 0.0201	< 0.0201	< 0.0201	< 0.0201	< 0.0217	< 0.0314	< 0.0314	< 0.0314	< 0.0344	**K 0.038**	< 0.0280	< 0.0187	< 0.0314	< 0.0187	< 0.0187	< 0.0193	< 0.0187	< 0.0314

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 31	PCB 35	PCB 36	PCB 37	PCB 38	PCB 39	PCB 40	PCB 41/64/68/71	PCB 42/59	PCB 43/49	PCB 44	PCB 45	PCB 46	PCB 47/48/75	PCB 50	PCB 51	PCB 52/73	PCB 53	PCB 54	PCB 55	PCB 56/60	PCB 57	PCB 58	PCB 61/74	PCB 62/65
TB-1	< 0.0100	< 0.0209	< 0.0194	**K 0.026**	< 0.0209	< 0.0194	< 0.0139	< 0.0110	< 0.0110	< 0.0100	< 0.0110	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0139	< 0.0139	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0150	< 0.0178	< 0.0165	**K 0.040**	**K 0.025**	< 0.0165	< 0.0283	< 0.0130	< 0.0130	< 0.0101	< 0.0130	< 0.0110	< 0.0110	< 0.0110	< 0.0100	< 0.0110	< 0.0110	< 0.0110	< 0.0100	< 0.0139	< 0.0139	< 0.0283	< 0.0283	< 0.0136	< 0.0110
TB-11	< 0.0750	< 0.0850	< 0.0789	< 0.0850	< 0.0850	< 0.0789	< 0.0402	**K 0.021**	**K 0.015**	< 0.0105	< 0.0135	< 0.0114	< 0.0114	< 0.0114	< 0.0100	< 0.0114	< 0.0114	< 0.0114	< 0.0100	< 0.0197	< 0.0197	< 0.0402	< 0.0402	< 0.0194	< 0.0114
TB-2	< 0.0138	< 0.0354	< 0.0328	< 0.0354	< 0.0354	< 0.0328	< 0.0181	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0181	< 0.0181	< 0.0100	**K 0.012**
TB-3	< 0.0142	< 0.0195	< 0.0181	0.026	< 0.0195	< 0.0181	< 0.0145	< 0.0162	< 0.0162	< 0.0126	< 0.0162	< 0.0136	< 0.0136	< 0.0136	< 0.0114	< 0.0136	< 0.0136	< 0.0136	< 0.0114	< 0.0100	< 0.0100	< 0.0145	< 0.0145	< 0.0100	< 0.0136
TB-3-2	< 0.0418	< 0.0232	< 0.0215	**K 0.039**	**K 0.170**	**K 0.054**	< 0.0316	< 0.0168	< 0.0168	< 0.0130	< 0.0168	< 0.0141	< 0.0141	< 0.0141	< 0.0118	< 0.0141	< 0.0141	< 0.0141	< 0.0118	< 0.0155	< 0.0155	< 0.0316	< 0.0316	< 0.0152	< 0.0141
TB-5	< 0.0120	< 0.0143	< 0.0133	< 0.0143	< 0.0143	< 0.0133	< 0.0242	< 0.0114	< 0.0114	< 0.0100	< 0.0114	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0119	< 0.0119	< 0.0242	< 0.0242	< 0.0117	< 0.0100
TB-6	< 0.0372	< 0.0586	< 0.0544	< 0.0586	< 0.0586	< 0.0544	< 0.0225	< 0.0201	< 0.0201	< 0.0156	< 0.0201	< 0.0169	< 0.0169	< 0.0169	< 0.0141	< 0.0169	< 0.0169	< 0.0169	< 0.0141	< 0.0110	< 0.0110	< 0.0225	< 0.0225	< 0.0108	< 0.0169
TB-7	< 0.0200	< 0.0340	< 0.0316	< 0.0340	< 0.0340	< 0.0316	< 0.0298	< 0.0140	< 0.0140	< 0.0109	< 0.0140	< 0.0118	< 0.0118	< 0.0118	< 0.0100	< 0.0118	< 0.0118	< 0.0118	< 0.0100	< 0.0146	< 0.0146	< 0.0298	< 0.0298	< 0.0143	< 0.0118
TB-8	< 0.0209	< 0.0280	< 0.0260	< 0.0280	< 0.0280	< 0.0260	< 0.0255	< 0.0178	< 0.0178	< 0.0138	< 0.0178	< 0.0150	< 0.0150	< 0.0150	< 0.0125	< 0.0150	< 0.0150	< 0.0150	< 0.0125	< 0.0125	< 0.0125	< 0.0255	< 0.0255	< 0.0123	< 0.0150
TB-9	< 0.0450	< 0.0519	< 0.0482	< 0.0519	< 0.0519	< 0.0482	< 0.0924	**K 0.062**	< 0.0435	< 0.0338	< 0.0435	< 0.0365	< 0.0365	< 0.0365	< 0.0305	< 0.0365	< 0.0365	< 0.0365	< 0.0305	< 0.0452	< 0.0452	< 0.0924	< 0.0924	< 0.0445	< 0.0365
TB-13	< 0.0171	< 0.0243	**K 0.030**	< 0.0243	< 0.0243	< 0.0226	< 0.0300	< 0.0213	< 0.0213	< 0.0166	< 0.0213	< 0.0179	< 0.0179	< 0.0179	< 0.0150	< 0.0179	< 0.0179	< 0.0179	< 0.0150	< 0.0147	< 0.0147	< 0.0300	< 0.0300	< 0.0145	< 0.0179
TB-15	< 0.0159	< 0.0241	**K 0.031**	< 0.0241	< 0.0241	< 0.0223	< 0.0260	< 0.0185	< 0.0185	< 0.0144	< 0.0185	< 0.0156	< 0.0156	< 0.0156	< 0.0130	< 0.0156	< 0.0156	< 0.0156	< 0.0130	< 0.0127	< 0.0127	< 0.0260	< 0.0260	< 0.0125	< 0.0156
TB-16	< 0.0224	< 0.0252	**K 0.108**	< 0.0252	< 0.0252	< 0.0234	< 0.0305	< 0.0321	< 0.0321	< 0.0250	< 0.0321	< 0.0270	< 0.0270	< 0.0270	< 0.0226	< 0.0270	< 0.0270	< 0.0270	< 0.0226	< 0.0149	< 0.0149	< 0.0305	< 0.0305	< 0.0147	< 0.0270
TB-17	< 0.0201	< 0.0252	**K 0.107**	< 0.0252	< 0.0252	< 0.0234	< 0.0285	< 0.0103	< 0.0103	< 0.0080	< 0.0103	< 0.0087	**K 0.018**	< 0.0087	**K 0.009**	**K 0.062**	< 0.0087	**K 0.028**	< 0.0072	< 0.0139	< 0.0139	< 0.0285	< 0.0285	**K 0.021**	**K 0.046**
TB-20	< 0.0305	< 0.0579	**K 0.092**	< 0.0579	< 0.0579	< 0.0537	< 0.0765	< 0.0230	< 0.0230	< 0.0179	< 0.0230	< 0.0193	**K 0.020**	**0.02**	< 0.0161	< 0.0193	< 0.0193	**K 0.026**	< 0.0161	< 0.0375	< 0.0375	< 0.0765	< 0.0765	**K 0.051**	**K 0.037**
TB-21	< 0.0555	< 0.0993	< 0.0922	< 0.0993	< 0.0993	< 0.0922	< 0.0309	< 0.0157	< 0.0157	< 0.0122	< 0.0157	< 0.0132	< 0.0132	< 0.0132	< 0.0110	K 0.018	< 0.0132	**K 0.014**	< 0.0110	< 0.0151	< 0.0151	< 0.0309	< 0.0309	< 0.0149	< 0.0132
TB-22	< 0.0286	**K 0.016**	< 0.0143	< 0.0154	< 0.0154	< 0.0143	< 0.0447	< 0.0352	< 0.0352	< 0.0273	< 0.0352	< 0.0296	< 0.0296	< 0.0296	< 0.0247	< 0.0296	< 0.0296	< 0.0296	< 0.0247	< 0.0219	< 0.0219	< 0.0447	< 0.0447	< 0.0215	< 0.0296
TB-23	< 0.0460	< 0.0639	< 0.0594	**K 0.376**	**0.158**	< 0.0594	< 0.0928	< 0.0678	< 0.0678	< 0.0527	< 0.0678	< 0.0570	< 0.0570	< 0.0570	< 0.0476	< 0.0570	< 0.0570	< 0.0570	< 0.0476	< 0.0454	< 0.0454	< 0.0928	< 0.0928	< 0.0447	< 0.0570
TB-23 Duplicate	< 0.0253	< 0.0288	< 0.0268	**K 0.041**	**K 0.045**	< 0.0268	< 0.0418	< 0.0279	< 0.0279	< 0.0217	< 0.0279	< 0.0235	< 0.0235	< 0.0235	< 0.0196	< 0.0235	< 0.0235	< 0.0235	< 0.0196	< 0.0204	< 0.0204	< 0.0418	< 0.0418	< 0.0201	< 0.0235
TB-24	< 0.0187	< 0.0302	< 0.0280	**K 0.116**	**K 0.084**	< 0.0280	< 0.0365	< 0.0214	< 0.0214	< 0.0167	< 0.0214	< 0.0180	< 0.0180	< 0.0180	< 0.0151	< 0.0180	< 0.0180	< 0.0180	< 0.0151	< 0.0179	< 0.0179	< 0.0365	< 0.0365	< 0.0176	< 0.0180

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. “<” indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). “K” indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 63	PCB 66/80	PCB 67	PCB 69	PCB 70/76	PCB 72	PCB 77	PCB 78	PCB 79	PCB 81	PCB 82	PCB 83/108	PCB 84	PCB 85/120	PCB 86/97	PCB 87/115/116	PCB 88/121	PCB 89/90/101	PCB 91	PCB 92	PCB 93/95	PCB 94	PCB 96	PCB 98/102	PCB 99
TB-1	< 0.0100	< 0.0100	< 0.0139	< 0.0100	< 0.0100	< 0.0110	< 0.0102	< 0.0102	< 0.0102	< 0.0102	< 0.0128	< 0.0100	< 0.0100	< 0.0128	< 0.0128	< 0.0128	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0136	< 0.0136	< 0.0283	< 0.0110	< 0.0136	< 0.0130	< 0.0162	< 0.0162	< 0.0162	< 0.0162	< 0.0160	< 0.0100	< 0.0100	< 0.0160	< 0.0160	< 0.0160	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-11	< 0.0194	< 0.0194	< 0.0402	< 0.0114	< 0.0194	< 0.0135	< 0.0220	< 0.0220	< 0.0220	< 0.0220	< 0.0241	< 0.0100	< 0.0100	< 0.0241	< 0.0241	< 0.0241	< 0.0104	**0.015**	< 0.0104	< 0.0100	K 0.016	< 0.0104	< 0.0104	< 0.0104	< 0.0100
TB-2	< 0.0100	< 0.0100	< 0.0181	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0180	< 0.0100	< 0.0100	< 0.0180	< 0.0180	< 0.0180	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-3	< 0.0100	< 0.0100	< 0.0145	< 0.0136	< 0.0100	< 0.0162	< 0.0114	< 0.0114	< 0.0114	< 0.0114	< 0.0138	< 0.0100	< 0.0100	< 0.0138	< 0.0138	< 0.0138	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-3-2	< 0.0152	< 0.0152	< 0.0316	< 0.0141	< 0.0152	< 0.0168	< 0.0152	< 0.0152	< 0.0152	< 0.0152	< 0.0124	< 0.0100	< 0.0100	< 0.0124	< 0.0124	< 0.0124	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-5	< 0.0117	< 0.0117	< 0.0242	< 0.0100	< 0.0117	< 0.0114	< 0.0119	< 0.0119	< 0.0119	< 0.0119	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-6	< 0.0108	< 0.0108	< 0.0225	< 0.0169	< 0.0108	< 0.0201	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0179	< 0.0124	< 0.0106	< 0.0179	< 0.0179	< 0.0179	< 0.0129	< 0.0106	< 0.0129	< 0.0106	< 0.0129	< 0.0129	< 0.0129	< 0.0129	< 0.0100
TB-7	< 0.0143	< 0.0143	< 0.0298	< 0.0118	< 0.0143	< 0.0140	< 0.0111	< 0.0111	< 0.0111	< 0.0111	< 0.0141	< 0.0100	< 0.0100	< 0.0141	< 0.0141	< 0.0141	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-8	< 0.0123	< 0.0123	< 0.0255	< 0.0150	< 0.0123	< 0.0178	< 0.0194	< 0.0194	< 0.0194	< 0.0194	< 0.0180	< 0.0176	< 0.0151	< 0.0180	< 0.0180	< 0.0180	< 0.0183	< 0.0151	< 0.0183	< 0.0151	< 0.0183	< 0.0183	< 0.0183	< 0.0183	< 0.0142
TB-9	< 0.0445	**0.055**	< 0.0924	< 0.0365	< 0.0445	**K 0.055**	**K 0.067**	< 0.0665	< 0.0665	< 0.0665	< 0.0534	< 0.0313	< 0.0268	< 0.0534	< 0.0534	< 0.0534	< 0.0325	< 0.0268	< 0.0325	< 0.0268	< 0.0325	< 0.0325	< 0.0325	< 0.0325	< 0.0252
TB-13	< 0.0145	< 0.0145	< 0.0300	< 0.0179	< 0.0145	< 0.0213	< 0.0116	< 0.0116	< 0.0116	< 0.0116	< 0.0149	< 0.0151	< 0.0129	< 0.0149	< 0.0149	< 0.0149	< 0.0157	< 0.0129	< 0.0157	< 0.0129	< 0.0157	< 0.0157	< 0.0157	< 0.0157	< 0.0122
TB-15	< 0.0125	< 0.0125	< 0.0260	< 0.0156	< 0.0125	< 0.0185	< 0.0111	< 0.0111	< 0.0111	< 0.0111	< 0.0160	< 0.0152	< 0.0130	< 0.0160	< 0.0160	< 0.0160	< 0.0158	< 0.0130	< 0.0158	< 0.0130	< 0.0158	< 0.0158	< 0.0158	< 0.0158	< 0.0123
TB-16	< 0.0147	< 0.0147	< 0.0305	< 0.0270	< 0.0147	< 0.0321	< 0.0109	< 0.0109	< 0.0109	< 0.0109	< 0.0214	< 0.0146	< 0.0125	< 0.0214	< 0.0214	< 0.0214	< 0.0152	< 0.0125	< 0.0152	< 0.0125	< 0.0152	< 0.0152	< 0.0152	< 0.0152	< 0.0118
TB-17	< 0.0137	< 0.0137	< 0.0285	< 0.0087	< 0.0137	< 0.0103	< 0.0111	< 0.0111	< 0.0111	< 0.0111	< 0.0176	< 0.0153	< 0.0131	< 0.0176	< 0.0176	< 0.0176	< 0.0159	< 0.0131	< 0.0159	< 0.0131	< 0.0159	< 0.0159	< 0.0159	< 0.0159	< 0.0124
TB-20	< 0.0368	< 0.0368	< 0.0765	< 0.0193	< 0.0368	< 0.0230	< 0.0314	< 0.0314	< 0.0314	< 0.0314	< 0.0185	< 0.0241	< 0.0206	< 0.0185	< 0.0185	< 0.0185	< 0.0250	< 0.0206	< 0.0250	< 0.0206	< 0.0250	< 0.0250	< 0.0250	< 0.0250	< 0.0194
TB-21	< 0.0149	< 0.0149	< 0.0309	< 0.0132	< 0.0149	< 0.0157	< 0.0142	< 0.0142	< 0.0142	< 0.0142	< 0.0178	< 0.0178	< 0.0152	< 0.0178	< 0.0178	< 0.0178	< 0.0184	< 0.0152	< 0.0184	< 0.0152	< 0.0184	< 0.0184	< 0.0184	< 0.0184	< 0.0143
TB-22	< 0.0215	< 0.0215	< 0.0447	< 0.0296	< 0.0215	< 0.0352	< 0.0233	< 0.0233	< 0.0233	< 0.0233	< 0.0258	< 0.0302	< 0.0259	< 0.0258	< 0.0258	**K 0.066**	< 0.0314	< 0.0259	< 0.0314	< 0.0259	< 0.0314	< 0.0314	< 0.0314	< 0.0314	< 0.0244
TB-23	< 0.0447	< 0.0447	< 0.0928	< 0.0570	< 0.0447	< 0.0678	< 0.0463	< 0.0463	< 0.0463	< 0.0463	< 0.0400	< 0.0337	< 0.0289	< 0.0400	< 0.0400	< 0.0400	< 0.0350	< 0.0289	< 0.0350	< 0.0289	< 0.0350	< 0.0350	< 0.0350	< 0.0350	< 0.0272
TB-23 Duplicate	< 0.0201	< 0.0201	< 0.0418	< 0.0235	< 0.0201	< 0.0279	< 0.0252	< 0.0252	< 0.0252	< 0.0252	< 0.0236	< 0.0221	< 0.0189	< 0.0236	< 0.0236	< 0.0236	< 0.0229	< 0.0189	< 0.0229	< 0.0189	< 0.0229	< 0.0229	< 0.0229	< 0.0229	< 0.0178
TB-24	< 0.0176	< 0.0176	< 0.0365	< 0.0180	< 0.0176	< 0.0214	< 0.0157	< 0.0157	< 0.0157	< 0.0157	< 0.0099	< 0.0157	< 0.0134	< 0.0099	< 0.0099	< 0.0099	< 0.0163	< 0.0134	< 0.0163	< 0.0134	< 0.0163	< 0.0163	< 0.0163	< 0.0163	< 0.0127

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 100	PCB 103	PCB 104	PCB 105/127	PCB 106/118	PCB 107/109	PCB 110	PCB 111/117	PCB 112	PCB 113	PCB 114	PCB 119	PCB 122	PCB 123	PCB 124	PCB 125	PCB 126	PCB 128	PCB 129	PCB 130	PCB 131/142	PCB 132/168	PCB 133	PCB 134/143	PCB 135/144
TB-1	< 0.0100	< 0.0100	< 0.0100	**K 0.034**	< 0.0100	< 0.0100	< 0.0100	< 0.0128	< 0.0100	< 0.0100	**K 0.017**	< 0.0100	**K 0.092**	< 0.0100	< 0.0100	< 0.0128	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0100	< 0.0100	< 0.0100	**K 0.023**	< 0.0102	< 0.0112	< 0.0112	< 0.0160	< 0.0100	< 0.0100	< 0.0109	< 0.0100	< 0.0109	< 0.0102	< 0.0112	< 0.0160	< 0.0113	< 0.0100	< 0.0100	< 0.0100	< 0.0112	< 0.0100	< 0.0112	< 0.0112	< 0.0112
TB-11	< 0.0104	< 0.0104	< 0.0100	< 0.0162	< 0.0162	< 0.0169	< 0.0169	< 0.0241	< 0.0100	< 0.0100	< 0.0164	< 0.0100	< 0.0164	< 0.0162	< 0.0169	< 0.0241	**K 0.862**	< 0.0117	< 0.0117	< 0.0117	< 0.0101	< 0.0104	< 0.0101	< 0.0101	< 0.0101
TB-2	< 0.0100	< 0.0100	< 0.0100	< 0.0121	< 0.0125	< 0.0126	< 0.0126	< 0.0180	< 0.0100	< 0.0100	< 0.0123	< 0.0100	< 0.0123	< 0.0125	< 0.0126	< 0.0180	< 0.0127	< 0.0137	< 0.0137	< 0.0137	< 0.0100	< 0.0122	< 0.0100	< 0.0100	< 0.0100
TB-3	< 0.0100	< 0.0100	< 0.0100	**K 0.030**	< 0.0100	< 0.0100	< 0.0100	< 0.0138	< 0.0100	< 0.0100	< 0.0100	< 0.0100	K 0.101	< 0.0100	< 0.0100	< 0.0138	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-3-2	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0124	< 0.0100	< 0.0100	K 0.011	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0124	< 0.0100	< 0.0161	< 0.0161	< 0.0161	< 0.0100	< 0.0142	< 0.0100	< 0.0100	< 0.0100
TB-5	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0102	< 0.0102	< 0.0102	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-6	< 0.0129	< 0.0129	< 0.0100	< 0.0120	< 0.0134	< 0.0125	< 0.0125	< 0.0179	< 0.0124	< 0.0106	< 0.0122	< 0.0100	< 0.0122	< 0.0134	< 0.0125	< 0.0179	< 0.0126	< 0.0129	< 0.0129	< 0.0129	< 0.0103	< 0.0115	< 0.0103	< 0.0103	< 0.0103
TB-7	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0101	< 0.0100	< 0.0100	< 0.0141	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0101	< 0.0100	< 0.0141	< 0.0100	< 0.0141	< 0.0141	< 0.0141	< 0.0100	< 0.0125	< 0.0100	< 0.0100	< 0.0100
TB-8	< 0.0183	< 0.0183	< 0.0129	< 0.0121	< 0.0118	< 0.0126	< 0.0126	< 0.0180	< 0.0176	< 0.0151	< 0.0123	< 0.0142	< 0.0123	< 0.0118	< 0.0126	< 0.0180	< 0.0127	< 0.0100	< 0.0100	< 0.0100	< 0.0107	< 0.0100	< 0.0107	< 0.0107	< 0.0107
TB-9	< 0.0325	< 0.0325	< 0.0229	< 0.0359	< 0.0401	< 0.0375	< 0.0375	< 0.0534	< 0.0313	< 0.0268	< 0.0364	< 0.0252	< 0.0364	< 0.0401	< 0.0375	< 0.0534	< 0.0377	< 0.0431	< 0.0431	< 0.0431	< 0.0127	< 0.0382	< 0.0127	< 0.0127	< 0.0127
TB-13	< 0.0157	< 0.0157	< 0.0111	< 0.0100	< 0.0099	< 0.0104	< 0.0104	< 0.0149	< 0.0151	< 0.0129	< 0.0101	< 0.0122	< 0.0101	< 0.0099	< 0.0104	< 0.0149	< 0.0105	< 0.0105	< 0.0105	< 0.0105	< 0.0075	< 0.0093	< 0.0075	< 0.0075	< 0.0075
TB-15	< 0.0158	< 0.0158	< 0.0112	< 0.0108	< 0.0101	< 0.0112	< 0.0112	< 0.0160	< 0.0152	< 0.0130	< 0.0109	< 0.0123	< 0.0109	< 0.0101	< 0.0112	< 0.0160	< 0.0113	< 0.0108	< 0.0108	< 0.0108	< 0.0096	< 0.0096	< 0.0096	< 0.0096	< 0.0096
TB-16	< 0.0152	< 0.0152	< 0.0107	< 0.0143	< 0.0144	< 0.0150	< 0.0150	< 0.0214	< 0.0146	< 0.0125	< 0.0146	< 0.0118	< 0.0146	< 0.0144	< 0.0150	< 0.0214	< 0.0151	< 0.0108	< 0.0108	< 0.0108	< 0.0153	< 0.0096	< 0.0153	< 0.0153	< 0.0153
TB-17	< 0.0159	< 0.0159	< 0.0112	< 0.0118	< 0.0099	< 0.0123	< 0.0123	< 0.0176	< 0.0153	< 0.0131	< 0.0120	< 0.0124	< 0.0120	< 0.0099	< 0.0123	< 0.0176	< 0.0124	< 0.0069	< 0.0069	< 0.0069	< 0.0103	< 0.0062	< 0.0103	< 0.0103	< 0.0103
TB-20	< 0.0250	< 0.0250	< 0.0176	< 0.0124	< 0.0129	< 0.0129	**K 0.014**	< 0.0185	< 0.0241	< 0.0206	**0.013**	< 0.0194	< 0.0126	< 0.0129	< 0.0129	< 0.0185	< 0.0131	< 0.0254	< 0.0254	< 0.0254	< 0.0140	< 0.0225	< 0.0140	< 0.0140	< 0.0140
TB-21	< 0.0184	< 0.0184	< 0.0130	< 0.0119	< 0.0108	< 0.0124	< 0.0124	< 0.0178	< 0.0178	< 0.0152	< 0.0121	< 0.0143	< 0.0121	< 0.0108	< 0.0124	< 0.0178	< 0.0125	< 0.0110	< 0.0110	< 0.0110	< 0.0096	< 0.0098	< 0.0096	< 0.0096	< 0.0096
TB-22	< 0.0314	< 0.0314	< 0.0222	< 0.0174	< 0.0174	< 0.0181	< 0.0181	< 0.0258	< 0.0302	< 0.0259	< 0.0176	< 0.0244	< 0.0176	< 0.0174	< 0.0181	< 0.0258	< 0.0183	< 0.0209	< 0.0209	< 0.0209	< 0.0264	< 0.0185	< 0.0264	< 0.0264	< 0.0264
TB-23	< 0.0350	< 0.0350	< 0.0247	**K 0.056**	< 0.113	< 0.0250	< 0.0250	< 0.0400	< 0.0337	< 0.0289	< 0.0250	< 0.0272	< 0.0250	< 0.113	< 0.0250	< 0.0400	< 0.0250	< 0.0265	< 0.0265	< 0.0265	< 0.0400	< 0.0235	< 0.0400	< 0.0400	< 0.0400
TB-23 Duplicate	< 0.0229	< 0.0229	< 0.0162	< 0.0159	< 0.0165	< 0.0166	< 0.0166	< 0.0236	< 0.0221	< 0.0189	< 0.0161	< 0.0178	< 0.0161	< 0.0165	< 0.0166	< 0.0236	< 0.0167	< 0.0199	< 0.0199	< 0.0199	< 0.0214	< 0.0176	< 0.0214	< 0.0214	< 0.0214
TB-24	< 0.0163	< 0.0163	< 0.0115	**K 0.075**	< 0.0072	< 0.0069	< 0.0069	< 0.0099	< 0.0157	< 0.0134	< 0.0068	< 0.0127	< 0.0068	< 0.0072	< 0.0069	< 0.0099	< 0.0070	< 0.0136	< 0.0136	< 0.0136	< 0.0144	< 0.0121	< 0.0144	< 0.0144	< 0.0144

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. “<” indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). “K” indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 136	PCB 137	PCB 138/163/164	PCB 139/149	PCB 140	PCB 141	PCB 145	PCB 146	PCB 147	PCB 148	PCB 150	PCB 151	PCB 152	PCB 153	PCB 154	PCB 155	PCB 156	PCB 157	PCB 158/160	PCB 159	PCB 161	PCB 162	PCB 165	PCB 166	PCB 167
TB-1	< 0.0100	< 0.0100	**0.012**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.015**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0112	< 0.0100	< 0.0100	< 0.0112	< 0.0112	< 0.0100	< 0.0112	< 0.0100	< 0.0112	< 0.0112	< 0.0112	< 0.0120	< 0.0112	< 0.0100	< 0.0112	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-11	< 0.0101	< 0.0100	0.018	0.021	< 0.0101	< 0.0100	< 0.0101	< 0.0100	< 0.0101	< 0.0101	< 0.0101	< 0.0108	< 0.0101	**K 0.018**	< 0.0101	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-2	< 0.0100	< 0.0117	< 0.0117	< 0.0100	< 0.0100	< 0.0117	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0103	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0117	< 0.0117	< 0.0100	< 0.0117	< 0.0100	< 0.0117	< 0.0100
TB-3	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-3-2	< 0.0100	< 0.0137	< 0.0137	< 0.0100	< 0.0100	< 0.0137	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0121	< 0.0100	< 0.0100	< 0.0106	< 0.0107	< 0.0137	< 0.0137	< 0.0100	< 0.0137	< 0.0100	< 0.0137	< 0.0107
TB-5	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-6	< 0.0103	< 0.0110	< 0.0110	< 0.0103	< 0.0103	< 0.0110	< 0.0103	< 0.0100	< 0.0103	< 0.0103	< 0.0103	< 0.0110	< 0.0103	< 0.0100	< 0.0103	< 0.0100	< 0.0100	< 0.0100	< 0.0110	< 0.0110	< 0.0100	< 0.0110	< 0.0100	< 0.0110	< 0.0100
TB-7	< 0.0100	< 0.0120	< 0.0120	< 0.0100	< 0.0100	< 0.0120	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0107	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0120	< 0.0120	< 0.0100	< 0.0120	< 0.0100	< 0.0120	< 0.0100
TB-8	< 0.0107	< 0.0100	< 0.0100	< 0.0107	< 0.0107	< 0.0100	< 0.0107	< 0.0100	< 0.0107	< 0.0107	< 0.0107	< 0.0114	< 0.0107	< 0.0100	< 0.0107	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-9	< 0.0127	< 0.0366	< 0.0366	**0.021**	< 0.0127	< 0.0366	< 0.0127	< 0.0108	< 0.0127	< 0.0127	< 0.0127	< 0.0135	< 0.0127	< 0.0324	< 0.0127	< 0.0100	< 0.0284	< 0.0287	< 0.0366	< 0.0366	< 0.0108	< 0.0366	< 0.0108	< 0.0366	< 0.0287
TB-13	< 0.0075	K 0.040	< 0.0089	< 0.0075	< 0.0075	< 0.0089	< 0.0075	< 0.0064	< 0.0075	< 0.0075	< 0.0075	< 0.0080	< 0.0075	< 0.0079	< 0.0075	< 0.0054	< 0.0069	< 0.0070	< 0.0089	< 0.0089	< 0.0064	< 0.0089	< 0.0064	< 0.0089	< 0.0070
TB-15	< 0.0096	K 0.038	< 0.0092	< 0.0096	< 0.0096	< 0.0092	< 0.0096	< 0.0082	< 0.0096	< 0.0096	< 0.0096	< 0.0102	< 0.0096	< 0.0082	< 0.0096	< 0.0068	< 0.0071	< 0.0072	< 0.0092	< 0.0092	< 0.0082	< 0.0092	< 0.0082	< 0.0092	< 0.0072
TB-16	< 0.0153	K 0.044	< 0.0092	< 0.0153	< 0.0153	< 0.0092	< 0.0153	< 0.0130	< 0.0153	< 0.0153	< 0.0153	< 0.0163	< 0.0153	< 0.0081	< 0.0153	< 0.0109	< 0.0071	< 0.0072	< 0.0092	< 0.0092	< 0.0130	< 0.0092	< 0.0130	< 0.0092	< 0.0072
TB-17	< 0.0103	< 0.0059	< 0.0059	< 0.0103	< 0.0103	< 0.0059	< 0.0103	< 0.0088	< 0.0103	< 0.0103	< 0.0103	< 0.0110	< 0.0103	< 0.0052	< 0.0103	< 0.0073	< 0.0046	< 0.0046	< 0.0059	< 0.0059	< 0.0088	< 0.0059	< 0.0088	< 0.0059	< 0.0046
TB-20	< 0.0140	< 0.0216	< 0.0216	< 0.0140	< 0.0140	< 0.0216	< 0.0140	< 0.0119	< 0.0140	< 0.0140	< 0.0140	< 0.0149	< 0.0140	< 0.0191	< 0.0140	< 0.0100	< 0.0167	< 0.0169	< 0.0216	< 0.0216	< 0.0119	< 0.0216	< 0.0119	< 0.0216	< 0.0169
TB-21	< 0.0096	< 0.0094	< 0.0094	< 0.0096	< 0.0096	< 0.0094	< 0.0096	< 0.0082	< 0.0096	< 0.0096	< 0.0096	< 0.0103	< 0.0096	< 0.0083	< 0.0096	< 0.0069	< 0.0072	< 0.0073	< 0.0094	< 0.0094	< 0.0082	< 0.0094	< 0.0082	< 0.0094	< 0.0073
TB-22	< 0.0264	< 0.0177	< 0.0177	< 0.0264	< 0.0264	< 0.0177	< 0.0264	< 0.0225	< 0.0264	< 0.0264	< 0.0264	< 0.0281	< 0.0264	< 0.0157	< 0.0264	< 0.0188	< 0.0138	< 0.0139	< 0.0177	< 0.0177	< 0.0225	< 0.0177	< 0.0225	< 0.0177	< 0.0139
TB-23	< 0.0400	< 0.0225	< 0.0225	< 0.0400	< 0.0400	< 0.0225	< 0.0400	< 0.0341	< 0.0400	< 0.0400	< 0.0400	< 0.0426	< 0.0400	< 0.0199	< 0.0400	< 0.0285	< 0.0174	< 0.0176	< 0.0225	< 0.0225	< 0.0341	< 0.0225	< 0.0341	< 0.0225	< 0.0177
TB-23 Duplicate	< 0.0214	< 0.0169	< 0.0169	< 0.0214	< 0.0214	< 0.0169	< 0.0214	< 0.0183	< 0.0214	< 0.0214	< 0.0214	< 0.0229	< 0.0214	< 0.0150	< 0.0214	< 0.0153	< 0.0131	< 0.0132	< 0.0169	< 0.0169	< 0.0183	< 0.0169	< 0.0183	< 0.0169	< 0.0133
TB-24	< 0.0144	< 0.0116	< 0.0116	< 0.0144	< 0.0144	< 0.0116	< 0.0144	< 0.0123	< 0.0144	< 0.0144	< 0.0144	< 0.0153	< 0.0144	< 0.0102	< 0.0144	< 0.0103	< 0.0090	< 0.0091	< 0.0116	< 0.0116	< 0.0123	< 0.0116	< 0.0123	< 0.0116	< 0.0091

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 169	PCB 170/190	PCB 171	PCB 172/192	PCB 173	PCB 174/181	PCB 175	PCB 176	PCB 177	PCB 178	PCB 179	PCB 180	PCB 182/187	PCB 183	PCB 184	PCB 185	PCB 186	PCB 188	PCB 189	PCB 191	PCB 193	PCB 194	PCB 195	PCB 196/203	PCB 197
TB-1	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**K 0.011**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**K 0.011**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0244	< 0.0244	< 0.0248	< 0.0179
TB-11	< 0.0100	**0.011**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**K 0.010**	**0.017**	**K 0.012**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.011**	< 0.0100
TB-2	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0164	< 0.0164	< 0.0168	< 0.0121
TB-3	< 0.0100	< 0.0104	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0178	< 0.0178	< 0.0182	< 0.0131
TB-3-2	< 0.0106	< 0.0184	< 0.0163	< 0.0163	< 0.0163	< 0.0162	< 0.0163	< 0.0123	< 0.0162	< 0.0163	< 0.0123	< 0.0163	< 0.0163	< 0.0162	< 0.0123	< 0.0162	< 0.0163	< 0.0123	< 0.0129	< 0.0163	< 0.0163	< 0.0100	< 0.0100	< 0.0100	< 0.0100
TB-5	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0124	< 0.0124	< 0.0126	< 0.0100
TB-6	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0176	< 0.0176	< 0.0179	< 0.0129
TB-7	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0153	< 0.0153	< 0.0156	< 0.0113
TB-8	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0169	< 0.0169	< 0.0172	< 0.0124
TB-9	< 0.0284	**K 0.028**	< 0.0173	< 0.0173	< 0.0173	< 0.0172	< 0.0173	< 0.0131	< 0.0172	< 0.0173	**K 0.016**	< 0.0173	< 0.0173	< 0.0172	< 0.0131	< 0.0172	< 0.0173	< 0.0131	< 0.0137	< 0.0173	< 0.0173	< 0.0539	< 0.0539	< 0.0550	< 0.0397
TB-13	< 0.0069	< 0.0099	< 0.0088	< 0.0088	< 0.0088	< 0.0087	< 0.0088	< 0.0067	< 0.0087	< 0.0088	< 0.0067	< 0.0088	< 0.0088	< 0.0087	< 0.0067	< 0.0087	< 0.0088	< 0.0067	< 0.0070	< 0.0088	< 0.0088	< 0.0150	< 0.0150	< 0.0153	< 0.0110
TB-15	< 0.0072	< 0.0085	< 0.0075	< 0.0075	< 0.0075	< 0.0074	< 0.0075	< 0.0057	< 0.0074	< 0.0075	< 0.0057	< 0.0075	< 0.0075	< 0.0074	< 0.0057	< 0.0074	< 0.0075	< 0.0057	< 0.0059	< 0.0075	< 0.0075	< 0.0196	< 0.0196	< 0.0200	< 0.0144
TB-16	< 0.0071	< 0.0086	< 0.0076	< 0.0076	< 0.0076	< 0.0075	< 0.0076	< 0.0058	< 0.0075	< 0.0076	< 0.0058	< 0.0076	< 0.0076	< 0.0075	< 0.0058	< 0.0075	< 0.0076	< 0.0058	< 0.0060	< 0.0076	< 0.0076	< 0.0238	< 0.0238	< 0.0242	< 0.0175
TB-17	< 0.0046	< 0.0080	< 0.0071	< 0.0071	< 0.0071	< 0.0070	< 0.0071	< 0.0054	< 0.0070	< 0.0071	< 0.0054	< 0.0071	< 0.0071	< 0.0070	< 0.0054	< 0.0070	< 0.0071	< 0.0054	< 0.0056	< 0.0071	< 0.0071	< 0.0124	< 0.0124	< 0.0126	< 0.0091
TB-20	< 0.0167	< 0.0098	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0065	< 0.0086	< 0.0086	< 0.0065	< 0.0086	< 0.0086	< 0.0086	< 0.0065	< 0.0086	< 0.0086	< 0.0065	< 0.0068	< 0.0086	< 0.0086	< 0.0180	< 0.0180	< 0.0183	< 0.0132
TB-21	< 0.0073	< 0.0133	< 0.0118	< 0.0118	< 0.0118	< 0.0117	< 0.0118	< 0.0089	< 0.0117	< 0.0118	< 0.0089	< 0.0118	< 0.0118	< 0.0117	< 0.0089	< 0.0117	< 0.0118	< 0.0089	< 0.0093	< 0.0118	< 0.0118	< 0.0179	< 0.0179	< 0.0183	< 0.0132
TB-22	< 0.0138	< 0.0226	< 0.0200	< 0.0200	< 0.0200	< 0.0199	< 0.0200	< 0.0152	< 0.0199	< 0.0200	< 0.0152	< 0.0200	< 0.0200	< 0.0199	< 0.0152	< 0.0199	< 0.0200	< 0.0152	< 0.0158	< 0.0200	< 0.0200	< 0.0280	< 0.0280	< 0.0285	< 0.0206
TB-23	< 0.0175	< 0.0510	< 0.0450	< 0.0450	< 0.0450	< 0.0448	< 0.0452	< 0.0342	< 0.0448	< 0.0452	< 0.0342	< 0.0450	< 0.0452	< 0.0448	< 0.0342	< 0.0448	< 0.0452	< 0.0342	< 0.0357	< 0.0450	< 0.0450	< 0.0702	< 0.0702	< 0.0716	< 0.0517
TB-23 Duplicate	< 0.0131	< 0.0207	< 0.0183	< 0.0183	< 0.0183	< 0.0182	< 0.0184	< 0.0139	< 0.0182	< 0.0184	< 0.0139	< 0.0183	< 0.0184	< 0.0182	< 0.0139	< 0.0182	< 0.0184	< 0.0139	< 0.0145	< 0.0183	< 0.0183	< 0.0355	< 0.0355	< 0.0362	< 0.0261
TB-24	< 0.0090	< 0.0111	< 0.0098	< 0.0098	< 0.0098	< 0.0097	< 0.0098	< 0.0074	< 0.0097	< 0.0098	< 0.0074	< 0.0098	< 0.0098	< 0.0097	< 0.0074	< 0.0097	< 0.0098	< 0.0074	< 0.0077	< 0.0098	< 0.0098	< 0.0291	< 0.0291	< 0.0297	< 0.0214

Appendix 2 continued. Raw PCB congener data for sediment core samples collected from the Kootenai River, 2007. "<" indicates a value less than the method detection limit (the number that follows this flag is the method detection limit). "K" indicates that a peak was detected that did not meet the qualitative identification criteria and the value following this flag represents the estimated maximum possible concentration.

CLIENT ID	PCB 198	PCB 199	PCB 200	PCB 201	PCB 202	PCB 204	PCB 205	PCB 206	PCB 207	PCB 208	PCB 209
TB-1	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**K 0.022**	< 0.0100	< 0.0100	< 0.0100
TB-1 (Duplicate)	< 0.0248	< 0.0248	< 0.0179	< 0.0179	< 0.0194	< 0.0179	< 0.0187	< 0.0176	< 0.0139	< 0.0139	< 0.0100
TB-11	< 0.0101	**K 0.011**	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	**0.063**	**K 0.113**	**0.023**	**0.076**
TB-2	< 0.0168	< 0.0168	< 0.0121	< 0.0121	< 0.0131	< 0.0121	< 0.0126	< 0.0173	< 0.0136	< 0.0136	< 0.0100
TB-3	< 0.0182	< 0.0182	< 0.0131	< 0.0131	< 0.0142	< 0.0131	< 0.0136	**K 0.012**	< 0.0100	< 0.0100	< 0.0100
TB-3-2	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0191	**K 0.018**	< 0.0151	< 0.0107
TB-5	< 0.0126	< 0.0126	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0100	< 0.0195	< 0.0154	< 0.0154	< 0.0100
TB-6	< 0.0179	< 0.0179	< 0.0129	< 0.0129	< 0.0140	< 0.0129	< 0.0135	< 0.0219	**K 0.025**	< 0.0173	< 0.0147
TB-7	< 0.0156	< 0.0156	< 0.0113	< 0.0113	< 0.0122	< 0.0113	< 0.0117	< 0.0112	< 0.0100	< 0.0100	< 0.0137
TB-8	< 0.0172	< 0.0172	< 0.0124	< 0.0124	< 0.0135	< 0.0124	< 0.0129	< 0.0181	< 0.0143	< 0.0143	< 0.0100
TB-9	< 0.0550	< 0.0550	< 0.0397	< 0.0397	< 0.0430	< 0.0397	< 0.0413	< 0.0463	< 0.0366	< 0.0366	< 0.0168
TB-13	< 0.0153	< 0.0153	< 0.0110	< 0.0110	< 0.0119	< 0.0110	< 0.0115	< 0.0150	< 0.0119	< 0.0119	< 0.0086
TB-15	< 0.0200	< 0.0200	< 0.0144	< 0.0144	< 0.0157	< 0.0144	< 0.0150	< 0.0152	< 0.0120	< 0.0120	< 0.0069
TB-16	< 0.0242	< 0.0242	< 0.0175	< 0.0175	< 0.0190	< 0.0175	< 0.0182	< 0.0190	< 0.0150	< 0.0150	< 0.0083
TB-17	< 0.0126	< 0.0126	< 0.0091	< 0.0091	< 0.0099	< 0.0091	< 0.0095	< 0.0171	**K 0.020**	< 0.0136	< 0.0046
TB-20	< 0.0183	< 0.0183	< 0.0132	< 0.0132	< 0.0143	< 0.0132	< 0.0138	< 0.0119	**K 0.017**	< 0.0094	< 0.0105
TB-21	< 0.0183	< 0.0183	< 0.0132	< 0.0132	< 0.0143	< 0.0132	< 0.0137	< 0.0234	< 0.0185	< 0.0185	< 0.0100
TB-22	< 0.0285	< 0.0285	< 0.0206	< 0.0206	< 0.0223	< 0.0206	< 0.0214	< 0.0323	< 0.0255	< 0.0255	< 0.0157
TB-23	< 0.0716	< 0.0716	< 0.0517	< 0.0517	< 0.0561	< 0.0517	< 0.0538	< 0.0622	< 0.0492	< 0.0492	< 0.0383
TB-23 Duplicate	< 0.0362	< 0.0362	< 0.0261	< 0.0261	< 0.0284	< 0.0261	< 0.0272	< 0.0323	**K 0.033**	< 0.0256	< 0.0162
TB-24	< 0.0297	< 0.0297	< 0.0214	< 0.0214	< 0.0232	< 0.0214	< 0.0223	< 0.0299	< 0.0236	< 0.0236	< 0.0077

Appendix 3a. Sampling equipment rinse proof QA/QC sample results for metals analysis. A value following the '<' sign indicates the method detection limit for the given metal.

Sample ID	TB1-E	TB3-E	TB3-2-E	TB5-E	TB6-E	TB7-E	TB8-E	TB9-E	TB11-E	TB11-E2	TB12-E	TB13-E	TB15-E	TB16-E	TB17-E	TB20-E	TB21-E	TB22-E	TB23-E	TB23-E2
Hardness (as CaCO3)	-	<0.70	<0.70	<0.70	<0.70	<0.70	0.85	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
pH	7.12	6.18	5.08	4.95	5.65	5.08	6.26	5.71	5.83	5.41	5.03	5.05	4.94	5.02	5.09	5.12	6.00	5.98	5.04	5.11
Total Metals																				
Aluminum (Al)-Total	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**0.0110**	<0.0050	<0.0060	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050
Antimony (Sb)-Total	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Total	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Beryllium (Be)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total	-	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	0.000024	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	0.000074	<0.000017	<0.000017	<0.000017
Calcium (Ca)-Total	-	**0.19**	<0.10	<0.10	<0.10	<0.10	**0.34**	**0.15**	<0.10	<0.10	<0.10	**0.18**	<0.10	<0.10	<0.10	<0.10	**0.26**	**0.17**	<0.10	<0.10
Chromium (Cr)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co)-Total	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Copper (Cu)-Total	-	**0.0020**	<0.0010	<0.0010	<0.0010	**0.0010**	**0.0011**	<0.0010	**0.0015**	**0.0035**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010
Iron (Fe)-Total	-	<0.030	<0.030	**0.050**	<0.030	<0.030	<0.030	<0.030	<0.030	**0.058**	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Total	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Total	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	**0.00045**	**0.00035**	<0.00030	**0.00064**	<0.00030	**0.00064**	<0.00030	<0.00030	<0.00030	<0.00030	**0.00081**	**0.00049**	<0.00030	<0.00030
Mercury (Hg)-Total	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.00010	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Molybdenum (Mo)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nickel (Ni)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Potassium (K)-Total	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silver (Ag)-Total	-	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)-Total	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Titanium (Ti)-Total	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Vanadium (V)-Total	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	-	**0.0068**	<0.0050	<0.0050	<0.0050	<0.0050	**0.0226**	**0.0057**	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	**0.0057**	<0.0050	<0.0050

Appendix 3b. Coring tube rinse proof QA/QC results for metals analysis. A value following the '<' sign indicates the method detection limit for the given metal.

Sample ID	TB3-C	TB7-C	TB11-C	TB20-C	TB21-C	TB23-C
Hardness (as CaCO3)	<0.70	<0.70	<0.70	5.57	<0.70	3.27
pH	6.10	6.18	5.79	6.80	6.03	6.47
Total Metals						
Aluminum (Al)-Total	<0.0050	<0.0050	<0.0050	**0.0414**	**0.0626**	**0.128**
Antimony (Sb)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Arsenic (As)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Barium (Ba)-Total	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Beryllium (Be)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron (B)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017
Calcium (Ca)-Total	**0.26**	**0.23**	**0.14**	**1.81**	**0.23**	**0.86**
Chromium (Cr)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt (Co)-Total	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Copper (Cu)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Iron (Fe)-Total	0.031	<0.030	<0.030	**0.172**	<0.030	**0.325**
Lead (Pb)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	**0.26**	<0.10	**0.27**
Manganese (Mn)-Total	**0.00085**	**0.00049**	**0.00124**	**0.00759**	**0.00088**	**0.0893**
Mercury (Hg)-Total	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Molybdenum (Mo)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nickel (Ni)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silver (Ag)-Total	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)-Total	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin (Sn)-Total	<0.00050	0.00167	<0.00050	<0.00050	**0.00410**	<0.00050
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0050	<0.0050	**0.0067**	<0.0050	**0.0072**	<0.0050

Appendix 3c. Trip blank QA/QC results for metals analysis. A value following the '<' sign indicates the method detection limit for the given metal.

Sample ID	TB6-T	TB9-T	TB23-T
Hardness (as CaCO3)	<0.70	4	<0.70
pH	6.10	6.71	5.16
Total Metals			
Aluminum (Al)-Total	<0.0050	**0.624**	**0.0087**
Antimony (Sb)-Total	<0.00050	<0.0025	<0.00050
Arsenic (As)-Total	<0.00050	<0.0025	<0.00050
Barium (Ba)-Total	<0.020	<0.10	<0.020
Beryllium (Be)-Total	<0.0010	<0.0050	<0.0010
Boron (B)-Total	<0.10	<0.50	<0.10
Cadmium (Cd)-Total	<0.000017	<0.000085	<0.000017
Calcium (Ca)-Total	**0.11**	**1.59**	<0.10
Chromium (Cr)-Total	<0.0010	<0.0050	<0.0010
Cobalt (Co)-Total	<0.00030	<0.0015	<0.00030
Copper (Cu)-Total	<0.0010	**0.0077**	<0.0010
Iron (Fe)-Total	<0.030	**1.00**	**0.044**
Lead (Pb)-Total	<0.00050	<0.0025	<0.00050
Lithium (Li)-Total	<0.0050	<0.025	<0.0050
Magnesium (Mg)-Total	<0.10	<0.50	<0.10
Manganese (Mn)-Total	**0.00038**	**0.0201**	**0.00080**
Mercury (Hg)-Total	<0.00010	<0.00020	<0.000020
Molybdenum (Mo)-Total	<0.0010	<0.0050	<0.0010
Nickel (Ni)-Total	<0.0010	<0.0050	<0.0010
Potassium (K)-Total	<2.0	<10	<2.0
Selenium (Se)-Total	<0.0010	<0.0050	<0.0010
Silver (Ag)-Total	<0.000020	<0.00010	<0.000020
Sodium (Na)-Total	<2.0	<10	<2.0
Thallium (Tl)-Total	<0.00020	<0.0010	<0.00020
Tin (Sn)-Total	<0.00050	<0.0025	<0.00050
Titanium (Ti)-Total	<0.010	<0.050	<0.010
Uranium (U)-Total	<0.00020	<0.0010	<0.00020
Vanadium (V)-Total	<0.0010	<0.0050	<0.0010
Zinc (Zn)-Total	<0.0050	<0.025	<0.0050

Literature Cited

Berlin, W.H., R.J. Hesselberg, and M.J. Mac. 1981. Growth and mortality of fry of Lake Michigan lake trout during chronic exposure to PCBs and DDE. Ann Arbor MI: U.S. Fish and Wildlife Service. Technical Paper 105. p 11-22.

British Columbia Ministry of the Environment. 2005. Working Guidelines for Sediments. http://www.env.gov.bc.ca/wat/wq/BCguidelines/working.html

Burton, G.A. 2004. Sediment quality criteria in use around the world. Limnology 3(2):65-76.

Clarke, J.U. 1995. Guidelines for statistical treatment of less than detection limit data in dredged sediment evaluations. U.W. Army Engineer Waterways Experiment Station. Vicksburg, MS. EEDP-04-23. USEPA/USACE. 1998. Evaluaiton of dredged material proposed for discharge in waters of the U.S. – Testing Manual: Inland Testing Manual. EPA-823-B-98-004.

Cleverly, D. 2005. Memorandum: Resoponse to ecological risk assessment forum request for information on the benefits of PCB congener-specific analyses. NCEA-C-1315 ERASC-002F, USEPA Ecological risk Assessment Support Center Office of research and Development, Cincinatti, OH.

Cuerrier, J.P., J.A. Keith, and E. Stone. 1967. Problems with DDT in fish culture operations. Naturaliste Can 94:315-320.

Cynthia M. Rachol and Daniel T. Button, 2006, Areal Distribution and Concentration of Contaminants of Concern in Surficial Streambed and Lakebed Sediments, Lake St. Clair and Tributaries, Michigan, 1999–2003: U.S. Geological Survey Scientific Investigations Report 2006-5189, 50 p. Date Posted: April 16, 2007. [http://pubs.water.usgs.gov/sir2006-5189/]

Davidson, A. and G. Kruse. 2006 Draft. Assessment of the organic and inorganic contaminants affecting native fish populations in the Kootenai River, Idaho, Montana. Environmental Contaminants Program: Off-Refuge Investigations Sub-Activity Final Report. Department of the Interior, US Fish and Wildlife Service, Project ID 200010002.1 FFS 1F32.

Di Toro, D.M., C.S. Zarba, D.J. Hansen, K.J. Scott, M.B. Hicks. S.M. Mayr, and M.S. Redmond. 1990. Toxicity of cadmium in sediments: the role of acif volatie sulfide. Environmental Toxicology and Chemistry 9:1487-1502.

Encyclopedia of Public Health. 2007. http://www.enotes.com/public-health-encyclopedia/

Environment Canada. 2003. Canadian Environmental Quality Guidelines. http://www.ec.gc.ca/CEQG-RCQE/English/default.cfm

Environment Canada. 1995. Interim Sediment Quality Guidelines. Draft Report. Evaluation and Interpretation Branch, Ecosystem Conservation Directorate, Ottawa, Ontario. 10 pp. + appendices.

EPA1: http://www.epa.gov/safewater/dwh/t-soc/methoxyc.html

EPA2: www.epa.gov

EPA3: http://www.pbtprofiler.net/

EPA/USACE. 1998. Evaluation of dredged material proposed for discharge in waters of the U.S. - Testing manual. EPA-823 -B-98 -O04, Washington, D.C.

Florida Department of Environmental Protection. http://www.dep.state.fl.us/water/monitoring/seds.htm

Ingersoll, C., J. Hayward, J. Field, E. Long, and D. MacDonald. 2001. Use of sediment quality guidelines and a weight of evidence approach in the assessment of sediment contamination. EPA Forum on Managing Contaminated Sediments at Hazardous Wast Sites – May 30, Alexandria, Virginia.

Ingersoll, C. and D. MacDonald. 2005. Development and application of empirically-derived sediment quality guidelines. Tri-State Mining District Forum Presentation - April 12 to 14. Missouri Southern State University, Joplin, MO

Knudson, K. 1994. Water quality status report: Kootenay (Kootenai) River basin British Columbia, Montana and Idaho. Report of Ecological Resource Consulting to the Kootenai River Network, Libby, Montana.

Kootenai River Network. 2000. Comprehensive water quality monitoring plan for the Kootenai River basin: British Columbia, Montana and Idaho. Report of Century West Inc., Summit Environmental, Aqua-Tex Scientific Consulting, EcoAnalysts, Inter-Fluve, and GeoResearch inc. to the Kootenai River Network, Libby, Montana.

Kruse, G. 2000. The effects of contaminants on reproduction, embryo development and related physiological processes in Kootenai River White Sturgeon, *Acipenser Transmontanus* Richardson. Masters Thesis, University of Idaho, Moscow.

Kruse, G.O. and D.L. Scarnecchia. 2002. Assessment of bioaccumulated metal and organochlorine compounds in relation to physiological biomarkers in Kootenia River white sturgeon. Journal of Applies Icthyology 18:430-438.

Kruse, G. 2003. 2001 Kootenai River Macroinvertebrate Contaminant Study. Report prepared for the Kootenai Tribe of Idaho, Bonners Ferry.

Kruse, G. 2005. Shorty's Island (Kootenai River) Sediment Core Analysis Report: PCBs, Organochlorine Pesticides and Metals Analysis. Report prepared for the Kootenai Tribe of Idaho, Bonners Ferry.

Kruse, G. and A. Fernandez. In Press. Kootenai River White Sturgeon Contaminant Monitoring: 2000-2007. Report being prepared for the Kootenai Tribe of Idaho, Bonners Ferry.

Long, E.R. and L.G. Morgan. 1990. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. National Oceanic and Atmospheric Administration. Seattle, Washington.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine nad estuarine sediments. Environmental Management 19(1):81-97.

Long, E.R., C.G. Ingersoll, and D.D. MacDonald. 2006. Calculation and Uses of Mean Sediment Quality Guideline Quotients: A Critical Review. Environmental Science & Technology, Vol 40(6), 1726-1736.

MacDonald, D.D. and C.G. Ingersoll. 2002. A guidance manual to support the assessment of contaminated sediments in freshwater ecosystems. Volume II – Design and Implementation of Sediment Quality Investigations. USEPA document number EPA-905-B02-001-B. Great Lakes National Program Office, Chicago, Illinois.

MacDonald, D.D. and M. MacFarlane. 1999. Criteria for managing contaminated sediment in British Columbia. British Columbia Ministry of Environment, Lands,a nd Parks. Victoria, British Columbia.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

MAAC. 2008. Mesothelioma and Asbestos Awareness Center. http://www.maacenter.org/asbestos/types.php

Macek, K.J. 1968. Growth and resistance to stress in Brook Trout fed sublethal levels of DDT. Journal of the Fisheries Research Board of Canada 25:2443.

Michelsen, T.C. 1992. Organic carbon normalization of sediment data. WADOE Technical Memorandum Number 05-09-050. www.ecy.wa.gov/pubs/0509050.pdf

MT DOT. 2007. Montana Department of Transportation. http://www.dot.state.mn.us/environment/pdf_files/Asbestos_Manual/AMmanual.pdf

NOAA 2004. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pp.

Ontario Ministry of Environment and Energy. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario.

Persaud, D., R. Jaagumagi, and A. Hayton 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. ISBN 0-7729-9248-7. Ontario Ministry of the Environemtn, Ottawa, Ontario. 23 p.

Rachol, C.M. and D.T. Button. 2006. Areal Distribution and Concentration of Contaminants of Concern in Surficial Streambed and Lakebed Sediments, Lake St. Clair and Tributaries, Michigan, 1999–2003: U.S. Geological Survey Scientific Investigations Report 2006-5189, 50 p. [http://pubs.water.usgs.gov/sir2006-5189/]

Richards, D. 1997. Kootenai River biological baseline status report. Report of the Kootenai Tribe of Idaho to the U.S. Department of Energy/Bonneville Power Administration Report, Project 97208-3621. Portland, Oregon.

Stockholm Convention. 2001. http://www.pops.int/documents/pops/default.htm

Tillitt, D.E. 1999. The toxic equivalents approach for fish and wildlife. Human and Ecological Risk Assessment 5(1):25-32.

USACE. 1996. Lower limits of organic carbon normalization: Results of fish/sediment/water equilibrium partitioning studies. Environmental effects of dredging - Technical Notes EEDP-01-38. US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Van den Berg M., L. Birnbaum, A.T.C. Bosveld, B. Brunström, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K. Djien Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Wærn, and T. Zacharewski. 1998. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environmental Health Perspecitves, 106(12), 775-792. [http;//www.who.int.pcs.docs/dioxin-exec-sum-final.htm].

Wisconsin Department of Natural Resources (WDNR). 2003. Consensus-based sediment quality guidelines: Recommendations for use and application. Interim Guidance. WDNR report number WT-732. Developed by the Contaminated Sediment Standing Team, Madison, Wisconsin.