COEUR
ALASKA
KENSINGTON GOLD MINE

February 28, 2008

Ms. Irene Hopkins
Office of Water – NPDES Compliance Assistance
U.S. Environmental Protection Agency
1200 Sixth Avenue (OW-133)
Seattle, WA 98101

RE: Annual Report; NPDES Permit AK 005057-1; Kensington Gold Project

Dear Ms. Hopkins:

As per the approved NPDES permit Coeur Alaska submits the required annual reporting. Enclosed please find:

- Annual Water Quality Monitoring Summary for 2007, Volume 1: Aquatic Resources; including sediment toxicity testing, resident and anadromous fish surveys, benthic invertebrate surveys and aquatic vegetation surveys.
- Annual Water Quality Monitoring Summary for 2007, Volume 2: Water Quality Analytical Data; including data for Outfall 001 influent and effluent, Outfall 003 effluent and receiving water stations.
- An electronic copy of historical water quality data.

Permit AK 005057-1 was previously in effect from May 1998 to May 2003. Coeur Alaska continued monitoring in accordance with this permit until September 1, 2005 when the new permit became effective. Changes in required monitoring by the new permit took effect as of September 1, 2005. Results of monitoring from January 1 to December 31, 2007 are included in this report.

If you have any concerns or comments please feel free to call me at your earliest convenience at (907) 523-3309.

Sincerely,

C. D. Gill

Clyde Gillespie
Environmental & Regulatory Affairs Manager

Attachment

Cc: Kenwyn George (ADEC)
John Dunker (ADNR)
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CFS 8.1.5 Annual 2007

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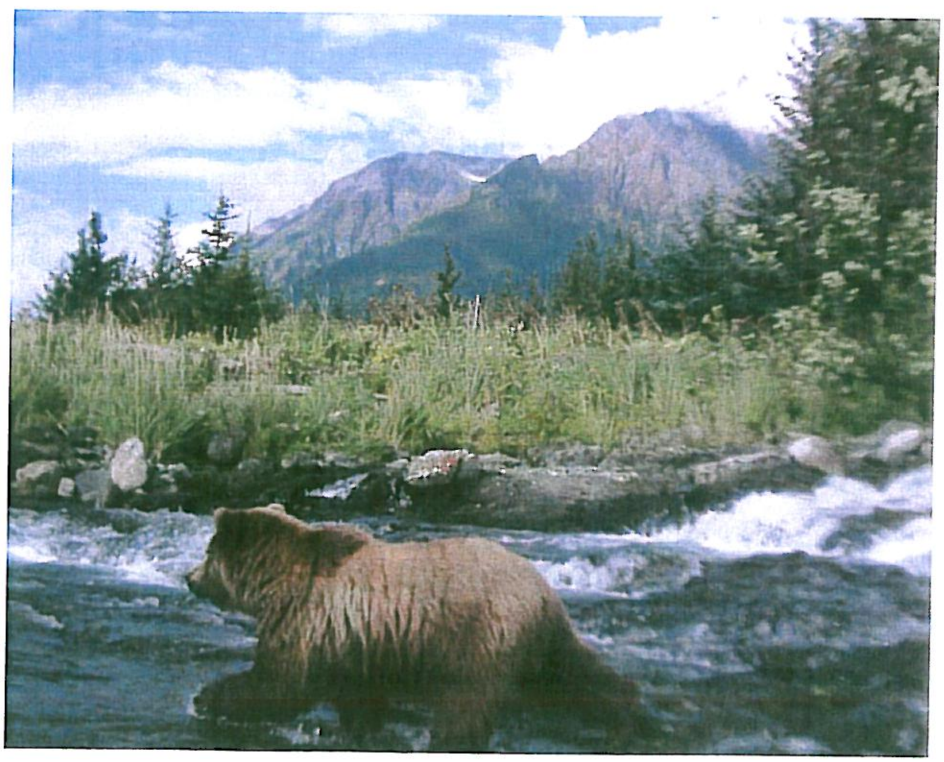
NPDES ANNUAL REPORT 2007

VOLUME 1: AQUATIC RESOURCES

January 2008



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1.0 Introduction

This report describes 2007 aquatic resource monitoring conducted for the Kensington Project, near Juneau, Alaska, as required by the National Pollutant Discharge Elimination System Permit (Permit No. AK-005057-1). Annual monitoring is conducted on Sherman, Johnson and Slate Creeks, adjacent to the project area, and includes toxicity testing of stream sediment, benthic invertebrate surveys, resident fish population estimates, counts of outmigrating salmon fry and returning adult salmon, analysis of spawning gravel quality, and aquatic vegetation surveys.

2.0 Study Area

Sherman Creek drains an area of 10.59km^2 (4.09 mile^2) that ranges from 0 to 1,693m (5,552ft) in elevation (Konopacky 1992). It consists of four upper tributaries, Ivanhoe, Ophir, Upper Sherman and South Fork Sherman, which converge into a single channel approximately 1,500m from the stream mouth on the east shore of Lynn Canal (Figure 1). A permanent barrier to fish migration in the form of vertical falls exists 360m from the stream mouth. A tunnel connecting the nearby Kensington Mine with Jualin Mine on the Berners Bay side of the project was completed in July 2007. Mine drainage from the tunnel enters a water treatment facility before being discharged into Sherman Creek at permitted outfall 001, upstream of the confluence with Ivanhoe and Ophir tributaries (Figure 1).

Slate Creek and Johnson Creek drain into the north side of Berners Bay (Figure 1). Slate Creek drains an area of 11.61km^2 (4.48 mile^2) and has vertical fall barriers that prohibit fish passage on both East and West forks approximately 800m from the stream mouth. Johnson Creek drains an area of 19.97km^2 (7.71 mile^2) and has impassable barrier falls approximately 1,200m upstream from the confluence with Berners Bay. Construction of the Tailings Storage Facility at Lower Slate Lake was halted in early 2007 due to legal issues.

Dolly Varden char (*Salvelinus malma*), pink salmon (*Onchorhynchus gorbuscha*), chum salmon (*O. keta*), cutthroat trout (*O. clarki*), and prickly sculpin (*Cottus asper*) inhabit lower reaches of each stream below waterfalls that inhibit fish passage (Konopacky 1992, Biostat 1998). Dolly Varden are the only species occurring upstream of these barriers (Biostat 1998).

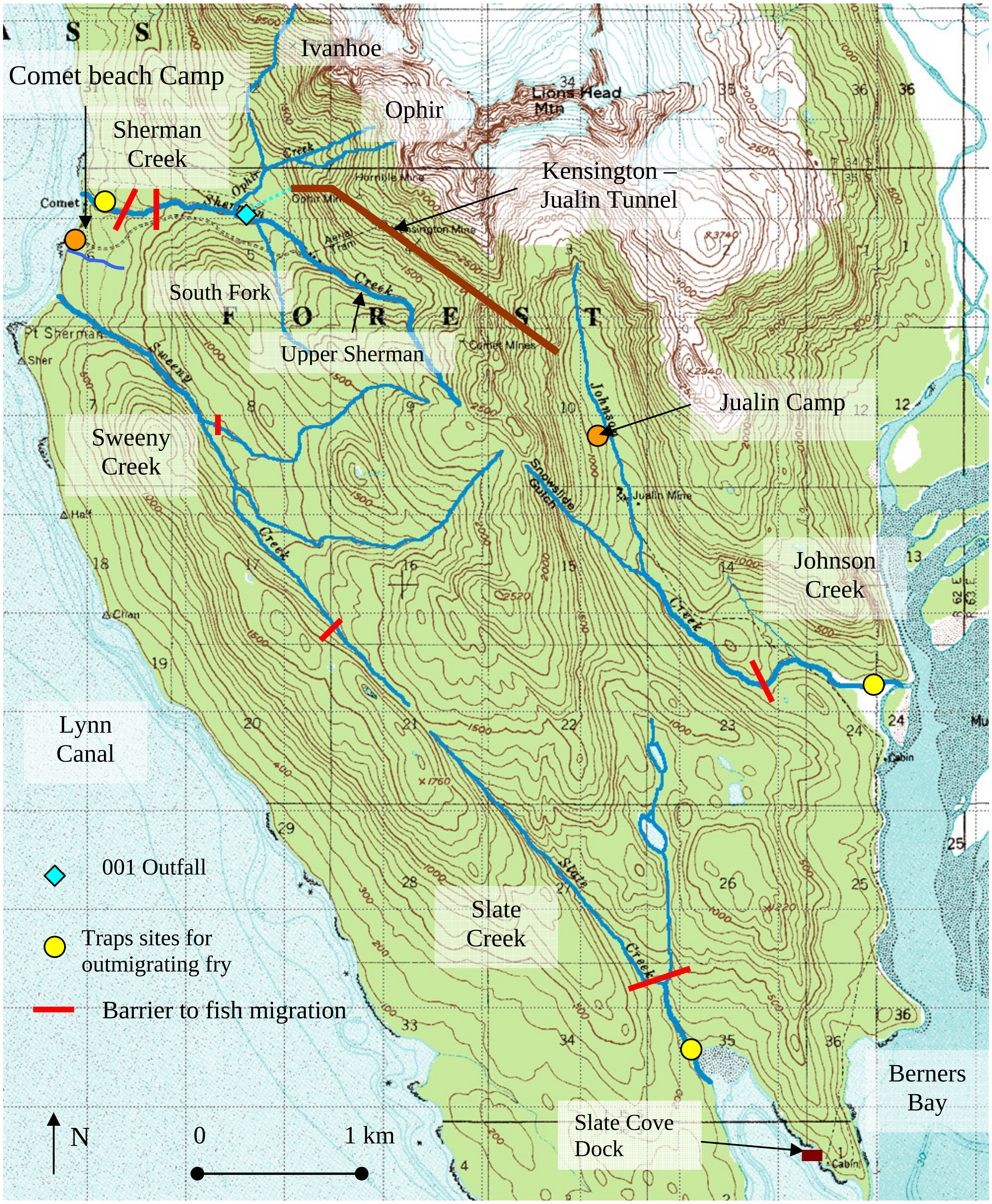


Figure 1: Location of streams near Kensington Mine included in 2007 aquatic resource monitoring. Sediment toxicity testing, benthic invertebrate surveys, resident and anadromous fish surveys, analysis of spawning gravel and aquatic vegetations surveys were conducted in Sherman, Johnson and Slate Creeks. Benthic invertebrate monitoring was also conducted on Sweeny Creek.

3.0 Sediment Monitoring

3.1 Introduction

Stream sediment samples are collected and tested for biological toxicity and physical composition. Specific tests performed included: (1) 10-day whole sediment toxicity tests on the amphipod *Hyalella azteca*, and the midge *Chironomus tentans*, (2) measures of total organic carbon, total solids, total volatile solids, total sulfide, (3) particle size analysis of sediment, and (4) analysis of metals in the sediment. Deposited stream sediment was collected in the lower and middle reaches of Sherman Creek, lower Slate Creek and lower Johnson Creek in August 2007. Metals tend to adhere to fine clay particles, but there a very few areas of fine sediment deposition in any of the streams. A few areas on the stream margins were found with fine deposits of mud trapped behind boulders. These areas were targeted for sample collection.

3.2 Methods

At each site, a sediment sample was collected by personnel using stainless steel scoops. The sediment was shaken through sieves with perforations of 1.68, 0.42 and 0.15mm to separate coarse and fine sediment. The fine sediment that passed through the smallest diameter sieve was then poured into an Imhoff cone and allowed to settle for 10 minutes. Water was then decanted off the top and the finest sediment left in the bottom of the cone collected for the sample. This process was repeated until approximately 2L of fine sediment was collected at each site.

100ml of the sediment was placed in pre-cleaned glass containers provided by the laboratory (ENSR, Fort Collins, Colorado). This sample was analyzed to determine physical composition (metal concentration, grain size etc). The remainder of the sample was placed in 2L pre-cleaned high-density polypropylene containers for toxicity testing. Sampling equipment (stainless steel scoops, sieves) was cleaned between sites by rinsing with site water and ethyl alcohol.

Particle size was determined for each creek using ASTM D422: Standard Test Method for Particle-Size Analysis of Soils. The distribution of particle sizes larger than 75 µm (retained on the No. 200 sieve) was determined by sieving, while the distribution of particle sizes smaller than 75 µm was determined by a sedimentation process using a hydrometer (Table 1).

Table 1: Sediment particle size determination for Sherman, Johnson, and Slate Creek samples.

Particle Size %	Lower Sherman	Middle Sherman	Lower Johnson	Lower Slate
Sand	82	78	18	78
Silt	14	20	56	20
Clay	4	2	26	2
Texture	Loamy sand	Loamy sand	Silt Loam	Loamy sand

Johnson Creek sediment contained the highest percentage of fine material (silt and clay). Samples from Sherman and Slate Creeks were similar in their compositions of sand and clay (Table 1). Total Solids, Total Volatile Solids, Total Sulfide, and were analyzed using Standard Methods 2540B, 2540E and Total Organic Carbon was determined using the Organic Matter-Walkley Black Method (Table 2). Concentrations of total organic carbon ranged from 0.3% in Johnson Creek sediment to 2.7% in Slate Creek sediment. Total volatile solids ranged from 0.8% in Johnson Creek sediment to 5% in Slate Creek samples. Sulfide was not detected in any of the samples (15 μmoles/g MRL). The laboratory reports are included as Appendix 1a and b.

Table 2: Inorganic parameter analysis for Sherman, Johnson, and Slate Creeks.

Parameter	Lower Sherman	Middle Sherman	Lower Johnson	Lower Slate
Total Solids %	74.4	73.3	72.5	66.5
Total Volatile Solids %	1.99	2.32	0.80	5.12
Acid Volatile Sulfide (μmoles/g)	<15	<15	<15	<15
Total Organic Carbon %	1.3	1.4	0.3	2.7

3.3 Sediment Metal Concentration

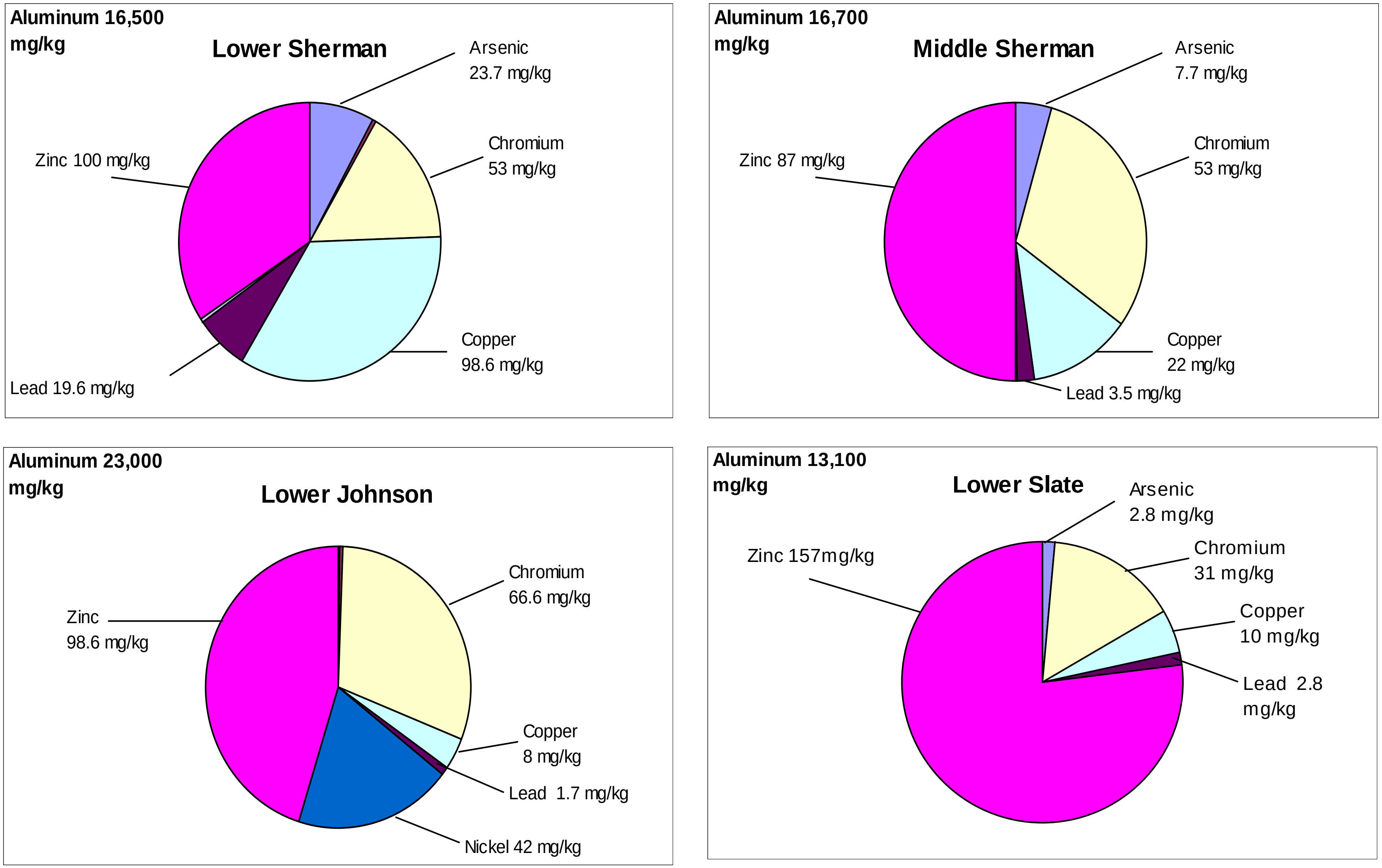
Total metals (aluminum, chromium, copper, nickel, silver, zinc) were determined using EPA method 6010B, inductivity-coupled plasma-atomic emission spectrometry (ICP-AES). Solid sample analysis of the metals arsenic, cadmium, lead and selenium was carried out using method 6020, inductivity-coupled plasma-mass spectrometry (ICP-MS) and mercury was determined by method 7471A, manual cold-vapor technique. Table 3 summarizes metal concentrations in the sediment collected from each stream.

Table 3: Concentrations of metals in stream sediment, August 2007 (mg/kg)

Analyte	Lower Sherman	Middle Sherman	Lower Johnson	Lower Slate
Aluminum	16,500	16,700	23,000	13,100
Arsenic	23.7	7.71	0.89	2.81
Cadmium	0.533	0.095	0.092	0.207
Chromium	47.1	53.0	66.6	31.1
Copper	98.6	22.2	8.04	10.3
Lead	19.6	3.51	1.67	2.83
Mercury	0.062	0.083	<0.02	0.058
Nickel	<5.0	<5.0	42.1	<5.0
Selenium	0.815	<0.2	<0.2	<0.2
Silver	<1.0	<1.0	<1.0	<0.1
Zinc	100	87.0	98.6	157

Five out of the eleven metals appeared to be of highest concentration in Lower Sherman (arsenic, cadmium, copper, lead and selenium). Five metals showed lowest concentrations in Johnson Creek. All three creeks had high concentrations of aluminum, particularly Johnson Creek with 23,000 mg/kg. Zinc, chromium and copper were the next most abundant metals after aluminum (Figure 2). Zinc made up almost 80% of the metal content (excluding aluminum) in the Lower Slate sample. Copper made up 35% of the sample at Lower Sherman and nickel comprised 19% at Lower Johnson.

Figure 2: Metal content of stream sediment.



3.4 Sediment Toxicity Testing

Short-term toxicity testing was conducted using the amphipod *Hyalella azteca* and 3rd instar midge larvae, *Chironomus tentans.* Any endemic organisms in the sediment were removed prior to testing. Eight replicates of stream sediment were used per treatment. The primary control sediment was silica sand and a secondary lab control sediment was formulated with a smaller grain size and higher organic matter content (Appendix 1a, 1b).

Both organisms underwent 10 day toxicity tests using survival and growth (ash-free dry weight per organism) as endpoints. Physical parameters including dissolved oxygen temperature, pH, hardness, alkalinity, conductivity, and ammonia were monitored throughout the tests (Appendix 1a, 1b). Lower Johnson showed significantly lower survival of *C. tentans* compared to the sand control, but not compared to the laboratory formulated control (Table 4A). Survival of *H. azteca* was also lower in Lower Johnson, but control sediments in this experiment showed poor survival due to test organisms being accidentally omitted from some control replicates. In a repeated experiment Lower Johnson showed 91.25 % survival.

Table 4A: Survival of organisms after 10-day exposure to sediment.

Biological Data			
Collection Date and Time	**Sample ID**	***Chironomus* Survival (%)**	***Hyalella azteca* Survival (%)**
8/15/07 @ 10:00	Lower Sherman	**80.0**	**78.75**
8/18/07 @ 10:30	Middle Sherman	**82.5**	**80.0**
8/17/07 @ 11:45	Johnson Creek	**67.5**[a]	**68.75 (91.25)**
8/16/07 @ 12:00	Slate Creek	**83.75**	**78.75**
	Sand - control	**85.0**	**50.0 (98.75)**
	Lab Formula	**71.25**	**57.5 (92.5)**

[a] significant compared to sand control but not lab formulated sediment.
Numbers in parenthesis are results of repeated experiment due to control failure in first experiment.

Survival of *C. tentans* in Johnson Creek in 2007 was lower than 2006, but equal to 2005 toxicity tests (Table 4B). Survival in Sherman and Slate Creeks was slightly lower in 2007 than 2006, but higher than 2005. The survival of *H. azteca* in Johnson Creek during the repeat test was higher than previous years. Only the original test with poor control performance included Lower Sherman Creek, for which survival appeared lower than previous years, but survival was still fair at almost 80%. 2007 was the first year sediment was collected from Middle Sherman so comparison with previous years was not possible for this site.

Table 4B: Comparison of survival rates from 2005-2007.

	2005	2006	2007
Sample ID	***Chironomus* Survival (%)**	***Chironomus* Survival (%)**	***Chironomus* Survival (%)**
Sherman Creek	**75**	**82.5**	**80**
Johnson Creek	**67.5**	**86**	**67.5**
Slate Creek	**65**	**85**	**83.75**
Sand - control	**87.5**	**88.75**	**85**
Lab Sediment	**71.2**	**87.5**	**71.25**
	2005	**2006**	**2007**
Sample ID	***Hyalella azteca* Survival (%)**	***Hyalella azteca* Survival (%)**	***Hyalella azteca* Survival (%)**
Sherman Creek	**93.75**	**91.25**	**78.75**
Johnson Creek	**85**	**82**	**68.75 (91.25)**
Slate Creek	**75**	**95**	**78.75**
Sand - control	**91.25**	**83.75**	**50 (98.75)**
Lab Sediment	**80**	**88.75**	**57.5 (92.5)**

Growth of organisms is surmised from the remaining ash free dry weights at the end of the tests expressed per number of original organisms used at the start of the test and the number surviving at the end. Growth (dry weight) of *H. azteca* and *C. tentans* was significantly reduced for Lower Johnson in the repeat experiment (Table 4C), however, growth was also significantly reduced in the lab formulated sediment. Growth responses were similar to those in 2006 for all sites tested. In 2007, as in 2006, the lowest survival and dry weights among the test sediments were found in Lower Johnson sediment.

Growth response data in the first set of *H. azteca* tests in 2007 indicated a pattern similar to that observed in previous years (Appendix 1b). Survival in Lower Johnson was not significantly different from the other sites (p = 0.537), but *H. azteca* growth was significantly less than Sherman sites, based on original organisms. Total organic carbon, which ameliorates the toxicity of several metals, was lower at Johnson Creek, perhaps explaining the difference in survival and growth rates. The relevant QA/QC information can be found in the lab reports (Appendix 1a, 1b).

Table 4C: Dry weights (growth) of organisms after 10-day exposure to sediment.

	Hyalella azteca		*Chironomus titans*	
	Ash Free Dry Weight (mg)		**Ash Free Dry Weight (mg)**	
Sample ID	*per original organism*	*per surviving organism*	*per original organism*	*per surviving organism*
Lower Sherman	0.047	0.060	0.845	1.079
Middle Sherman	0.044	0.054	0.024	0.029
Johnson Creek	0.026	0.036	0.803	1.23
Slate Creek	0.041	0.052	1.050	1.305
Sand - control	0.029	0.057	0.897	1.093
Lab-Sediment	0.017	0.027	1.091	1.594

Repeat experiment

	Hyalella azteca	
	Ash Free Dry Weight (mg)	
Sample ID	*per original organism*	*per surviving organism*
Johnson Creek	0.049[a]	0.054[a]
Sand - control	0.107	0.108
Lab-Sediment	0.068	0.074

a = significantly different from sand control

4.0 Benthic Invertebrates

4.1 Aquatic Invertebrate Collection

Benthic invertebrates were collected from established sampling sites on Johnson, Slate, Sherman and Sweeny Creeks in April and May 2007. Samples were collected from Sweeny Creek on April 14 and Sherman Creek on April 18 at sites used by Konopacky in 1995 (Konopacky 1996). Reach 1 of Sherman Creek lies between 3 and 29m upstream from the mouth while Reach 2 lies between 288 and 315m. Reach 1 of Sweeny Creek lies between 38 and 60m upstream and Reach 2 lies between 236 and 260m. At Johnson Creek samples were collected at the JS-1 flow monitoring site, upstream of the upper bridge crossing on April 12, and at Slate Creek, 400m downstream from Lower Slate Lake on May 7. Each reach was examined for all possible sampling sites, namely riffles with substrate particles greater than 20cm and water depth less than 0.5m. Every 3rd or 4th potential site was sampled until a total of 6 samples were obtained for the reach. Samples were collected using a $0.093m^2$ Surber sampler equipped with 300μm mesh (Figure 3), placed in labeled whirlpak bags and preserved with 70% ethyl alcohol.

4.2 Invertebrate identification

Sorting and identification of invertebrates was conducted by Elizabeth Flory PhD. in Juneau, Alaska, who performed previous invertebrate identification for Kensington Mine samples. Invertebrates were identified to genus level using appropriate taxonomic keys (Merritt & Cummins 1996, Thorp 2001, Clarke 1981) and numbers of each genus recorded for each sample. The number of genera at each site is given in Table 5 and the species composition of samples is given in Table 6.

4.3 Data Analysis

The area covered by the Surber sampling device is 0.093 m^2. The density of invertebrates expressed as total numbers of invertebrates per m^2 was calculated by dividing the number of invertebrates per sample by 0.093. Shannon Diversity (H) and Evenness (E) indices were calculated using the following equations:

$$H = \text{sum} (Pi \log10 \{Pi\})$$

$$E = H/\log10 (S)$$

Where Pi is the number of organisms of a given species divided by the total number of organisms in the sample (the proportion of the sample comprised of species i), and S is the number of species or genera present in the sample. Diversity indices are presented in Table 7. The relative abundance of the EPT taxa, Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddis flies), in each sample was counted and the number of EPT taxa was expressed as a proportion of the total number of taxa present.

Figure 3: The Surber sampler used to collect benthic invertebrates.

4.4 Taxonomic Classification

Slate Creek samples contained a total of 2860 invertebrates from 27 genera, including 14 EPT taxa (Table 5). The ratio of EPT to non-EPT taxa was 0.5. Non-EPT taxa included 10 Diptera genera, of which 7 were Chironomidae (non-biting midges), 2 were Tipulidae (cranefly) and 1 belonged to the Ceratopogoniidae family. There was also the common pea clam *Psidium*, a Simulidae (blackfly), a Collembola (springtail), and an Oligochaetae. Johnson Creek samples contained 1706 invertebrates from 36 genera composed of 32 EPT taxa, 2 Chironomidae taxa, one member of the Sciomyzidae family and one Simulidae, giving a ratio of EPT to non-EPT of 0.9.

Sherman Creek samples contained 494 individuals in Reach 1 and 546 individuals in Reach 2. Reach 1 samples contained 36 genera with 28 EPT taxa while Reach 2 samples contained 27 genera including 22 EPT taxa giving a an EPT ratio of 0.8 for both reaches. Non-EPT taxa included 2 Chironomidae taxa, a Tipulidae, a Simulidae, two other Diptera and an Oligochaetae. Sweeny Creek samples contained 180 individuals in Reach 1 and 297 individuals in Reach 2. Sweeny Creek samples from Reach 1 contained 23 genera, with 7 of these non EPT taxa (3 Chironomidae, 4 Tipulidae). Sweeny Creek samples from Reach 2 contained 27 genera, with 11 of these non EPT taxa (4 Chironomidae, 2 Tipulidae, 3 Brachycera, a Collembola and an Oligochaetae).

Samples from Johnson and Sherman Creeks contained higher numbers of Ephemeroptera, Plecoptera and Trichoptera (EPT taxa) than Slate or Sweeny Creeks as well as fewer non EPT taxa (Table 5) resulting in a higher EPT ratio (Figure 4A).

Table 5: Total number of genera in each taxanomic group

	# Ephem.	# Plecop	# Trichop	# EPT	# non-EPT	# Total taxa	EPT ratio
Slate	7	4	2	13	14	27	0.48
Johnson	9	14	9	32	4	36	0.89
Sherman 1	9	12	7	28	8	36	0.78
Sherman 2	7	8	7	22	5	27	0.81
Sweeny 1	5	7	4	16	7	23	0.70
Sweeny 2	5	8	3	16	11	27	0.59

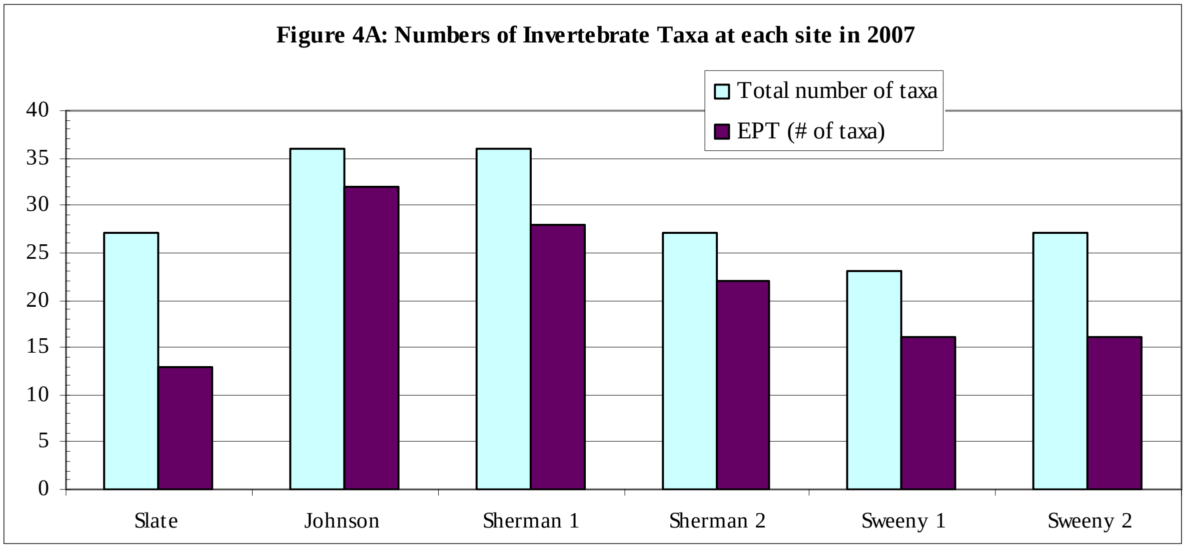


Figure 4A: Numbers of Invertebrate Taxa at each site in 2007
Total number of taxa
EPT (# of taxa)
40
35
30
25
20
15
10
5
0
Slate
Johnson
Sherman 1
Sherman 2
Sweeny 1
Sweeny 2

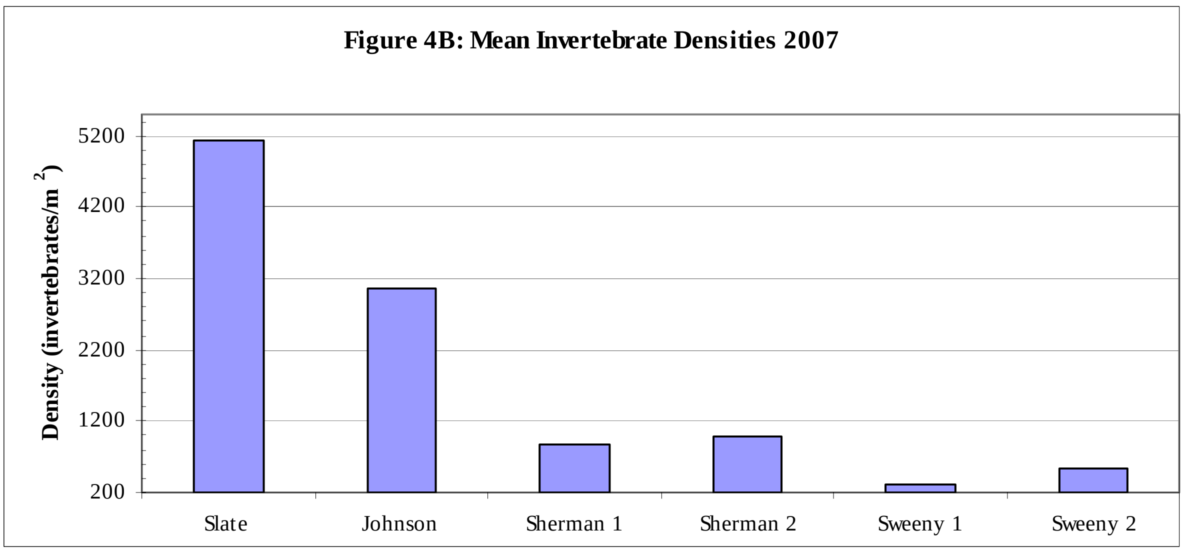


Figure 4B: Mean Invertebrate Densities 2007
Density (invertebrates/m 2)
5200
4200
3200
2200
1200
200
Slate
Johnson
Sherman 1
Sherman 2
Sweeny 1
Sweeny 2

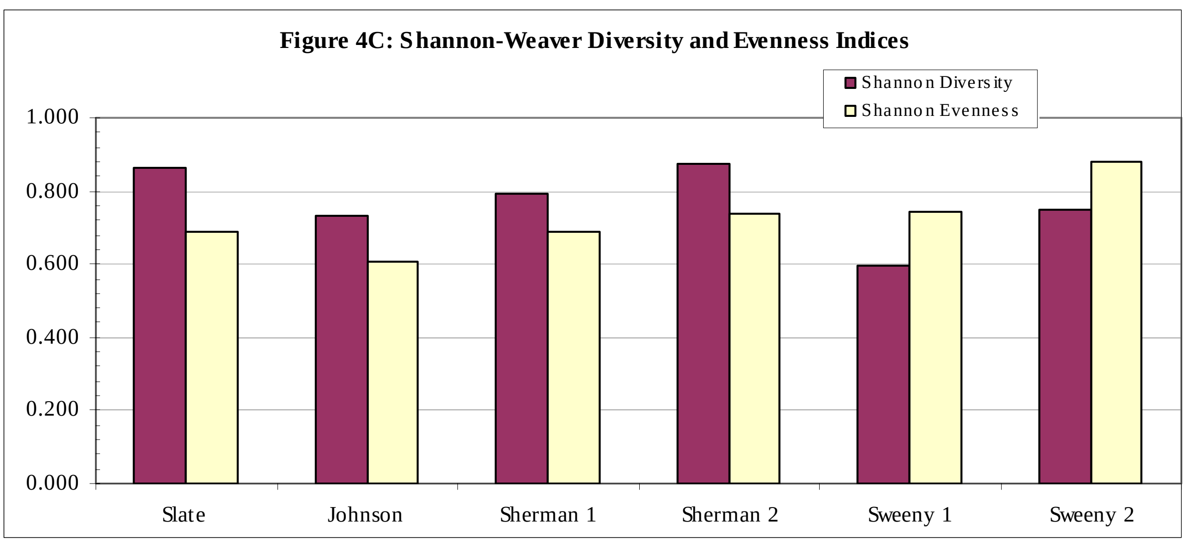


Figure 4C: Shannon-Weaver Diversity and Evenness Indices
Shannon Diversity
Shannon Evenness
1.000
0.800
0.600
0.400
0.200
0.000
Slate
Johnson
Sherman 1
Sherman 2
Sweeny 1
Sweeny 2

Densities of invertebrates in Slate Creek ranged from 1290 to 19,043 per m^2 with a mean of $5133/m^2$ (Table 7). Johnson Creek densities ranged from 1312 to $4806/m^2$ with a mean of $3057/m^2$. Sherman Creek densities ranged from 538 to $1742/m^2$ over both reaches with a mean density of $885/m^2$ in Reach 1 and $978/m^2$ in Reach 2. Sweeny Creek densities ranged from 161 to $892/m^2$ over both reaches with mean density of $323/m^2$ for Reach 1 and $532/m^2$ for Reach 2. Figure 4B compares mean densities between sites. Slate Creek had the highest densities of invertebrates and Sweeny Creek had the lowest. Invertebrate densities in 2007 were more than double 2006 figures at Slate and Johnson Creeks and Reach 2 of Sherman Creek (Figure 5) perhaps due to persistent snow cover over the winter that insulated the streambed from the cold.

The most abundant genera in Slate Creek were the mayflies *Baetis*, *Leptophlebia* and *Epeorus*, the stonefly, *Haploperla*, the pea clam *Psidium*, the blackfly larvae *Prosimulium* and the midges *Eukiefferiella* and *Tanytarsus* (Table 6). In Johnson Creek, the mayflies *Baetis*, *Cinygmula*, *Caudatella* and *Drunella*, the stonefly Zapada and the caddis fly *Rhyacophila* were the most numerous. In Sherman Creek the most abundant taxa were the mayflies *Baetis*, *Cinygmula*, *Caudatella*, and *Rithrogena*, and the stonefly *Plumiperla*. Sweeny Creek abundant fauna included the mayfly *Baetis*, and stoneflies *Plumiperla and Haploperla* and midge *Eukiefferiella*. Most of these genera were numerous at the same sites in 2005 and 2006. *Haploperla* spp. were more numerous at Slate Creek in 2007 than previous years.

4.5 Diversity Indices

The Shannon Diversity (H) and Evenness (E) Indices are commonly applied measures of diversity. The minimum value of H is 0, which would describe a community with a single species. The value increases as species richness (number of species) and species evenness (equal abundance of species) increase. A community with one very dominant species has low evenness and therefore lower diversity. Figure 4C compares the diversity and evenness indices between sites.

The highest diversity was observed at Sherman and Slate Creeks and the lowest diversity at Sweeny Creek, but Sweeny showed high evenness indicating that the few species found were represented by fairly even numbers of species (Table 7). Johnson had a high number of genera, but large numbers of a few mayflies, particularly *Baetis*, reduced diversity.

Table 6: Species Composition of Benthic Invertebrate Samples collected in April and May 2007.

Taxonomic Group				Johnson	Slate	Sherman 1	Sherman 2	Sweeny 1	Sweeny 2
Class	**Order**	**Family**	**Genus**	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**
Insecta	Ephemeroptera	Baetidae	Baetis	157.2	11.2	34.5	40.7	9.0	24.5
			Procleon	0.2	0.0	0.0	0.0	0.0	0.0
		Heptageniidae	Epeorus	2.8	10.3	1.3	3.8	0.7	1.7
			Cinygmula	31.0	8.2	5.5	5.8	0.3	1.2
			Rithrogena	5.2	0.0	5.7	3.8	0.5	2.2
		Ephemerellidae	Attenella	1.5	0.3	0.3	1.7	0.0	0.0
			Drunella	29.7	1.5	1.8	2.2	1.0	1.3
			Caudatella	18.5	0.3	6.7	6.5	0.0	0.0
		Leptophlebiidae	Paraleptophlebia	0.4	43.5	0.8	0.0	0.0	0.0
		Ameletidae	Ameletus	0.0	0.0	0.2	0.0	0.0	0.0
	Plecoptera	Chloroperlidae	Triznaka	0.2	0.0	0.0	0.0	0.0	0.0
			Haploperla	2.7	14.2	0.7	1.8	2.3	2.2
			Suwallia	0.2	0.0	0.2	0.0	0.0	0.2
			Kathroperla	0.2	0.0	0.2	0.0	0.0	0.2
			Plumiperla	0.0	0.0	14.8	11.7	9.8	2.2
			Alaskaperla	0.2	0.0	0.5	0.0	0.0	0.0
			Neaviperla	0.7	1.5	0.0	0.0	0.0	0.2
			Paraperla	0.0	0.0	0.2	0.0	0.0	0.0
			Sweltsia	0.2	0.0	0.0	0.0	0.0	0.2
		Leuctridae	Despaxia	0.3	0.0	0.0	0.0	0.2	0.0
			Perlomyia	3.7	0.0	0.5	1.3	1.3	1.8
			Leuctra	0.0	0.0	0.0	0.2	0.0	0.0
		Perlidae	Agnetina	0.0	3.8	0.0	0.0	0.0	0.0
		Nemouridae	Zapada	7.2	1.5	1.0	1.0	0.0	0.0
			Nemoura	0.2	7.5	0.0	0.0	0.2	0.0
			Shipsa	0.7	0.0	0.0	0.2	0.2	0.0
		Capniidae	Paracapnia	0.2	0.0	0.2	0.5	0.3	0.3
			Allocapnia	0.2	0.0	1.0	0.0	0.0	0.0
			Eucanopsis	0.0	0.0	0.7	0.0	0.0	0.0
		Perlodidae	Megarcys	0.0	0.0	0.2	0.7	0.0	0.0

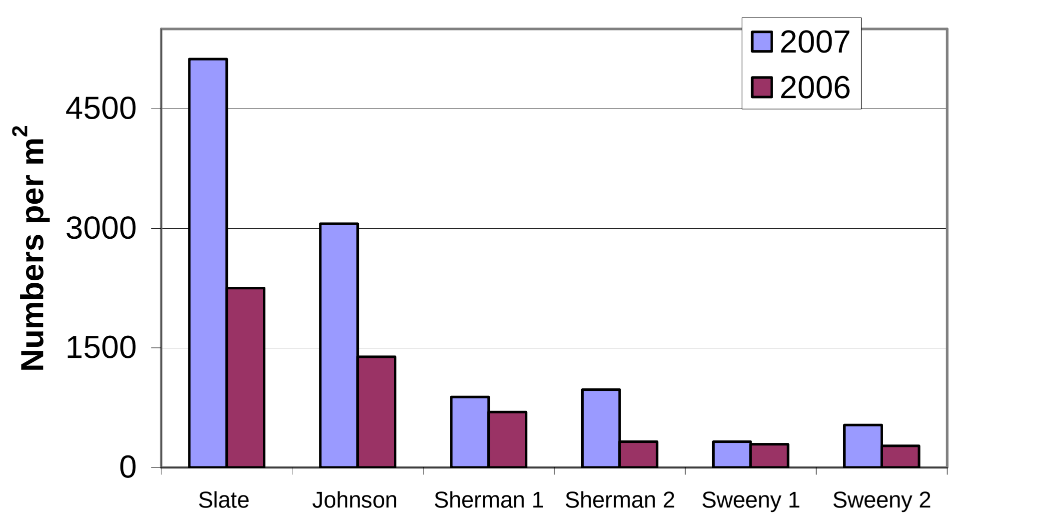
Table 6 cont.

Taxanomic Group				Johnson	Slate	Sherman 1	Sherman 2	Sweeny 1	Sweeny 2
Class	Order	Family	Genus	Mean	Mean	Mean	Mean	Mean	Mean
	Trichoptera	Brachycentridae	Micrasema	0.0	0.0	0.2	0.0	0.0	0.0
		Hydropsychidae	Parapsyche	0.7	0.0	0.2	0.0	0.2	0.3
			Amniocentrus	1.5	0.0	0.0	0.0	0.0	0.0
			Arctopsyche	0.2	0.0	0.0	0.0	0.0	0.0
		Glossosomatidae	Glossoma	0.0	0.0	0.3	0.5	0.2	0.0
			Anagapetus	3.3	0.2	0.0	0.0	0.0	0.0
		Polycentropidae	Neureclipses	0.0	1.7	0.2	0.5	0.2	0.2
		Rhyacophillidae	Rhyacophila	5.0	0.0	0.8	1.8	0.2	0.2
			Himalopsyche	0.0	0.0	0.3	0.8	0.0	0.0
		Psychomiidae	Lype	0.2	0.0	0.0	0.0	0.0	0.0
		Limnephelidae	Pedomeocus	0.2	0.0	0.0	0.0	0.0	0.0
			Apatania	0.3	0.0	0.3	1.8	0.0	0.0
			Moselyana	0.0	0.0	0.0	0.3	0.0	0.0
			Allomyia	0.0	0.0	0.0	0.2	0.0	0.0
	Diptera								
Non EPT	Chironomidae	Orthocladiinae	Eukiefferiella	2.7	25.7	1.7	1.8	1.2	4.7
			Tvetania	3.0	3.2	0.0	0.0	0.5	0.0
			Parachaetocladius	0.0	0.8	0.0	0.0	0.0	0.0
			Corynoneura	0.0	0.7	0.0	0.0	0.0	0.0
			Pagasta	0.0	5.0	0.0	0.0	0.0	0.0
		Tanytarsini	Tanytarsus	0.0	187.3	0.2	0.3	0.3	0.2
			Stempellinella	0.0	5.3	0.0	0.0	0.0	1.8
		Podonominae	Boreochlini	0.0	0.0	0.0	0.0	0.0	0.8
	Nematocera	Tipulidae	Dicranota	0.0	0.0	0.0	0.0	1.0	0.0
			Tipula	0.0	3.2	0.7	0.5	0.2	0.2
			Antocha	0.0	0.5	0.0	0.0	0.0	2.0
			Hesperoconopa	0.0	0.0	0.0	0.0	0.2	0.0
			Prionocera	0.0	0.0	0.0	0.0	0.2	0.0
	Brachycera	Ceratopogonidae	Probezzia	0.0	3.8	0.0	0.0	0.0	0.0
			Culicoides	0.0	0.0	0.0	0.0	0.0	0.2
		Sciomyzidae	Hedria	0.2	0.0	0.0	0.0	0.0	0.0
		Empididae	Chelifera	0.0	0.0	0.0	0.0	0.0	0.2
		Muscidae		0.0	0.0	0.0	0.0	0.0	0.2
		Syrphidae		0.0	0.0	0.2	0.2	0.0	0.0
		Dryomyziidae		0.0	0.0	0.2	0.0	0.0	0.0
	Simuliidae	Simuliidae	Prosimulium	1.2	39.7	0.2	0.3	0.0	0.0
	Collembola	Isotomidae	Folsomina	0.0	0.3	0.0	0.0	0.0	0.2
	Oligochaetae	Naididae		0.0	0.3	0.2	0.0	0.0	0.5
Bivalva	Sphaeriidae	Psidiinae	Psidium (pea clam)	0.0	98.0	0.0	0.0	0.0	0.0

Table 7: Diversity and Evenness Indices for Benthic Invertebrates 2007.

	Density	Shannon-Weaver			Density	Shannon-Weaver	
	(inverts/m^2)	Diversity	Evenness		(inverts/m^2)	Diversity	Evenness
Slate				**Johnson**			
1	1591.4	0.810	0.707	**1**	3559.1	1.178	0.878
2	1290.3	0.813	0.675	**2**	1698.9	0.726	0.590
3	1784.9	0.949	0.742	**3**	1311.8	0.699	0.648
4	3096.8	0.945	0.739	**4**	3720.4	0.689	0.521
5	3946.2	0.900	0.704	**5**	4806.5	0.562	0.419
6	19043.0	0.792	0.581	**6**	3247.3	0.547	0.573
Mean	**5125.4**	**0.868**	**0.691**	**Mean**	**3057.3**	**0.734**	**0.605**
Sherman 1				**Sherman 2**			
1	666.7	0.838	0.777	**1**	279.6	0.419	0.539
2	537.6	1.004	0.854	**2**	161.3	0.383	0.803
3	795.7	0.619	0.574	**3**	688.2	0.939	0.843
4	1376.3	0.826	0.646	**4**	301.1	0.726	0.761
5	1032.3	0.800	0.638	**5**	344.1	0.661	0.782
6	903.2	0.659	0.659	**6**	161.3	0.443	0.736
Mean	**885.3**	**0.791**	**0.691**	**Mean**	**322.6**	**0.595**	**0.744**
Sweeny 1				**Sweeny 2**			
1	279.6	0.419	0.539	**1**	559.1	0.562	0.829
2	161.3	0.383	0.803	**2**	709.7	0.566	0.926
3	688.2	0.939	0.843	**3**	451.6	0.764	0.850
4	301.1	0.726	0.761	**4**	892.5	1.039	0.822
5	344.1	0.661	0.782	**5**	301.1	0.827	0.918
6	161.3	0.443	0.736	**6**	279.6	0.730	0.925
Mean	**322.6**	**0.595**	**0.744**	**Mean**	**532.3**	**0.621**	**0.878**

Figure 5: Comparison of Invertebrate Density



5.0 Resident Fish Population

5.1 Delineation of Strata

Population surveys of resident fish were conducted in 2007 in lower, middle and upper reaches of Sherman, Johnson and Slate Creeks (Figures 6, 7). Each reach is 360m in length. Sherman Creek reaches were designated during aquatic resource surveys in 1998 (Aquatic Science Inc. 1998) while Johnson and Slate reaches were first surveyed in 2005. All middle and upper strata are located above barrier falls and are thereby inaccessible to sea-run fish.

Lower Sherman extends from the stream mouth to the barrier falls 360m upstream. Middle Sherman extends 360m downstream from the confluence of Sherman Creek and Ophir tributary. Upper Sherman extends 360m upstream from the road bridge across Upper Sherman Creek. Lower Johnson begins at the forest/meadow border approximately 500m upstream from the confluence with Berners Bay. Middle Johnson begins at the confluence with the tributary draining Snowslide Gulch. Upper Johnson is located upstream of the mill site pad and above a braided section of river, in the Jualin basin. Lower Slate begins 400m upstream from the mouth; Middle Slate begins 400m downstream from the proposed dam at Lower Slate Lake; Upper Slate begins at the mouth of the north inlet to Upper Slate Lake. GPS points for the start of each reach are given in Table 8.

Table 8: GPS Coordinates of Sherman, Johnson and Slate Creek Strata.

Reach	GPS Coordinates	Elevation
Lower Sherman	N 58°52.121 W 135°08.506’	12 ft
Middle Sherman	N 58°52.041’ W 135°06.961’	420 ft
Upper Sherman	N 58°51.785’ W 135°06.118	720 ft
Lower Johnson	N 58°49.437’ W 135°59.966	12 ft
Middle Johnson	N 58°49.845’ W 135°02.325	550 ft
Upper Johnson	N 58°51.088’ W 135°02.935	800 ft
Lower Slate	N 58°47.754’ W 135°02.332	15 ft
Middle Slate	N 58°48.201’ W 135°02.322	350 ft
Upper Slate	N 58°48.847’ W 135°02.418	800 ft

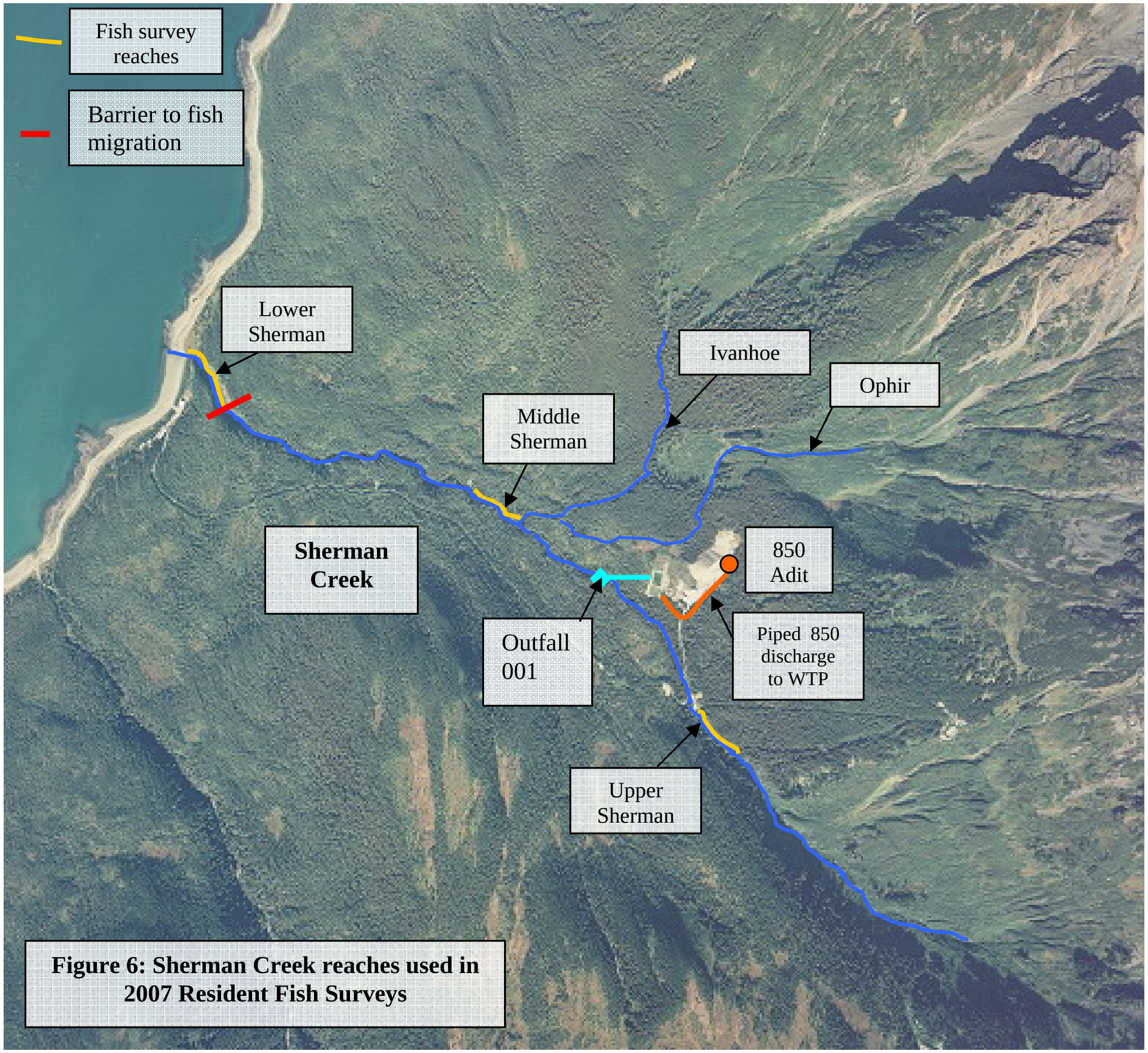


Figure 6: Sherman Creek reaches used in 2007 Resident Fish Surveys

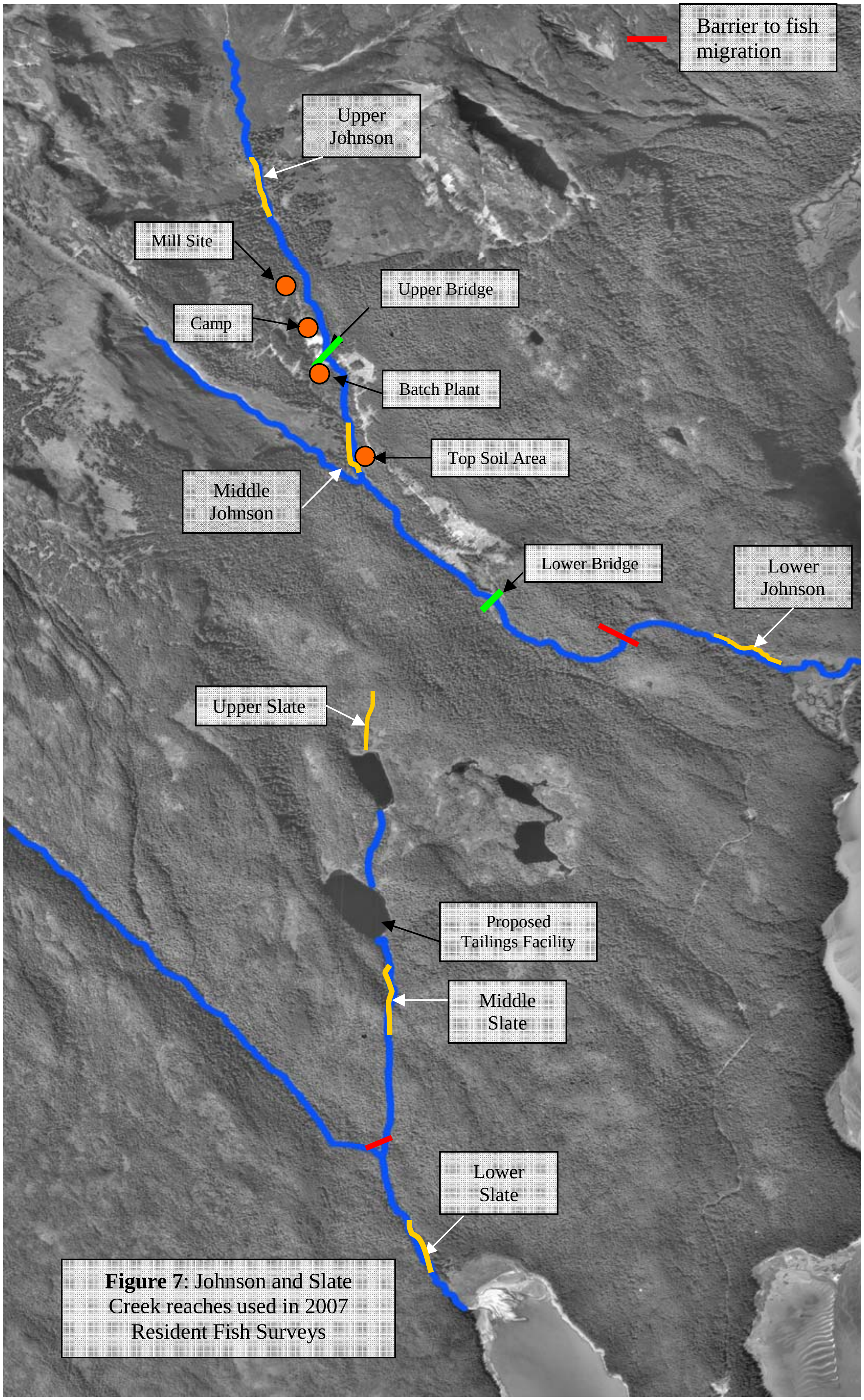


Figure 7: Johnson and Slate Creek reaches used in 2007 Resident Fish Surveys

5.2 Resident fish population survey methods

The number of fish within each stratum was estimated using the methods of Hankin and Reeves (1988) as in baseline surveys (Aquatic Science 1998-2004). Resident fish surveys were conducted between July 10 and August 14, 2007. Lower reaches were surveyed first prior to adult pink salmon entering streams to spawn in late July. Electrofishing gear is not permitted in the presence of spawning salmonids, as stipulated in the Alaska Department of Fish and Game Fish Resource Permit (Appendix 3a).

In each reach, stream habitat units were first categorized as riffle, pool, glide or cascade following the classifications of Bisson et al (1981). At least every third riffle, pool and glide was selected for snorkeling. One team member, equipped with dry suit and snorkel, quietly entered the water at the downstream end of a selected unit and proceeded upstream observing fish underwater. A second team member, following behind to minimize disturbance to fish, measured the length of each habitat unit to the nearest 0.1m using a metric hip chain, and recorded the fish counts. Habitat unit width was measured using a 15m tape measure and meter stick.

The accuracy of visual counts was verified by electro-fishing at least three units (if present) of each habitat type previously snorkeled. A three-member team proceeded upstream using a Smith-Root gasoline-powered backpack electro-fishing unit with output waves designed to minimize impact on fish. All stunned fish were counted and as many as possible captured using dip nets to allow length and weight measurements to be taken. Minnow traps baited with cured salmon eggs were set in high density fish areas identified by the diver. This allowed some fish to be removed and counted prior to electro-fishing, thereby minimizing effects of the electric current on the fish population.

Captured fish were anesthetized in a solution of MS222 (Tricanemethane Sulphonate), weighed to the nearest 0.1g and their total length measured to the nearest 1mm. The fish were then placed in a container of fresh stream water with a battery-powered aerator to recover before being returned to the habitat unit from which they were captured.

5.3 Data analysis methods

The number of fish within a reach was estimated by first applying a correction factor to the visual counts based on electro-fishing counts. It is assumed that electro-fishing counts are more accurate than snorkel counts since fish hiding between rocks might remain undetected by a diver, but can be captured by electro-fishing. The corrected counts for sampled units were then extrapolated over the total number of units of each habitat type within a reach to give a population estimate. Standard deviations and 95% confidence intervals for the population estimates were determined using equations (5) through (11) in Hankin & Reeves (1988). The precision of population estimates was calculated by expressing the 95% confidence intervals as a percentage of the estimated population size.

Definitions for equations used:

yi = true number of fish in each unit; i = 1,2,…..,N,
Y = total number of fish in all units, di = count of fish by diver in unit i,
n' = number of units for which both diver and electrofishing counts are made
n = number of units for which diver counts only are made (n>n').

The number of fish present is firstly estimated by yi = diR(for i not in n') where R is the ratio of actual numbers present to diver counts, estimated by R = Σ y/Σ d (for i in n') or the total electrofish counts to diver counts. The estimate is then extrapolated over all units using: Y = N/n (Σyi). An estimation of error is then made using the equation:

$$V(Y) = \frac{N(N-n)\,\Sigma\,(yi - y)^2}{n(N-1)} + \frac{N\Sigma V(yi)}{n}$$

where $V(yi) = di^2\, V(R) - V(R)$ and $V(R) = \frac{(N - n')}{Nn'\text{mean } d^2}\, S(yi - Rdi)2/(n'-1)$

The dimensions of each habitat unit in each reach are given in Appendix 3b. The total area of each habitat type was calculated and used in the computation of fish densities (number of fish per m^2). Minimum detectable differences between population estimates were calculated by performing analysis of variance on fish counts for each habitat type.

5.4 Population estimates

Numbers of fish counted by divers and captured by electro-fishing and minnow trapping are summarized in Table 9. Population estimates by habitat type and by reach are presented in Table 10 and illustrated in Figure 8. Dolly Varden were found in all stream reaches, while cutthroat trout were only present in the lower stream reaches, below barrier falls. Dolly Varden numbers were highest in middle and upper Sherman Creek, particularly in pools. Cutthroat numbers were highest in Lower Slate Creek.

Comparison of Dolly Varden numbers over time (Figure 9) showed that numbers appeared to be higher in Lower Sherman and Lower Johnson in 2005 than 2006 or 2007, although confidence intervals were much greater in 2005. Fish are able to move in and out of these lower reaches via the stream mouth, which may explain changes in numbers of Dolly Varden and cutthroats in lower reaches over time. Fish may move in and out of lower reaches in response to changing stream flows or food availability. A large flood event in November 2005 followed by severe winter of 2006 may also have affected numbers in lower reaches.

Numbers of Dolly Varden were higher in 2007 than 2006 for Middle and Upper Sherman and Upper Johnson, while similar numbers were found each year for Middle Johnson and Middle Slate. Upper Slate showed higher numbers in 2006 than 2005 or 2007. There is natural variability in the population from year to year as well as differences in the numbers detected by snorkeling and electro-fishing, which may be affected by differences in stream flow and temperature.

The 56 Dolly Varden captured by electro-fishing and minnow trapping in the three reaches of Sherman Creek represented 25.6% of the estimated Dolly Varden population of Sherman Creek. The 8 cutthroat trout captured in Lower Sherman represented 33.3% of the estimated Sherman Creek cutthroat population. The 42 Dolly Varden captured in Johnson Creek represented 33.1% of the estimated population of Johnson Creek. No cutthroats were captured in Johnson Creek, although some were observed. The 36 Dolly Varden captured in Slate Creek composed 36% of the Slate Creek population and the 18 cutthroats captured represented 19% of the Lower Slate population. Actual counts of fish obtained by snorkeling and electro-fishing in each habitat unit are presented in Appendix 3c.

Table 9: 2007 Resident Fish Counts in Sherman, Johnson and Slate Creeks.

Stream Reach	Habitat Type	Total Units (N) in stratum	Snorkeling Units (n) snorkled	Snorkeling Numbers Observed Dolly	Snorkeling Numbers Observed Cutthroat	Electrofishing/Trapping Units (n') fished	Electrofishing/Trapping Numbers Captured Dolly	Electrofishing/Trapping Numbers Captured Cutthroat
Lower Sherman	Riffle	21	9	2	5	4	1	3
	Pool	30	20	6	13	10	6	11
	Glide	1	1	0	0	0	0	0
	All Units	52	30	8	18	14	7	14
Middle Sherman	Riffle	30	11	6	0	4	3	0
	Pool	49	33	46	0	10	16	0
	Glide	1	0	0	0	0	0	0
	All Units	80	44	52	0	14	19	0
Upper Sherman	Riffle	19	6	3	0	3	1	0
	Pool	70	52	60	0	24	27	0
	Glide	3	3	3	0	2	3	0
	All Units	92	61	66	0	29	31	0
Lower Johnson	Riffle	17	9	4	0	4	2	0
	Pool	29	20	11	1	6	7	0
	Glide	10	5	0	0	0	0	0
	All Units	56	34	15	1	10	9	0
Middle Johnson	Riffle	12	9	1	0	4	1	0
	Pool	39	27	15	0	8	20	0
	Glide	6	4	2	0	3	0	0
	All Units	57	40	18	0	15	21	0
Upper Johnson	Riffle	16	8	5	0	3	5	0
	Pool	31	22	27	0	6	12	0
	Glide	9	6	4	0	2	2	0
	All Units	56	36	36	0	11	19	0
Lower Slate	Riffle	27	8	0	6	4	0	0
	Pool	32	24	11	36	8	0	18
	Glide	10	8	1	12	3	0	0
	All Units	69	40	12	54	15	0	18
Middle Slate	Riffle	23	8	2	0	7	3	0
	Pool	24	18	2	0	8	2	0
	Glide	13	8	1	0	4	3	0
	All Units	60	34	5	0	19	8	0
Upper Slate	Riffle	26	10	4	0	6	4	0
	Pool	28	22	11	0	16	22	0
	Glide	11	8	2	0	4	2	0
	All Units	65	40	17	0	26	28	0

Table 10: Population estimates by species, habitat type and stratum, 2007.

Sherman Creek Dolly Varden					
Reach	Habitat Unit	Estimate	C.I.	Precision (%)	Std. Dev
Lower	Riffles	5	1.14	22.8	1.96
	Pools	14	0.88	6.3	2.01
	Glides	-	-	-	-
	All Units	**19**	**2.82**	**14.8**	**2.80**
Middle	Riffles	19	2.26	11.9	3.82
	Pools	68	0.61	0.9	1.78
	Glides	-	-	-	-
	All Units	**96**	**1.1**	**1.1**	**3.66**
Upper	Riffles	10	1.87	18.7	2.34
	Pools	92	0.7	0.8	2.16
	Glides	3	0	0.0	0.00
	All Units	**107**	**0.91**	**0.9**	**3.64**

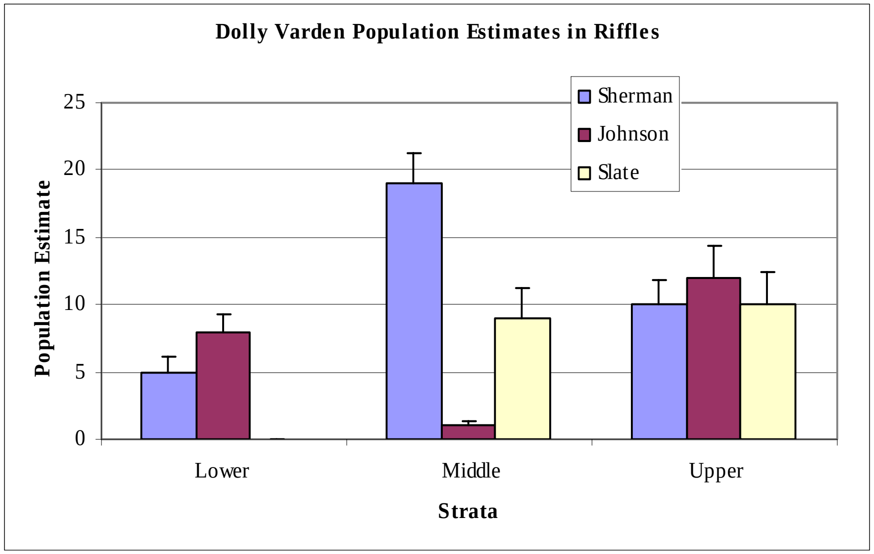
Johnson Creek Dolly Varden					
Reach	Habitat Unit	Estimate	C.I.	Precision (%)	Std. Dev
Lower	Riffles	8	1.23	15.4	1.37
	Pools	19	2.38	12.5	2.33
	Glides	-	-	-	-
	All Units	**28**	**3.46**	**12.4**	**3.21**
Middle	Riffles	1	0.4	40.0	0.61
	Pools	39	1.68	4.3	4.44
	Glides	2	0.94	47.0	0.96
	All Units	**41**	**1.67**	**4.1**	**5.40**
Upper	Riffles	12	2.34	19.5	3.38
	Pools	39	1.21	3.10	2.91
	Glides	8	1.29	16.13	1.62
	All Units	**61**	**1.27**	**2.08**	**3.88**

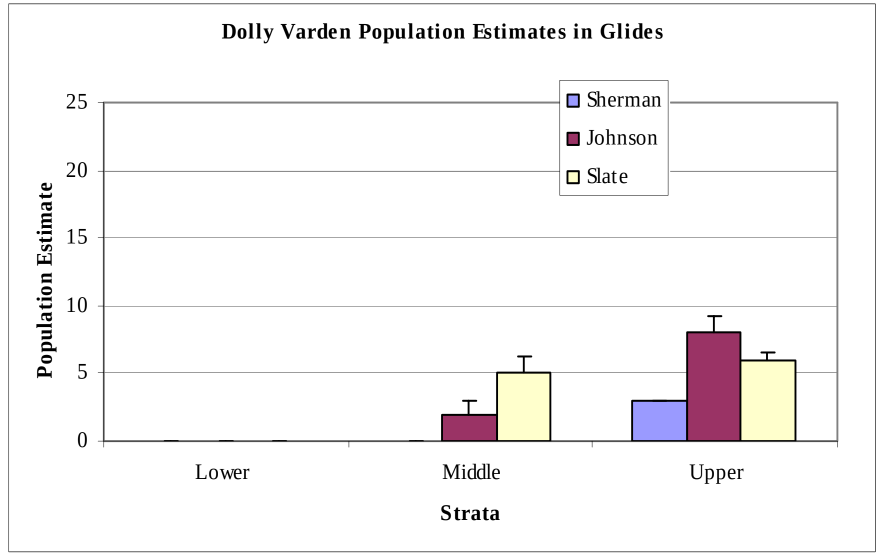
Slate Creek Dolly Varden					
Reach	Habitat Unit	Estimate	C.I.	Precision (%)	Std. Dev
Lower	Riffles	-	-	-	-
	Pools	15	0.78	5.2	1.96
	Glides	-	-	-	-
	All Units	**21**	**1.02**	**4.9**	**3.30**
Middle	Riffles	9	2.23	24.8	3.22
	Pools	4	0.83	20.8	1.81
	Glides	5	1.22	24.4	1.76
	All Units	**16**	**0.87**	**5.4**	**2.59**
Upper	Riffles	10	2.43	1.2	3.92
	Pools	42	1.41	3.4	3.38
	Glides	6	0.53	8.8	0.77
	All Units	**63**	**2.11**	**3.3**	**6.84**

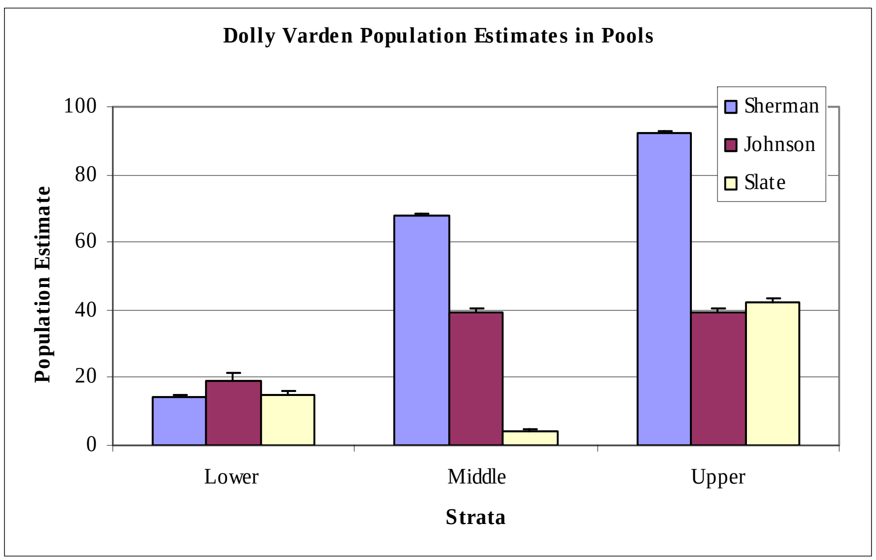
Cutthroat Trout					
Creek	Habitat Unit	Estimate	C.I.	Precision (%)	Std. Dev
Sherman	Riffles	12	1.72	14.3	1.62
Lower	Pools	21	2.4	11.4	2.34
	Glides	-	-	-	-
	All Units	**31**	**3.77**	**12.2**	**3.24**
Johnson	Riffles	-	-	-	-
Lower	Pools	2	0.38	25	0.92
	Glides	-	-	-	-
	All Units	**2**	**0**	**0**	**0**
Slate	Riffles	20	2.97	14.9	4.28
Lower	Pools	47	1.58	3.4	3.94
	Glides	18	0.93	5.2	1.34
	All Units	**95**	**2.35**	**2.5**	**7.59**

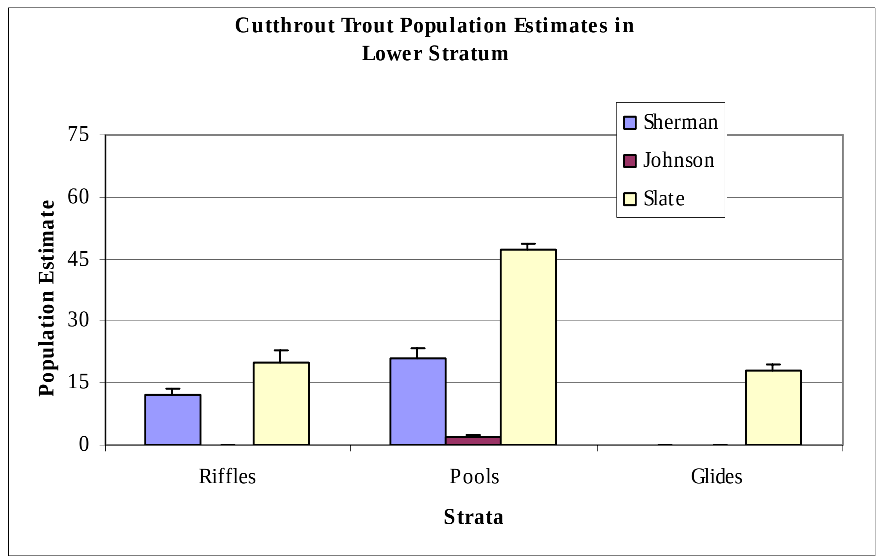
Figure 8: 2007 Population Estimates of Resident Fish in Sherman, Johnson and Slate Creeks by species, habitat type and stratum. Error bars represent 95% upper confidence limits.

Figure 8: Population estimates by species, habitat type and reach for 2007.









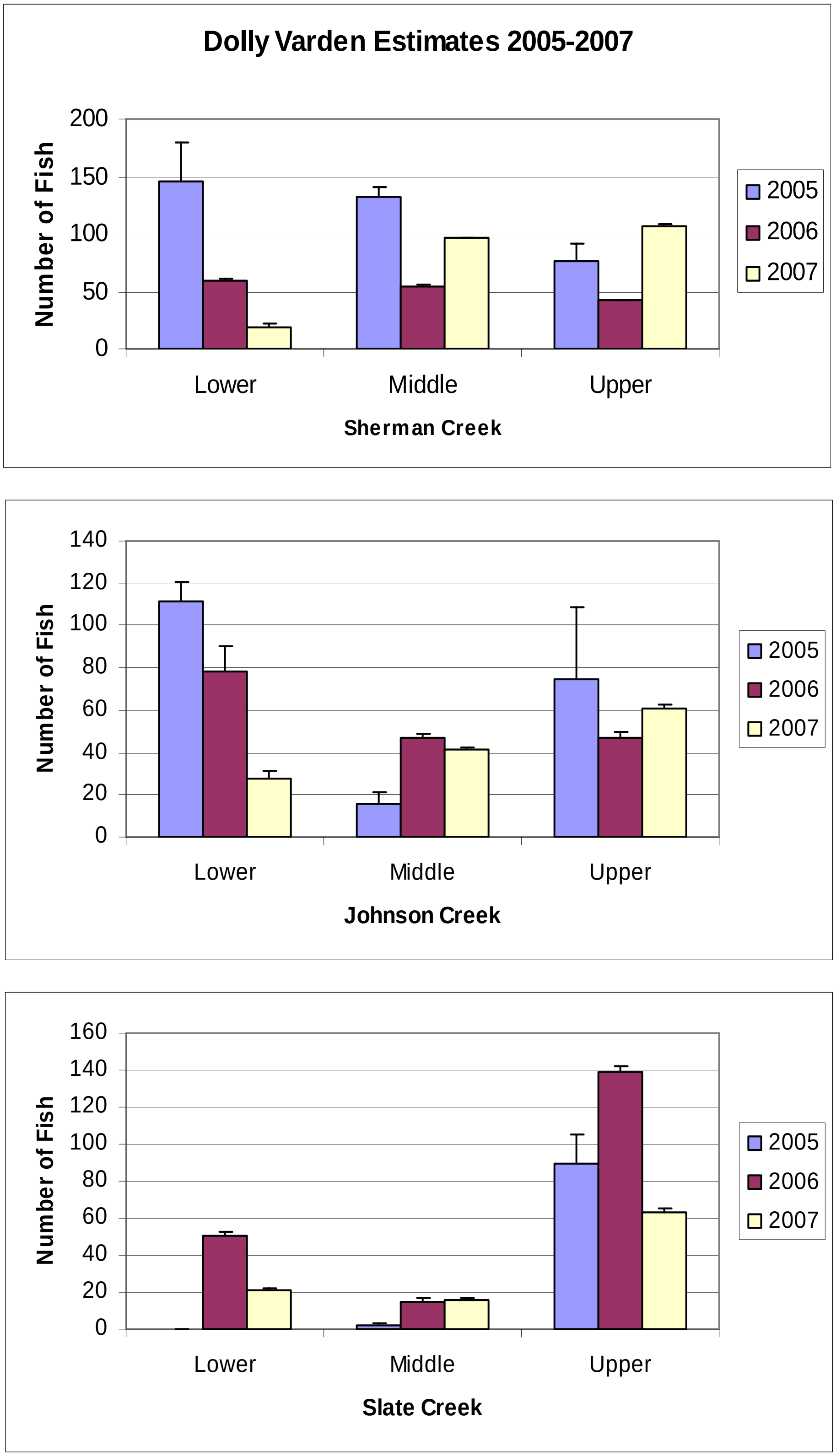


Figure 9: Comparison of population estimates for Dolly Varden over time.

5.5 Minimum detectable differences among population estimates.

By specifying the significance level and samples size for an analysis of variance, it is possible to determine what the smallest detectable difference between population means will be. Minimum detectable differences in mean numbers of fish counted in each stream reach and in each habitat type were calculated using the following equation:

$$\delta = \sqrt{\frac{2\, k\, s^2\, \phi^2}{n}}$$

where δ is the minimum detectable difference between means, k is the number of groups being compared, s^2 is the mean square error derived from analysis of variance, n is the sample size (number of habitat units), and ϕ is a quantity read from tables, incorporating k, n, and the probabilities of committing a Type I and Type II error (Zar 1999). A significance level (α) of 0.05, and a statistical power ($1 - \beta$) of 0.8 were specified for the analysis, determining that differences between means at a 95% significance level could be detected 80% of the time.

Mean numbers of fish in each habitat type were used to compute minimum detectable differences between reaches. Table 11 gives the mean number of fish in each habitat type and the MDD resulting from comparing habitat types in each stream reach. A difference in means of 1 to 2 fish per habitat unit was detectable among riffles in all three creeks. Minimum detectable differences were greater for pool and glides, reflecting the higher variation in numbers of fish in these habitats. The greatest differences were in comparisons of lower reaches as some pools held large numbers of fish, and others held none. This was particularly true of cutthroat trout which were fairly abundant in Slate Creek, but few were observed in Johnson Creek. A difference in means of 4 or 5 fish would be required for detection in among pools and glides. Glide habitat was limited, restricting the number of units that could be surveyed. The ability to detect small differences in numbers of fish is important in detecting changes in the population from year to year.

Table 11: Mean number of Dolly Varden per habitat type and minimum detectable differences (MDD) between means for different stream reaches.

Dolly Varden 2007: Mean numbers of fish in each habitat type and MDD									
	Sherman Creek			**Johnson Creek**			**Slate Creek**		
Strata	Riffle	Pool	Glide	Riffle	Pool	Glide	Riffle	Pool	Glide
Lower	0.000	0.450	0.000	0.333	0.600	0.500	0.000	0.500	0.125
Middle	0.636	1.455	0.000	0.111	1.000	0.700	0.375	0.167	0.286
Upper	0.500	1.269	0.000	0.667	1.273	0.000	0.400	1.545	0.250
MDD	**2.033**	**2.595**	**-**	**1.274**	**1.541**	**0.854**	**1.055**	**3.504**	**0.422**

Dolly Varden 2007									
	Lower reaches			**Middle reaches**			**Upper reaches**		
Strata	Riffle	Pool	Glide	Riffle	Pool	Glide	Riffle	Pool	Glide
Sherman	0.000	0.450	0.000	0.636	1.455	0.500	0.500	1.269	1.000
Johnson	0.333	0.600	0.000	0.111	1.000	0.286	0.750	1.273	0.700
Slate	0.000	0.500	0.000	0.375	0.167	0.000	0.400	1.545	0.250
MDD	**0.931**	**0.341**	**-**	**1.347**	**3.320**	**0.825**	**1.046**	**0.762**	**2.832**

Cutthroat Trout 2007			
	Lower reaches		
Strata	Riffle	Pool	Glide
Sherman	0.444	0.611	0.000
Johnson	0.000	0.050	0.000
Slate	0.750	1.458	1.750
MDD	**1.945**	**4.800**	**3.709**

5.6 Fish density

Due to differences in the size of habitat areas sampled, population estimates were converted to numbers of fish per unit area for easier comparisons between strata and habitat types. Densities of both fish species tended to be highest in pool habitat and increased from downstream to upstream, with the exception of Slate Creek, which had high cutthroat densities in the lower reach (Tables 12A, 12B).

Table 12A: Densities of fish by species, stratum and habitat type.

Fish Density (number of fish/m^2)									
		Dolly Varden				Cutthroat Trout			
Creek	**Strata**	**Riffles**	**Pools**	**Glides**	**All**	**Riffles**	**Pools**	**Glides**	**All**
Sherman	Lower	0.003	0.017	0.000	**0.007**	0.007	0.025	0.000	**0.012**
	Middle	0.010	0.248	0.000	**0.042**				
	Upper	0.020	0.332	0.080	**0.131**				
Johnson	Lower	0.005	0.039	0.000	**0.010**	0.000	0.105	0.000	**0.001**
	Middle	0.001	0.054	0.008	**0.017**				
	Upper	0.014	0.104	0.054	**0.045**				
Slate	Lower	0.000	0.053	0.000	**0.012**	0.016	0.211	0.032	**0.054**
	Middle	0.012	0.017	0.013	**0.012**				
	Upper	0.020	0.292	0.050	**0.083**				

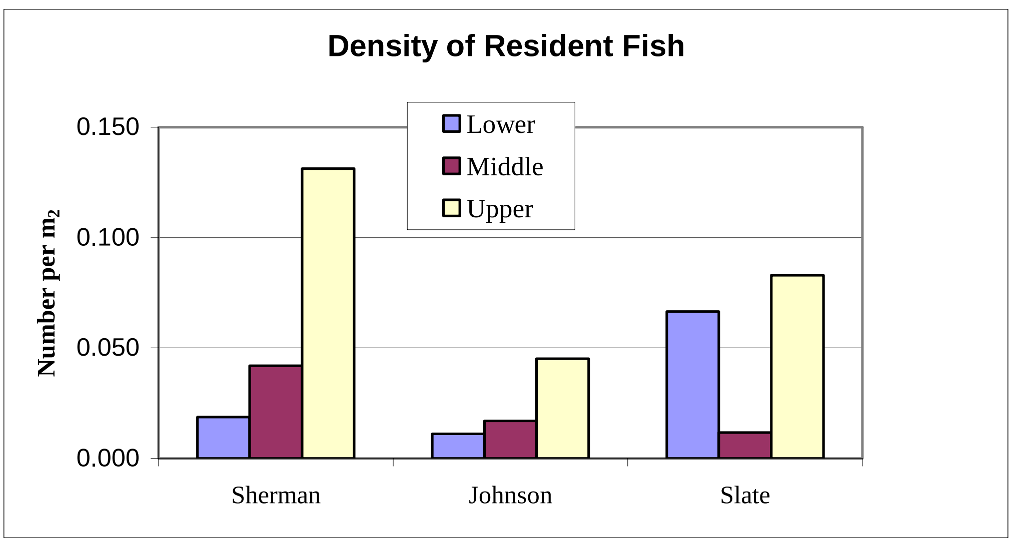
Dolly Varden density was highest in upper reaches where there is less habitat area available so fish are more concentrated. Upper Slate appears to be a spawning and nursery area for Upper Slate Lake (Figure 10). The highest density of cutthroat trout was found at Lower Slate, which has a gentle gradient and long, shallow riffles. Flow was low during this survey resulting in a smaller habitat area. Both Dolly Varden and cutthroat density was highest in pools compared to glides and riffles. Middle and Upper Sherman and Upper Slate showed the highest pool and overall densities.

There is evidence from literature that Dolly Varden densities are suppressed when stream habitat is shared with cutthroat trout. *Oncorhynchus* (salmon and trout) tend to outcompete *Salvelinus* (char eg. Dollys) when both are present (Hinder et al 1988, Hastings 2005). Densities of Dolly Varden in Sherman and Johnson Creeks were lower in the reaches where cutthroat were present. In Lower Slate Dolly Varden densities were slightly higher than the other streams despite high cutthroat densities, but the densities were stil lower than those in most other reaches free from cutthroat.

Table 12B: Densities of Dolly Varden and Cutthroat Combined 2007.

Fish Density (# of fish/m^2)					
		Dolly Varden and Cutthroat			
Creek	**Strata**	**Riffles**	**Pools**	**Glides**	**All Units**
Sherman	Lower	0.010	0.042	na	**0.019**
	Middle	0.010	0.248	na	**0.042**
	Upper	0.020	0.332	0.080	**0.131**
Johnson	Lower	0.005	0.144	0.000	**0.011**
	Middle	0.001	0.054	0.008	**0.017**
	Upper	0.014	0.104	0.054	**0.045**
Slate	Lower	0.017	0.217	0.066	**0.066**
	Middle	0.012	0.017	0.013	**0.012**
	Upper	0.020	0.292	0.050	**0.083**

Figure 10: Densities of Resident Fish in Sherman, Johnson and Slate Creeks, 2007



5.7 Fish condition

Fish condition is an index based on the ratio of fish length to weight and was determined from field measurements of fish captured by electro-fishing. The histograms in Figure 11 show the size range of fish captured in each creek. A large number of small Dolly Varden were captured in Upper Slate Creek, which provides a nursery and spawning area for the upper lake. Lengths and weights of fish were used to calculate Fulton's condition factor (K) using the equation given in Anderson & Neumann (1996):

$$K = W/L^3 \times 10{,}000$$

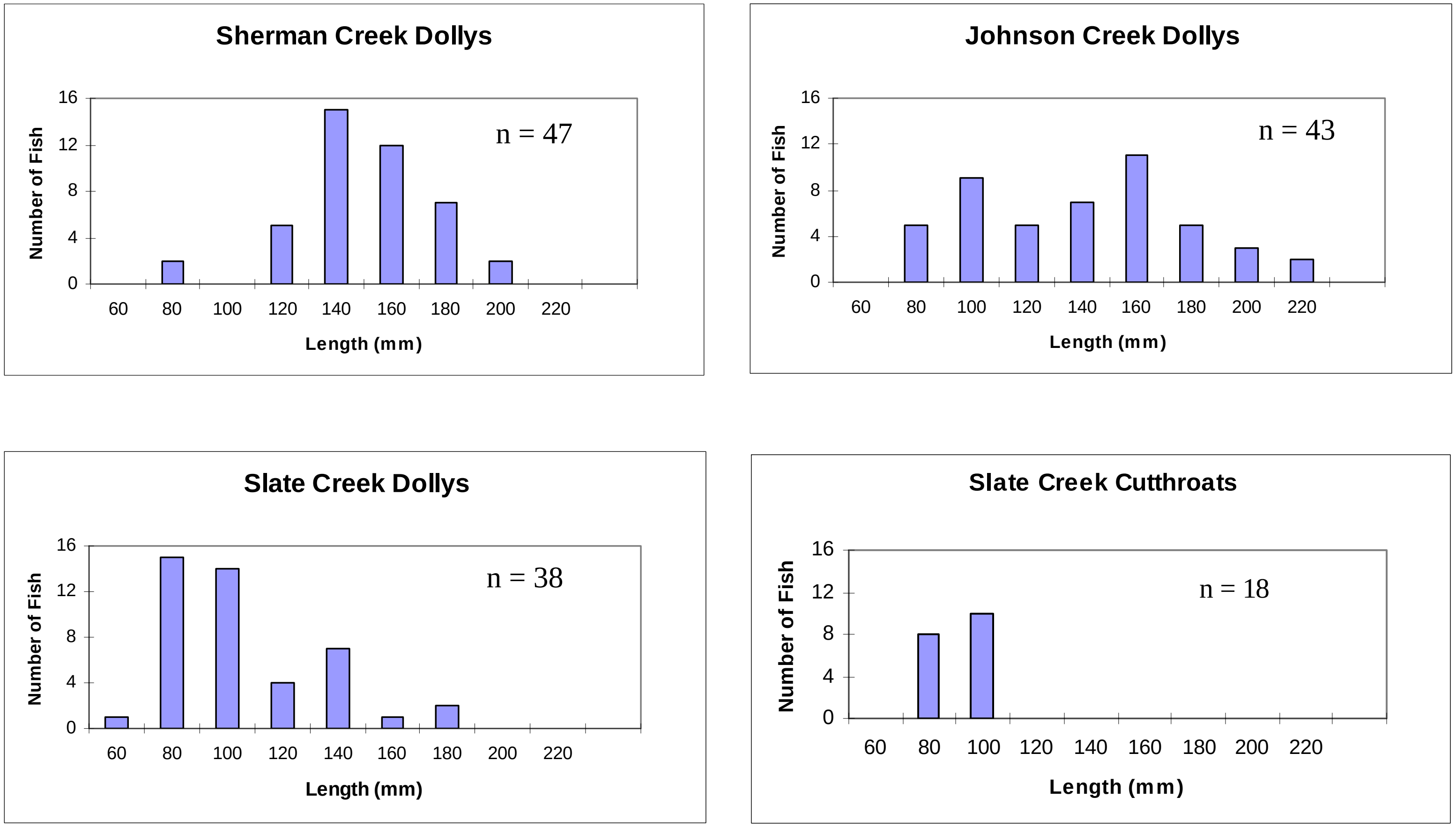
W = weight in g; L = total length in mm

The length, weight and condition factor of each fish are presented in Appendix 3d. Mean condition factors by stratum are presented in Table 13 and Figure 12. Condition of Dolly Varden appeared slightly lower in Lower Johnson than other strata perhaps due to competition with other fish. Condition of cutthroats in Sherman appeared high, but the mean is only based on 4 individuals. The low density of fish in Lower Sherman could also favor growth of remaining fish.

Table 13: Mean condition factor of Dolly Varden and cutthroats by stratum.

		Sherman		**Johnson**		**Slate**	
	Reach	Mean K	95% C.I.	Mean K	95% C.I.	Mean K	95% C.I.
Dolly Varden	**Lower**	0.861	0.151	0.762	0.058		
	Middle	0.882	0.037	0.907	0.026	0.838	0.048
	Upper	0.874	0.030	0.879	0.038	0.862	0.025
Cutthroat	**Lower**	1.051	0.056			0.865	0.057

Figure 11: Length-frequency histograms for Dolly Varden and cutthroat trout captured in Sherman, Johnson and Slate Creeks in 2007.



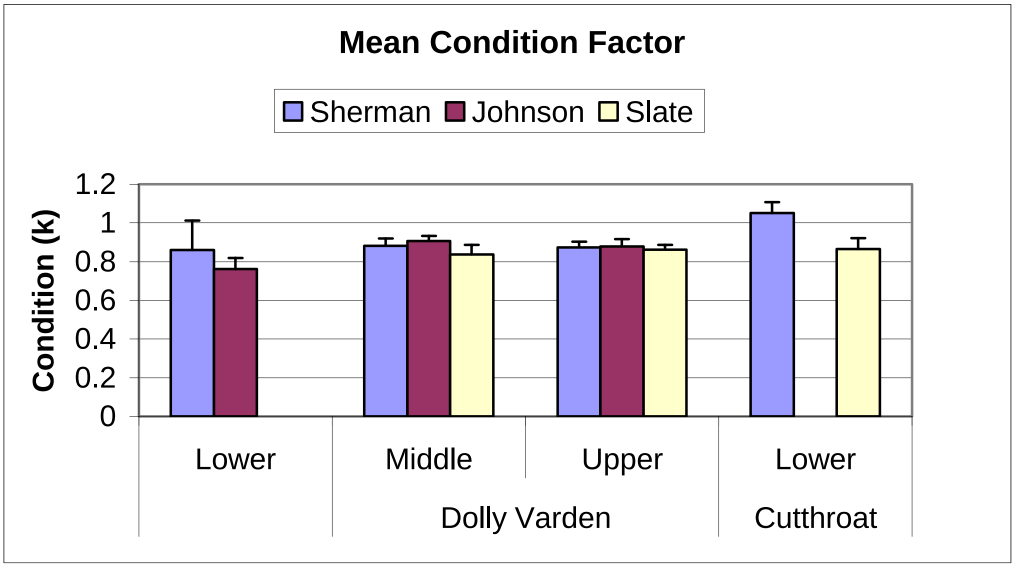
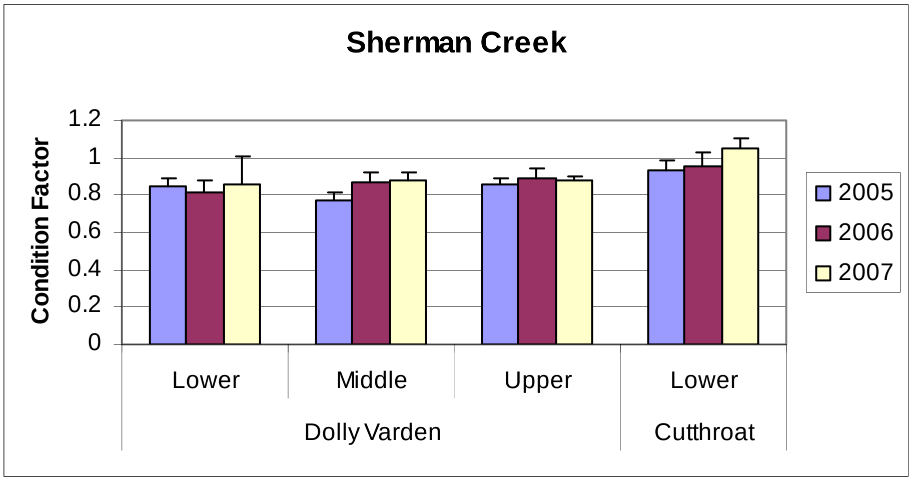
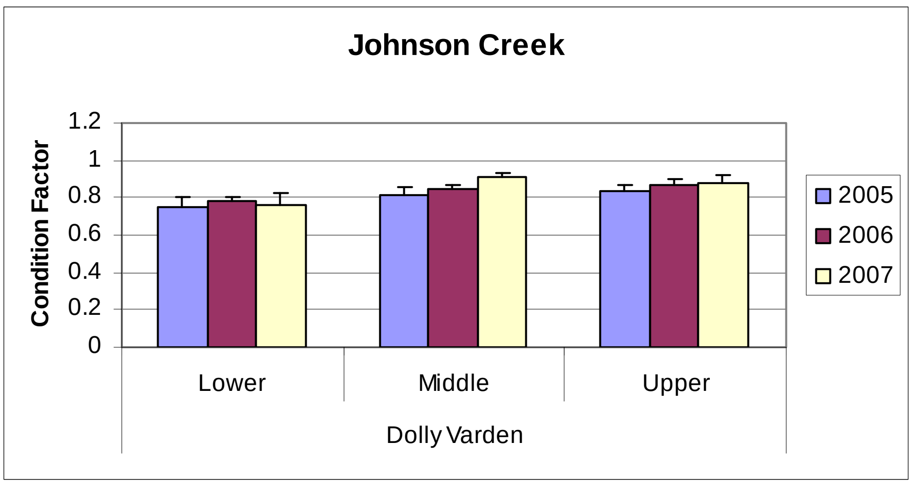


Figure 12: Mean Condition Factor of fish captured by electro-fishing in 2007.

Figure 13: A Dolly Varden captured in Middle Sherman Creek, August 2007.

Comparison with previous years did not reveal many significant changes in mean condition factor (Figure 14). Cutthroats appeared to show slightly higher condition factor in 2007 than 2005 perhaps due to lower density in 2007. Dolly Varden condition appeared higher in middle reaches of Sherman and Johnson in 2007. Upper Slate Creek showed lower condition in 2005 perhaps due to smaller, younger fish being captured in the nursery creek there.





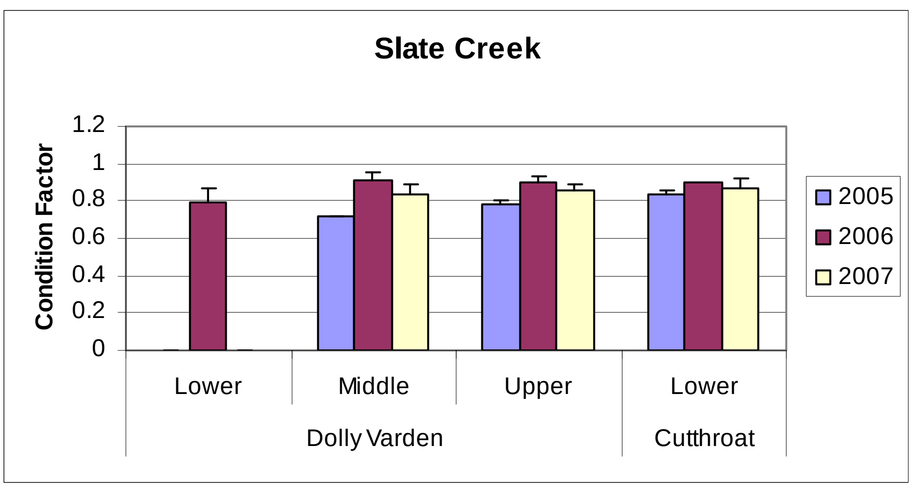


Figure 14: Comparison of mean condition factor from 2005 to 2007.

6.0 Anadromous Fish Monitoring

6.1 Pink Salmon Ecology

Pink salmon, also known as humpbacks or humpies for the exaggerated dorsal hump that develops in mature males, are the most abundant salmon species and also the smallest (about 2kg) at maturity. All pink salmon migrate to sea, are 2 years old at maturity and all die after spawning. This results in odd-year and even-year populations that do not interbreed (Quinn 2005). Around Southeast Alaska, even-year populations are generally larger than odd years. The differences between odd and even year populations may have originated during the last ice age when ice cover resulted in two distinct populations at northern (even) and southern (odd) glacial refuges. Odd-year populations are generally larger further south perhaps being better adapted to warmer water.

Adult pink salmon migrate into coastal streams to spawn from July through September. Pink salmon tend to spawn closer to the ocean than other species, although when large numbers of salmon return at the same time, accessible sites further upstream will be utilized. Fertilized eggs are buried in a nest or redd of gravel that is dug and guarded by the female for 10-13 days after construction (Heard 1991). The embryos develop over the fall and winter and fry emerge from the gravel between the end of March and beginning of June, predominately at night and immediately migrate downstream to the ocean. The night migration is considered to be an avoidance of predator adaptation (Godin 1980). At emergence, pink salmon fry are fully adapted for seawater and migrate directly to sea, making essentially no use of freshwater for rearing. Overall freshwater survival of pink salmon from egg to emergent fry averages 11.5% (Quinn 2005).

6.2 Trapping Procedures

Previous studies on Sherman and Sweeny Creeks used a fence trap system followed by fyke nets (EVS 1998, 2000, Coeur Alaska Annual Report 2005, 2006). Fence traps set across the entire stream channel resulted in high mortality, particularly at times of high flow, due to fish being impinged against wire mesh by the current. Fyke nets were more successful with much lower mortality since only a portion of the stream was sampled and the angle of the net against the flow was reduced.

Due to the distance between streams and the necessity of checking traps daily, two teams of field personnel are required to conduct the study. In 2007, Sherman Creek was accessed by one team from Comet Beach camp, while a second team accessed Johnson Creek via a trail from the Jualin road at mile 3, and Slate Creek via kayak from the Slate Cove dock (Figure 1). Fyke nets with adjustable wings constructed from 1/8 inch mesh were used to trap outmigrating salmon fry at each creek (Figure 15A). The width of each net opening was adjusted according to stream flow from 4 to 11 feet across by deploying the wings. The larger the proportion of stream sampled, the more accurate the population estimate should be, however, at high flow the pressure of water on the net wings when fully deployed resulted in some mortality of fry. The nets were therefore adjusted daily to minimize mortality as the flow increased or decreased. The percentage of stream flow sampled by the nets was estimated each day.

One net was set in Sherman Creek on April 11, 2007 approximately 50m upstream of the creek mouth at mean high water. A net was set in Johnson Creek on April 9 approximately 100m from the confluence with the Lace River (Figure 1). The Slate Creek net was also set on April 9 approximately 25m above mean high water. Each net was attached to a live holding box that contained a partition to deflect the flow and allow fry to pass underneath to a compartment of low flow (Figure 15B). The live boxes were made of aluminum and had adjustable legs that could be raised or lowered with stream flow so that moderate flow could be maintained inside the box.

6.3 Physical Data Collection

Water temperature and stream discharge were monitored throughout the sampling period on each stream by data-logging units that recorded measurements every 15 minutes. On Sherman Creek the data-logger was adjacent to the net; on Johnson and Slate Creeks the data-loggers were over 1km upstream, but still gave an indication of changes in flow and temperature when combined with measurements near the nets. Physical measurements of stream discharge were made at least once a week using a Pygmy flow meter. Measurements were taken at 12 to 15 intervals across the stream. Water level (stage) was also measured daily from a staff gauge in each stream. A stage-discharge relationship was developed to allow estimation of stream discharge on those days when it was not measured directly.

Figure 15A: Fyke net and live holding box in Johnson Creek.

Figure 15B: A partition in the holding box helps maintain moderate flow inside.

Figure 16: A ladder was needed to access Johnson Creek in April.

6.4 Fish Data Collection

Prior to the beginning of field operations, Coeur Alaska obtained a Fish Resource Permit from the Alaska Department of Fish and Game (Appendix 4a) which authorized sampling fish in each creek with fyke nets or inclined-plane traps. In addition, Coeur Alaska holds a Fish Habitat Permit from the Alaska Department of Natural Resources permitting use of a trap structure in each stream (Appendix 4b).

The outmigration count began at Johnson and Slate Creeks on April 10, at Sherman Creek on April 12 and continued until negligible numbers of fish remained. Sampling was halted on June 4 at Sherman Creek, June 5 at Johnson Creek and June 6 at Slate Creek. Traps were visited daily to count and remove fish and clean any debris from nets. Before conducting the counts, a general assessment of the flow, debris accumulation, and number of dead fish in the traps was conducted. Fish were scooped out of the holding box using 4 by 6 inch hand nets, identified using a field guide (Pollard et al 1997) and released back into the stream. Numbers of each species were recorded every day.

6.5 Mark-Recapture Trials

Since fish are not randomly or evenly distributed within streams, estimates of total counts cannot be based simply on the percent of total discharge being sampled by the nets. The total number of daily migrants was estimated by firstly capturing and marking individuals from the migrating population, releasing marked fish upstream of the trap, and then re-sampling to determine what fraction of the total number caught are marked. This allowed calculation of the sampling efficiency of the nets in terms of the number of fish caught in the net verses the number passing by downstream.

Mark-recapture trials were conducted every 3-4 days to determine the total number of fry outmigrating based on the ratio between marked and unmarked individuals. Repeated trials were conducted since trap efficiency is likely to vary with fluctuating stream flow, with fish having less chance of capture at higher flows. The trials were separated by at least three days to avoid capturing marked fish from an earlier marking episode. Bismark Brown Y dye was used to mark fry because it is easily visible amongst large numbers of fish, does not harm fish, and is fast and simple to apply (Figure 17). Fish were immersed for 10 minutes in 1.5 gallons of water in which 0.3 g of dye had been dissolved. A battery operated aerator was placed in the water with the fry to ensure they had sufficient oxygen. After immersion, fish were transferred to a container of fresh water for a few minutes to recover from the staining process and released approximately 30 to 50 m upstream of the nets. Marked fish were released by spreading them evenly across the current. Many marked fish were found in the live holding box immediately after release, so these were counted and released downstream the same day.

The number of fish marked depended on numbers initially captured each day. At least 17 mark-recapture trials were conducted at each stream with typically 100 to 150 fish marked on each occasion (Table 14). This number usually resulted in a recapture rate of more than 10%. A few marking events resulted in a very low percentage of fish being recaptured in the holding boxes. Events with less than 5% of marked fish recaptured were not included in the population estimation.

6.6 Calculation of Population Estimate

The total daily number of outmigrating pink salmon fry was calculated using the ratio of marked to unmarked fish captured in the net. Marking experiments were conducted every 3 days and an average recapture rate calculated for every two successive experiments. The average recapture rate was then applied to the actual numbers captured each day. For example, on April 18, 100 marked fish were released and 51 were recaptured (51% of total released) while on April 21, 150 marked fish were released and 59 fish were captured (39%). The average of these two catch rates is 45%. A catch of 695 fish on April 21 divided by 0.45 gives a total estimate of 1539 fish for that day. The estimated total catch was calculated in this way for each day and then a final total summed for the entire survey period. The actual recapture rates for the first and last trials were used to estimate fish numbers at the beginning and end of the study respectively.

Figure 17: Pink salmon fry marked with Bismark Brown dye.

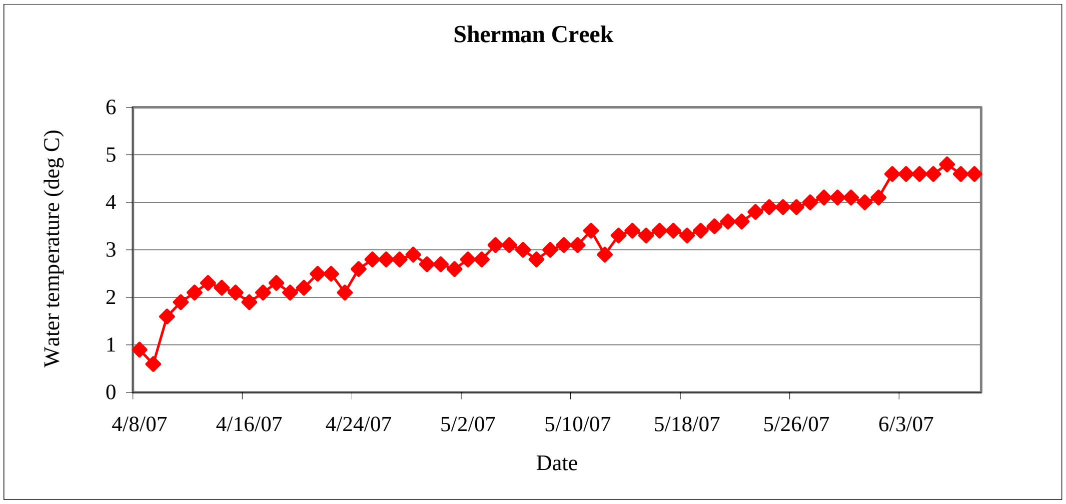
6.7 Physical Data

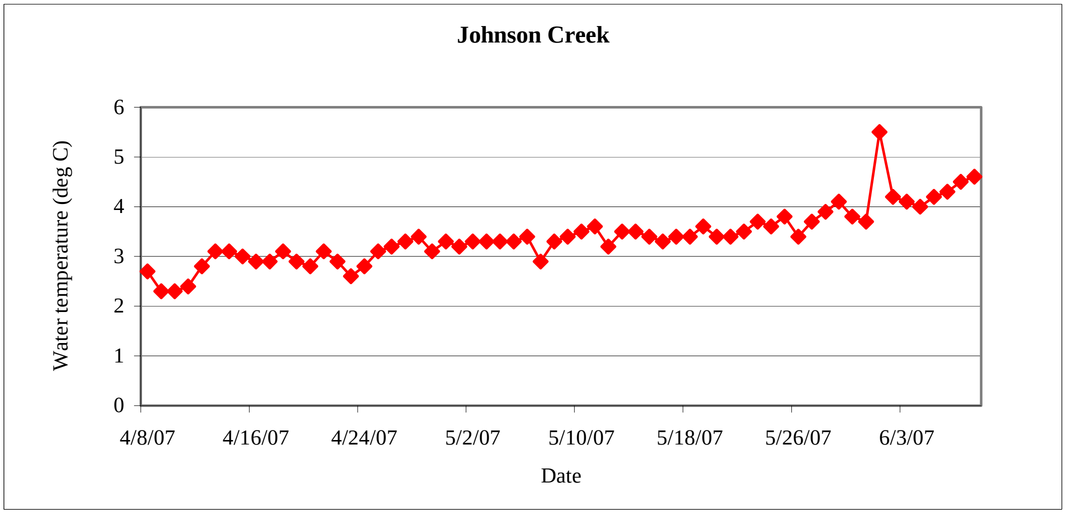
Water temperature of Sherman Creek increased fairly rapidly from less than 1^{o}C to over 2^{o}C between April 8 and April 12 as ice melted, then increased more slowly to 4^{o}C by May 29 (Figure 18). Johnson Creek was already over 2^{o}C in early April, but still only reached 4^{o}C on May 29. Johnson Creek seems heavily influence by groundwater that maintains more even temperature throughout the year. Slate Creek showed a more dramatic change from 0^{o}C in April to over 6^{o}C in June, coinciding with ice on the lakes melting followed by lake warming.

Stage-discharge relationships were developed for each stream based on manual discharge measurements and staff gage readings near the fyke nets, and in the case of Sherman Creek, pressure readings from a data logger. These relationships were then used to calculate discharge for each day of the fry study (Figure 19). Johnson Creek had around 20cfs in early April and increased to 80-120cfs after May 23. Slate Creek had more stable flow, mostly fluctuating between 20 and 40cfs throughout the study period. Sherman Creek had 21cfs in early April and increased to remain mostly over 50cfs after mid-May with peaks to almost 130cfs. Peak flow periods for all three streams were April 23, May 7, 16 (peaks due to rainfall), 24-26 (warm sunny weather likely increasing snowmelt), May 30 (rainfall) and June 3 (snowmelt).

High snowfall from the previous winter, lead to high flows in Sherman and Johnson Creeks and late May and June, while Slate Creek flows were likely buffered by Upper and Lower Slate lakes. Average flows in Sherman and Johnson were similar at 51 and 58cfs, respectively, while Slate Creek averaged 31cfs.

The proportion of the flow sampled by the nets varied with discharge and creek. At Sherman Creek around 15% of the flow was sampled at high flow to around 40% at low flow. At Slate Creek only around 10% of the flow was sampled during high flow and 40% at more moderate flow. At Johnson Creek a more constant 15-20% of flow was sampled across a wide range of flows.





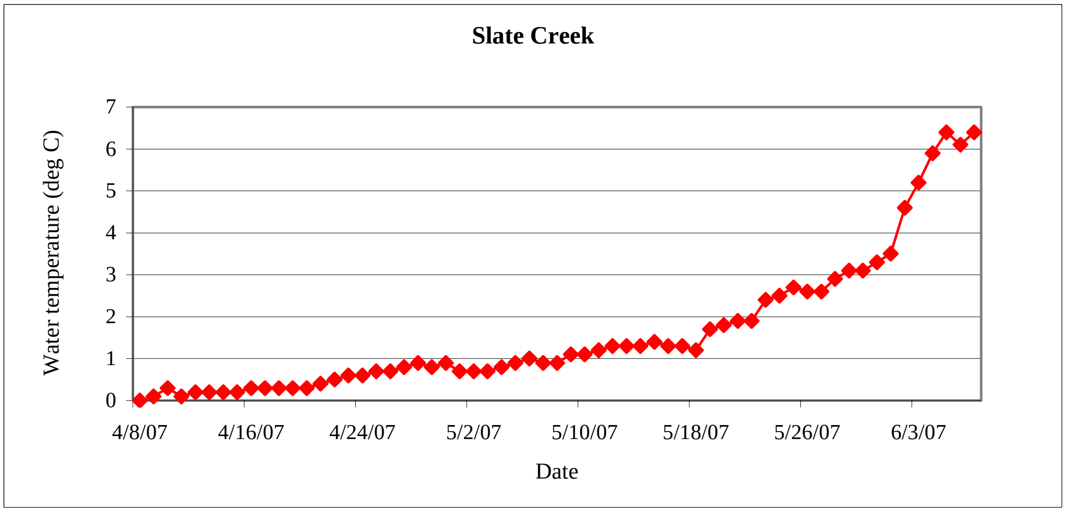


Figure 18: Daily water temperature at 0900 hrs in each creek.

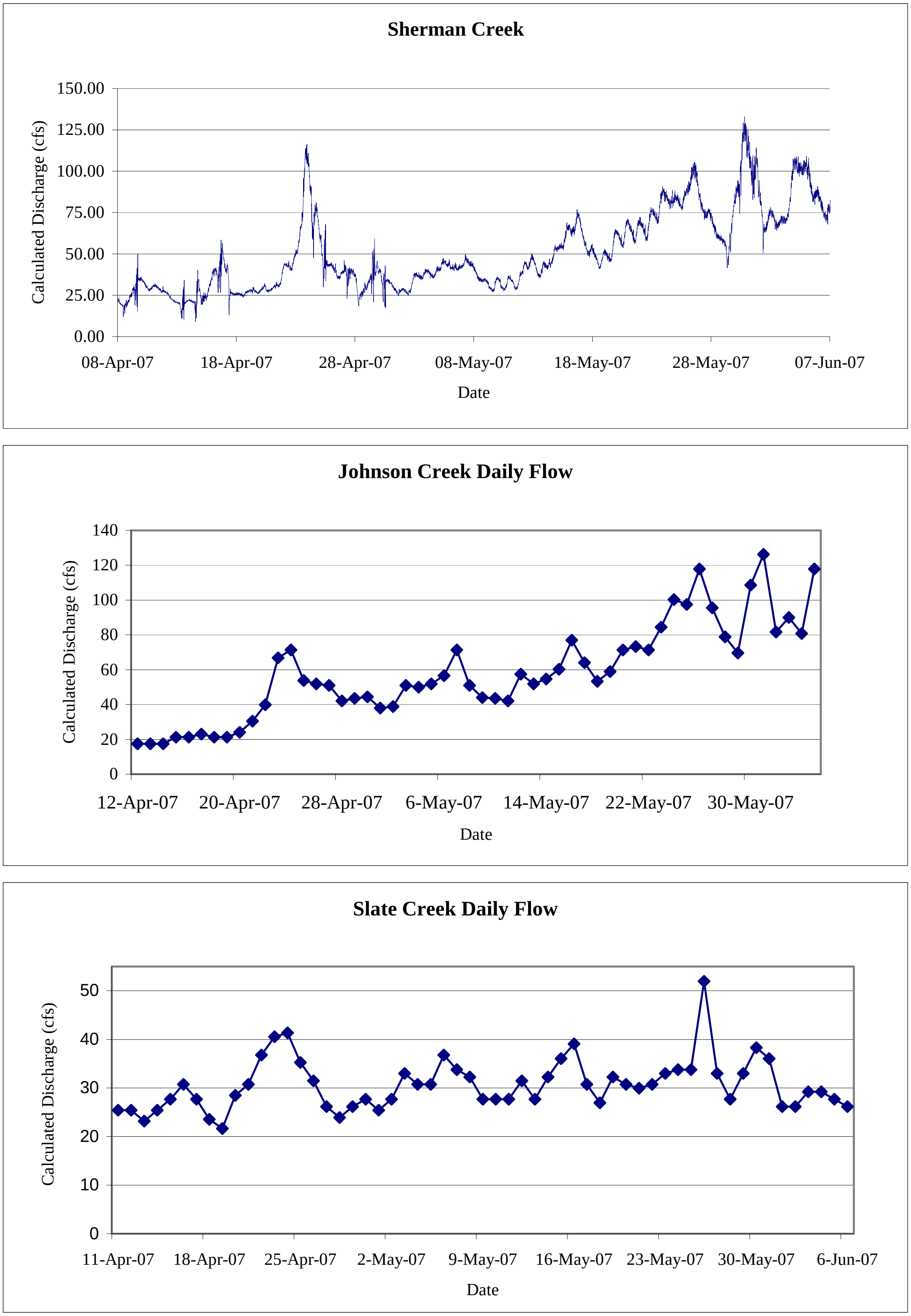
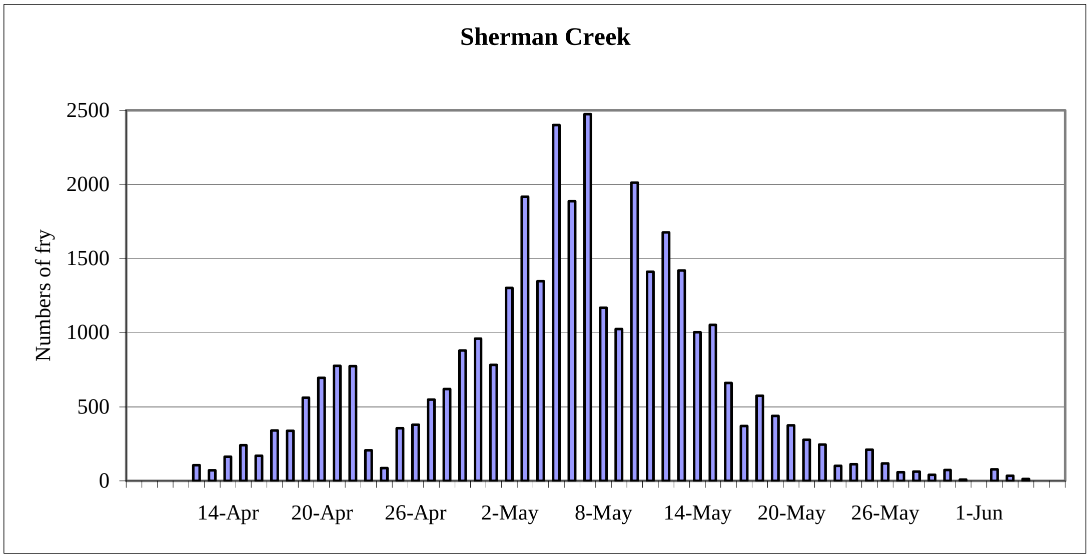
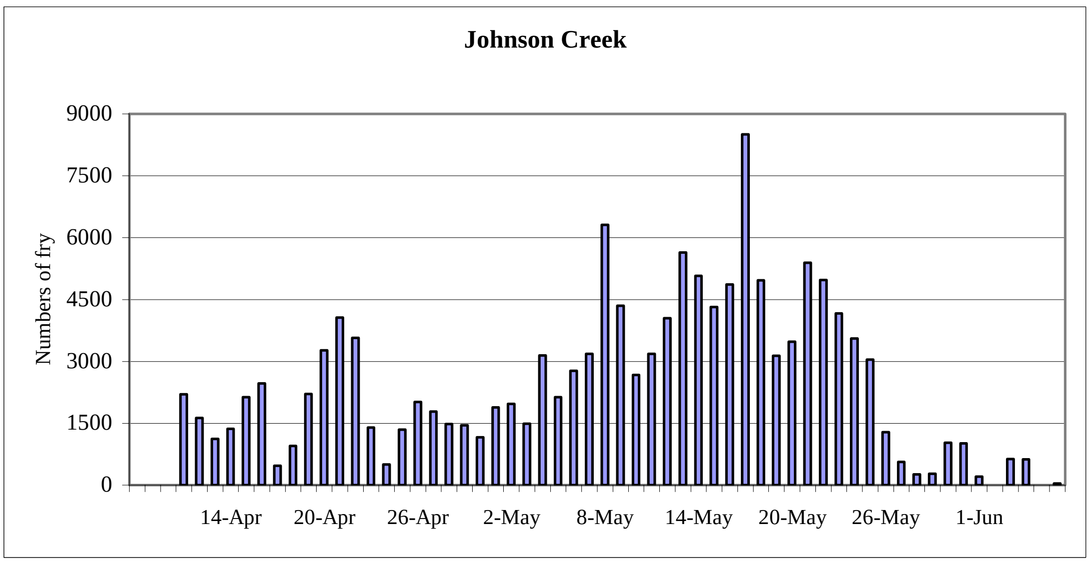


Figure 19: Discharge flow in Sherman, Johnson and Slate Creeks.

Figure 20: Daily catch of pink salmon fry April-June 2007.





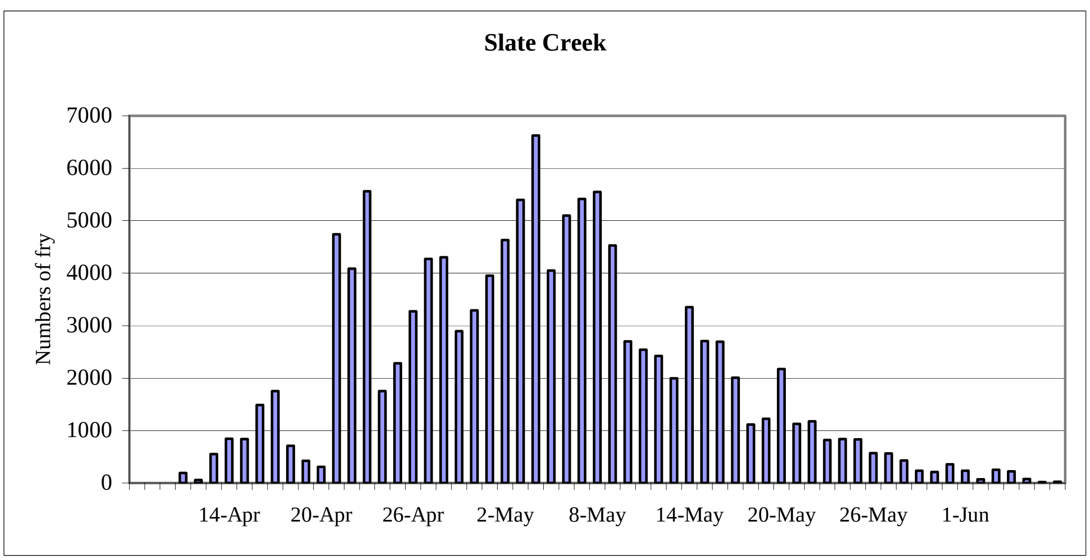
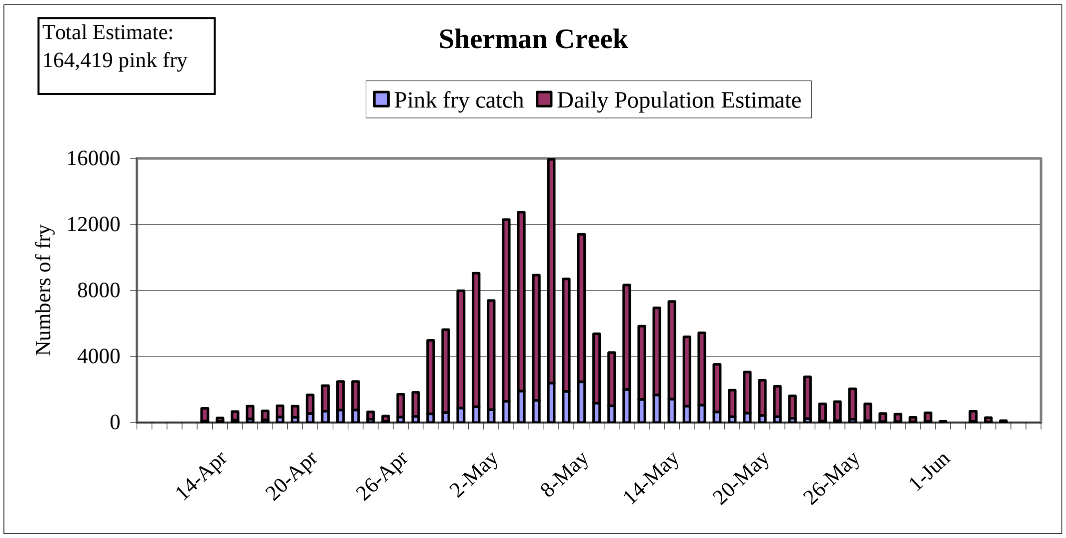
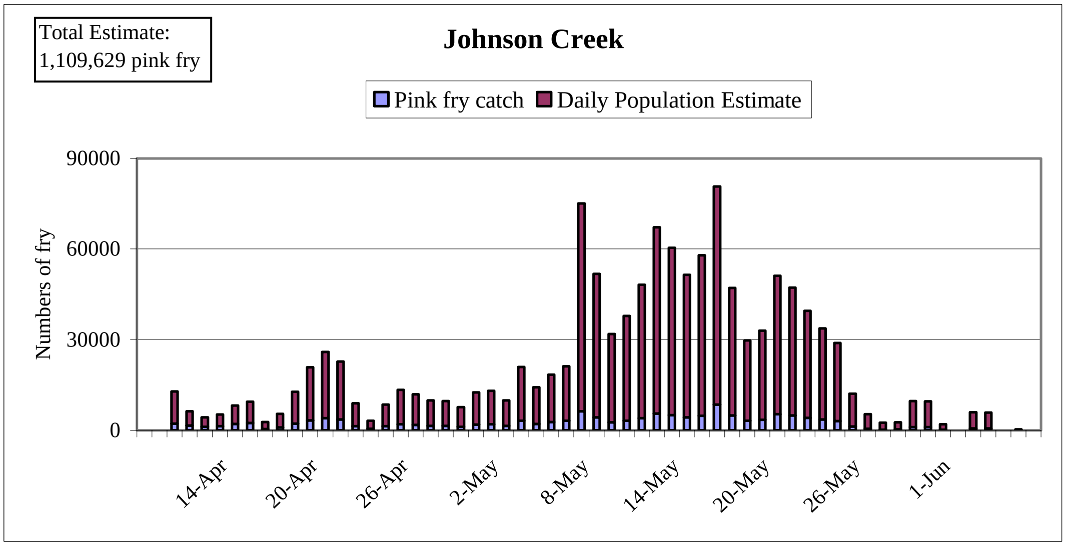
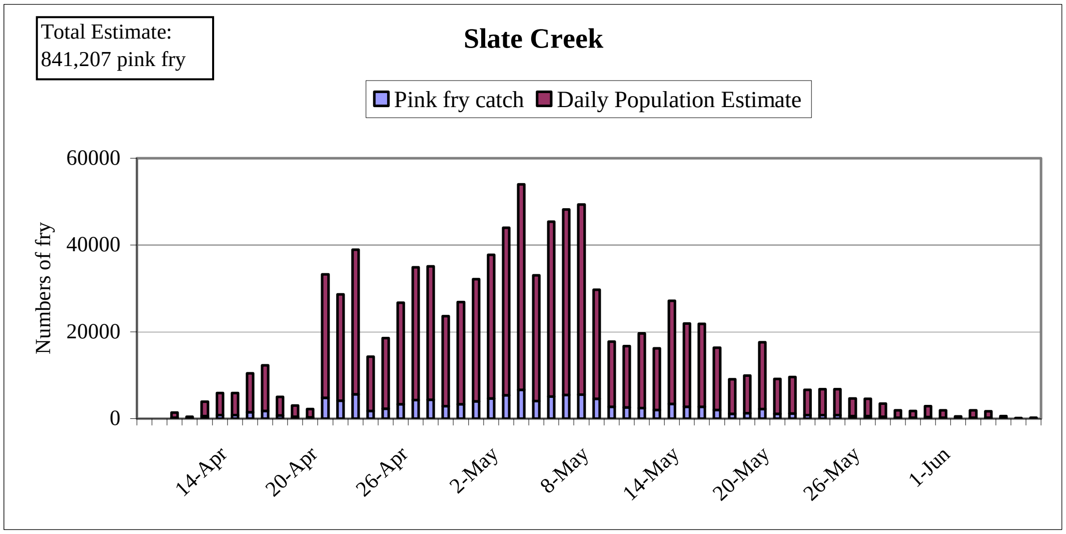


Figure 21: Estimated daily total pink fry migrating downstream.







6.8 Timing of Pink Salmon Outmigration

Numbers of captured fry increased steadily in Sherman Creek from around 100 fish in early April, rising to almost 2500 on May 7 then declining again to low numbers in early June. Numbers were already relatively high at Johnson Creek at the beginning of the study (over 2000 fish) and increased to 8500 fish on May 16. Slate Creek showed the earliest peak in daily catch with numbers reaching over 6600 on May 3. Some periods of low fry capture coincided with high flow (eg. April 23-24, May 16) when a lower proportion of the total stream flow was sampled by the nets. Fyke net wings could not be deployed at the highest flows as fry would become impinged against the mesh, reducing the amount of flow sampled. Water temperature appeared to dip slightly during rainfall events.

6.9 Daily Catch and Mark-Recapture Trials

The total catch at Slate Creek was 3.5 times the magnitude at Sherman Creek while the catch at Johnson Creek was 4 times the magnitude of Sherman. The total catch from Sherman Creek was 34,993 pink salmon fry between April 12 and June 9 with a maximum daily catch of 2474 fry on May 7. Sherman Creek mark-recapture experiments resulted in 50% recovery of marked fish at the beginning of the survey then recapture rates varied with stream flow, dropping to 10% in May. Figure 21 shows the estimated daily catch of pink fry based on mark-recapture trials. The total population estimate for the survey period for Sherman Creek is 164,419 pink fry. Table 14 gives the daily catches of fry and population estimates.

Johnson Creek was sampled from April 10 to June 5 with a total catch of 140,768 pink fry and maximum daily catch of 8505 on May 16. Johnson mark-recapture surveys resulted in 35% recovery at the beginning of the survey to 7% recovery in May then 12% recovery toward the end of the survey. The total population estimate for the Johnson Creek survey based on mark-recapture experiments was 1,110,629 pink fry. Predation of marked fry released upstream of the net may have contributed to low recovery rates at times.

Slate Creek was sampled from April 10 to June 6 with a total catch of 121,908 pink fry and maximum daily catch of 6626. Average recapture rates of between 10 and 17% resulted in a total population estimate of 841,207 pink fry.

Table 14A: Daily Catch at Sherman Creek

	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	34993	**2015**	**471**					**164761**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Recapture Rate	Daily Population Estimate
10-Apr								
11-Apr								
12-Apr	**106**	94	6	7.45			0.14	766
13-Apr	70		7	7.45			0.32	221
14-Apr	164		0	0.00	13	13.83	0.32	518
15-Apr	**241**	99	47	49.49			0.32	761
16-Apr	170		2	0.00			0.32	537
17-Apr	339		0	0.00	49	49.49	0.50	675
18-Apr	**337**	100	50	50.00			0.50	671
19-Apr	561		0	0.00			0.50	1116
20-Apr	695		1	0.00	51	51.00	0.45	1539
21-Apr	**777**	150	59	39.33			0.45	1720
22-Apr	774		0	0.00			0.45	1714
23-Apr	206		0	0.00			0.45	456
24-Apr	85		0	0.00	59	39.33	0.26	327
25-Apr	**354**	158	20	12.66			0.26	1362
26-Apr	379		0	0.00			0.26	1458
27-Apr	548		0	0.00	20	12.66	0.12	4430
28-Apr	**620**	149	17	10.07			0.12	5012
29-Apr	879		1	1.34			0.12	7106
30-Apr	959		0	0.00	18	12.08	0.12	8090
1-May	**783**	172	18	10.47			0.12	6605
2-May	1302		2	1.16			0.12	10983
3-May	1918		0	0.00	20	11.63	0.18	10815
4-May	**1347**	151	35	23.84			0.18	7595
5-May	2401		1	0.66			0.18	13539
6-May	1887			0.00	36	23.84	0.28	6810
7-May	**2474**	152	48	31.58			0.28	8928
8-May	1169		0	0.00			0.28	4219
9-May	1024		0	0.00	48	31.58	0.32	3221
10-May	**2012**	150	45	30.00			0.32	6329
11-May	1412		3	2.00			0.32	4442
12-May	1675		0	0.00			0.32	5269
13-May	1419		0	0.00	48	32.00	0.24	5913
14-May	**1003**	150	24	16.00			0.24	4179
15-May	1053		0	0.00			0.24	4388
16-May	661		0	0.00	24	16.00	0.23	2874
17-May	**369**	150	45	30.00			0.23	1604
18-May	574		0	0.00			0.23	2496
19-May	438		0	0.00	45	30.00	0.21	2123
20-May	**375**	151	17	11.26			0.21	1818
21-May	278		0	0.00			0.21	1348
22-May	246		0	0.00	17.00	11.26	0.10	2540
23-May	**101**	37	3	8.11			0.10	1043
24-May	112		0	0.00			0.10	1156
25-May	211		0	0.00	3.00	8.11	0.11	1842
26-May	**118**	54	8	14.80			0.11	1030
27-May	58		0	0.00			0.11	506
28-May	63		0	0.00	8.00	14.80	0.14	451
29-May	**40**	38	1	2.63			0.14	286
30-May	74		0	0.00			0.14	529
31-May	9		4	10.53			0.14	64
1-Jun	0		0	0.00	5.00	13.16	0.12	342
2-Jun	**77**	60	7	11.67			0.12	620
3-Jun	34		0	0.00			0.12	274
4-Jun	12		0	0.00	7.00	11.67	0.12	100

Table 14B: Daily Catch at Slate Creek

	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	121909	**2701**	**236**					**922181**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
10-Apr	**197**	60	10	16.66			0.17	1182
11-Apr	62		0				0.13	463
12-Apr	552		0		10	16.67	0.13	4124
13-Apr	**841**	99	10	10.10			0.13	6284
14-Apr	836		0				0.13	6246
15-Apr	1486		0				0.13	11103
16-Apr	1753		0		10	10.10	0.10	18040
17-Apr	**709**	99	0	0.00			0.10	7296
18-Apr	427		0				0.10	4394
19-Apr	311		0		0	0.00	0.10	3201
20-Apr	**4744**	150	14	9.33	14	9.33	0.10	48821
21-Apr	**4083**	150	10	6.67			0.10	42018
22-Apr	5560		6	4.00			0.10	57218
23-Apr	1753		0		16	10.67	0.14	12521
24-Apr	**2280**	100	5	5.00			0.14	16286
25-Apr	3274		0				0.14	23386
26-Apr	4276		0		5	5.00	0.14	30543
27-Apr	**4303**	150	6	4.00			0.14	30736
28-Apr	2895		0				0.14	20679
29-Apr	3293		0		6	4.00	0.14	23521
30-Apr	**3950**	150	6	3.33			0.14	28214
1-May	4631		0				0.14	33079
2-May	5400		0		6	4.00	0.14	38571
3-May	**6626**	150	9	6.00			0.14	47329
4-May	4052		3	2.00			0.14	28943
5-May	5098		0		12	8.00	0.13	40247
6-May	**5417**	150	26	17.33			0.13	42766
7-May	5551		0				0.13	43824
8-May	4532		0		26	17.33	0.18	25178
9-May	**2702**	150	26	17.33			0.18	15011
10-May	2544		2	1.37			0.18	14133
11-May	2420		0	0.00	28	18.67	0.14	17183
12-May	**1999**	200	12	6.00			0.14	14194
13-May	3353		6	3.00			0.14	23808
14-May	2708		1	0.50	19	9.50	0.14	19228
15-May	**2696**	200	0	0.00			0.14	19143
16-May	2011		9	4.50			0.14	14279
17-May	1120		0	0.00	9	4.50	0.14	7953
18-May	**1225**	151	11	7.28			0.14	8698
19-May	2173		2	1.32			0.14	15430
20-May	1129		0	0.00	13.00	8.61	0.14	8017
21-May	**1177**	150	7	4.67			0.14	8357
22-May	820		0	0.00			0.14	5822
23-May	837		0	0.00	7.00	4.67	0.14	5943
24-May	**831**	145	8	5.52			0.14	5901
25-May	569		1	0.69			0.14	4040
26-May	562		0	0.00	9.00	6.21	0.14	3991
27-May	**429**	148	2	1.35			0.14	3046
28-May	235		0	0.00			0.14	1669
29-May	215		0	0.00	2.00	1.35	0.14	1527
30-May	**358**	149	13	8.72			0.14	2542
31-May	235		0	0.00			0.14	1669
1-Jun	70		0	0.00	13.00	8.72	0.15	459
2-Jun	**254**	150	31	20.81			0.15	1664
3-Jun	222		0	0.00			0.15	1454
4-Jun	80		0	0.00			0.15	524
5-Jun	17		0	0.00			0.15	111
6-Jun	26		0	0.00	31.00	21.81	0.15	170

	Table 14C: Daily Catch at Johnson Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	140768	**2760**	**273**					**1116014**
Date	Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total	% Recaptured per event	Mean Racapture Rate	Daily Population Estimate
10-Apr	**2203**	141	38	20.56			0.21	10715
11-Apr	1633		14	9.93			0.35	4696
12-Apr	1123		**0**		52	36.88	0.35	3230
13-Apr	**1370**	150	37	24.67			0.35	3940
14-Apr	2131		12	8.00			0.35	6128
15-Apr	2462		**0**				0.35	7080
16-Apr	469		0		49	32.67	0.21	2241
17-Apr	**948**	196	0	0.00			0.21	4530
18-Apr	2208		**18**	9.18			0.21	10552
19-Apr	3270		0		18	9.18	0.19	17588
20-Apr	**4062**	150	19	12.67			0.19	21848
21-Apr	3569		**10**	6.67			0.19	19197
22-Apr	1400		0				0.19	7530
23-Apr	499	150	13	8.67			0.19	2684
24-Apr	1344		0				0.19	7229
25-Apr	2019		**0**		42	28.00	0.18	11428
26-Apr	**1784**	150	5	3.33			0.18	10098
27-Apr	1484		2	1.33			0.18	8400
28-Apr	1450		**0**		7	4.67	0.18	8208
29-Apr	**1159**	150	2	1.33			0.18	6560
30-Apr	1888		2				0.18	10687
1-May	1969		**0**		4	2.67	0.18	11145
2-May	**1492**	150	0	0.00			0.18	8445
3-May	3145		3	2.00			0.18	17802
4-May	2134		**0**		3	2.00	0.18	12079
5-May	**2776**	150	8	5.33			0.18	15713
6-May	3179		3	2.00			0.18	17994
7-May	6312		**0**		11	7.33	0.09	68858
8-May	**4351**	150	3	2.00			0.09	47465
9-May	2675		2	1.33			0.09	29182
10-May	3179		0	0.00	5	3.33	0.09	34680
11-May	**4045**	149	1	0.69			0.09	44127
12-May	5640		5	3.36			0.09	61527
13-May	5076		0	0.00	6	4.03	0.09	55375
14-May	**4320**	200	7	3.50			0.09	47127
15-May	4864		15	7.50			0.09	53062
16-May	8505		0	0.00	22	11.00	0.12	72260
17-May	**4965**	175	3	1.71			0.12	42184
18-May	3133		3	1.71			0.12	26619
19-May	3480		0	0.00	6.00	3.43	0.12	29567
20-May	**5392**	100	5	5.00			0.12	45811
21-May	4976		0	0.00			0.12	42277
22-May	4166		0	0.00	5.00	5.00	0.12	35395
23-May	**3552**	150	2	1.33			0.12	30178
24-May	3041		3	2.00	5.00	3.33	0.12	25837
25-May	**1280**	146	9	6.16			0.12	10875
26-May	566		0	0.00			0.12	4809
27-May	262		0	0.00	9.00	6.16	0.12	2226
28-May	**278**	153	10	6.54			0.12	2362
29-May	1025		0	0.00			0.12	8709
30-May	1012		0	0.00			0.12	8598
31-May	207		0	0.00			0.12	1759
1-Jun	0		0	0.00	10.00	6.54	0.12	3577
2-Jun	**635**	150	19	12.42			0.12	5395
3-Jun	623		0	0.00			0.12	5293
4-Jun	0		0	0.00			0.12	2808
5-Jun	38		0	0.00	19.00	12.54	0.12	323

6.10 Total Population Estimates

Numbers of pink fry migrating downstream in the spring of 2007 were estimated from mark-recapture experiments as 164,419, 1,110,629, and 841,207 in Sherman, Johnson and Slate respectively. These estimates only include fry that hatched upstream of the traps. At Sherman Creek approximately 12% of the total spawning habitat is located downstream of the trap. It could be assumed that the total outmigrating fry count would include an additional 12% or 19,730 fry bringing the total to 184,150. At Johnson Creek approximately 10% of the total spawning habitat was located downstream of the trap giving a final total estimate of 1,221,690. Slate Creek also had an additional 10% of potential spawning habitat downstream of the trap giving a total estimate of 925,328 pink fry. Based on these numbers, total mortality caused by monitoring was 0.91% (1681 fry), 0.07% (811 fry) and 0.21% (1975 fry) of the total estimated outmigration in Sherman, Johnson and Slate Creeks, respectively.

The number of spawning pink salmon adults estimated in the fall of 2006 was 1,000 in Sherman Creek, 6,534 in Johnson Creek and 2428 in Slate Creek. Assuming a 1:1 sex ratio, the numbers of fry produced per adult female was 368 in Sherman Creek, 374 at Johnson Creek and 762 at Slate Creek. The Slate Creek estimate seems rather high compared to published rates and previous year's studies. In 1998, the estimated number of fry produced per female in Sherman Creek was 194. In 2000, the numbers were approximately 10-fold lower with 15 fry per female in Sherman Creek (EVS 2000) and in 2006 numbers were lower again at only 7 fry per female. Johnson Creek produced fry at a rate similar to that for Sherman Creek in 1998 (196). Average pink salmon fry production over 15 brood years in Auke Creek, SE Alaska, was 12.3 fry per spawner (Fukushima, 1996) or 25 fry per female. In other streams fry production varied between 50 and 200 (Chebanov, 1989) and between 103 and 562 (Shershnev and Zhul'kov, 1980). There is evidently large variability in fry production from year to year and stream to stream.

It is possible that numbers of fry at Slate Creek were overestimated due to marked fish avoiding the trap a second time or predators locating marked fish more easily. At times only 10% of the flow was sampled reducing the chance of recapturing marked fish. It is also possible that numbers of female adult salmon were underestimated the previous summer. If the fry estimate were closer to 800,000 and adult female estimate closer to 2000 then the number of fry per female would be 400, which seems more reasonable (Table 15).

The survival rate from egg to emergent fry can be estimated by assuming each female lays between 1500 and 2000 eggs (Heard 1991). For Sherman Creek total egg production would lie between 750,000 eggs (500 females x 1500 eggs) and 1,000,000 eggs (500 females x 2000 eggs). If 184,150 fry emerged in Spring then between 18.4 and 24.5% survived from the egg stage. For Johnson Creek, an estimated 4,900,500 to 6,534,000 eggs produced 1,221,691 fry or between 18.7 and 24.9% survived. At Slate Creek, an estimated 1,821,000 to 2,428,000 eggs produced 925,238 fry so the survival rate was between 38 and 50.8%. Overall freshwater survival of pink salmon from egg to alevin, even in highly productive streams, commonly reaches only 10-20%, and at times is as low as 1% (Heard, 1991). In Sashin Creek, SE Alaska, egg to fry survival varied from 0.1 to 22 % (Heard, 1978) over a 28 year period. Quinn (2005) gives a rate of 11.5% as being typical. In 2000, survival rate at Sherman Creek was estimated as 0.6%. Rates in 2006 were less than 0.5% for Sherman Creek, 10-13% for Johnson and 7-9% for Slate.

The egg-to-fry survival rate estimated for Slate Creek in 2007 seems rather high. It could be that marked fish were avoiding the trap after their release or that predators were selecting marked fish over unmarked fish. The number of adult pink salmon in Slate Creek could have been underestimated the previous summer. Using adjusted numbers of 2000 female salmon laying 3-4 million eggs that produced around 800,000 fry gives a survival rate of 20-27% which seems more realistic (Table 15). This rate is still high compared to published rates, but survival could have been high due to early and persistent snow fall that helped insulate eggs over the winter.

Stream	Adjusted estimate of outmigrating fry	Estimated number of adult females	Number of fry per female	Egg to fry survival rate
Sherman	184,150[a]	500	368	18-25%
Johnson	1,221,690[a]	3267	374	18-25%
Slate	800,000[a,b]	2000[b]	400[b]	20-27%

Table 15: Estimates adjusted for numbers hatching downstream of trap(a) and for realistic egg to fry survival rates(b).

6.11 Other Species Collected

In addition to pink salmon, six other species were caught in the fyke nets (Table 16). 1557 chum salmon fry (*Oncorhynchus keta*) were captured in Johnson Creek during the study, but only one was caught in Slate Creek and none were captured in Sherman Creek. The only other species caught in Sherman Creek was Dolly Varden with 4 juveniles caught between April 13 and 24. A total of 230 coast-range sculpins (*Cottus aleuticus*) were caught in Slate Creek and 10 were caught in Johnson Creek. 64 juvenile coho salmon were caught in Johnson Creek and 11 were caught in Slate Creek. One juvenile cutthroat trout was captured in each of Johnson and Slate Creeks. 39 eulachon (*Thaleichtys pacificus*) were captured in Slate Creek during the last week of April as they entered the stream to spawn.

Table 16: Other species captured in fyke nets at each creek.

	Sherman	Johnson	Slate
Chum	0	1557	1
Coho	0	64	11
Dolly V.	4	1	15
Cutthroat	0	1	230
Sculpin	0	10	39
Eulachon	0	0	1

6.12 Discussion and Recommendations

The Johnson and Slate Creeks population estimates were around 4-6 times that of Sherman Creek. The actual catch of fish in Johnson and Slate Creeks was 3.5 to 4 times that of Sherman Creek. Even if total population estimates are high, there were still far more fish counted in Johnson and Slate Creeks. Johnson Creek has more spawning habitat than the other creeks, with barrier falls located approximately 1.2km upstream from Berners Bay. Sherman Creek has barrier falls only 360m upstream from the ocean and Slate Creek has barrier falls approximately 900m from the ocean. The total anadromous area in Sherman Creek was measured as 1,944 m^2 in July 2005 (Aquatic Science 2005). The anadromous area of Johnson Creek has not been measured, but can be estimated from the distance from stream mouth to falls (1.5km) multiplied by average stream width of 8m. This gives an area of roughly 12,000 m^2. Slate Creek can be estimated by multiplying 900m by 9m giving 8100m^2. It appears that the difference in numbers of fry between streams is in proportion to the differences in habitat area present.

Fukushima et al. (1998) found that use of limited spawning areas led to the loss of eggs and was roughly proportional to spawner abundance. Smirnov (1975) suggested that 1.5 - 2.0 m^2 of spawning area per female was necessary for effective use of spawning grounds. A total of 500 female spawners at Sherman Creek, would allow 3.9 m^2 per female, 3267 females at Johnson Creek would allow 3.7m^2 per female, and 2000 females at Slate Creek would allow 4m^2 per female. Even though the spawning substrate available would be much less than the total stream area available, it appears that spawning area limitation was not a factor affecting fry survival.

A large freshet occurred in November 2005 in Sherman Creek, with around 17 inches of rain falling near the site within a week. Given the typical peaks in flow that tend to occur in Sherman Creek with rainfall, it is likely that a high level of scouring occurred in the stream, which may have destroyed some redds and the embryos within, resulting in low numbers of fry observed in 2006. Fluctuations in stream flow between the time of spawning and fry migration is one of the most significant non-biological factors influencing pink salmon survival in freshwater (Wickett, 1958). Higher numbers of fry in 2007 suggest stream conditions were more favorable during incubation.

Mortality due to sampling in Sherman, Slate and Johnson Creeks was less than 1% of the total estimated population for each creek. Mortality occurs when high flow causes bulges in the net and fry become impinged against the net wall or large amounts of debris trap fry against the walls of the holding box. Rigid sections of perforated aluminum places against the side of the fyke net in future years may help reduce bulging and lower mortality rates even further. The height-adjustable legs of the holding boxes made it easy to accommodate a wide range of stream flows from day to day, also helping reduce mortality rates.

7.0 Weekly Adult Salmon Counts

7.1 Surveys and Analysis

Counts of migrating adult pink salmon were made once a week in the anadromous reaches of Sherman, Johnson and Slate creeks from July 26 to September 27, 2007. Prior to the first survey, markers were placed along one bank of each creek at 50m intervals (Sherman Creek) or 100m intervals (Slate Creek). Each survey on Sherman and Slate Creeks was conducted by biologists on foot, who began at the intertidal zone and proceeded upstream along the bank, recording live and dead salmon present in each reach. Johnson Creek was surveyed using a combination of foot surveys and aerial surveys from a helicopter. Reach numbers painted on sheet metal are located on various log jams and can be read from the air to locate reaches. Approximate stream flow (low, average, high) and water clarity (visibility of fish) were noted at the beginning of each survey.

The data gathered from the surveys was used to determine the abundance and distribution of returning adult salmon in each stream, as well as the timing of the spawning run. Total escapement (the number of salmon that return to their natal stream to spawn) for pink salmon was estimated using the methods of Neilson and Geen (1981), where the sum of all weekly counts is divided by the average residence time of adult spawners in the stream. Since each weekly count includes some fish counted in the previous survey, an adjustment was made to avoid overestimation of escapement. The number of times an individual fish may have been counted during consecutive surveys is assumed to equal the average residence time. A residence time of two weeks was used to compute escapement, as this has been used in previous studies in the area (Biotec 1998, USDA 1997). In a tagging study conducted by Pentec (1990), the residence time of pink salmon spawners in Sherman Creek ranged from one to three weeks. Where chum or coho were only observed for one week, the total number observed was counted as the escapement.

7.2 Adult Salmon Counts

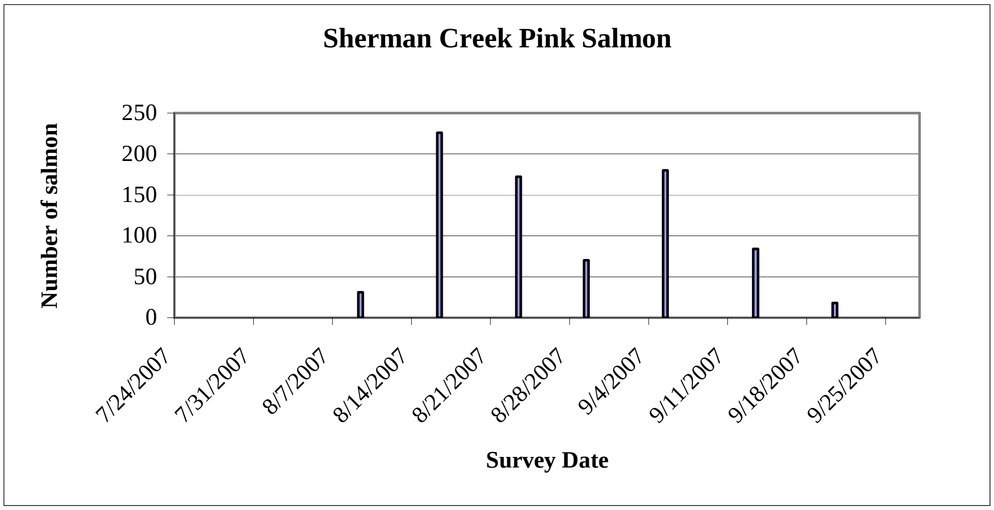
Weekly counts of adult salmon for 2007 are presented in Appendix 5. Figure 23 shows the magnitude and timing of the pink salmon spawning runs in Sherman, Johnson and Slate Creeks. Pink salmon were observed in Sherman Creek from July 26 to September 27 with a maximum of 226 individuals observed on August 16. No chum or coho salmon were observed in Sherman Creek. Low flow due to a dry August lead to salmon in the intertidal area being unable to travel further upstream until flows increased. In Johnson Creek, pink salmon were observed from July 26 to September 13, with numbers peaking at around 2,050 fish on August 10. Around 65 chum salmon were observed in Johnson Creek on July 26, around 100 on August 3 and 120 on August 10. An estimated 50 coho were observed in Johnson Creek on October 11.

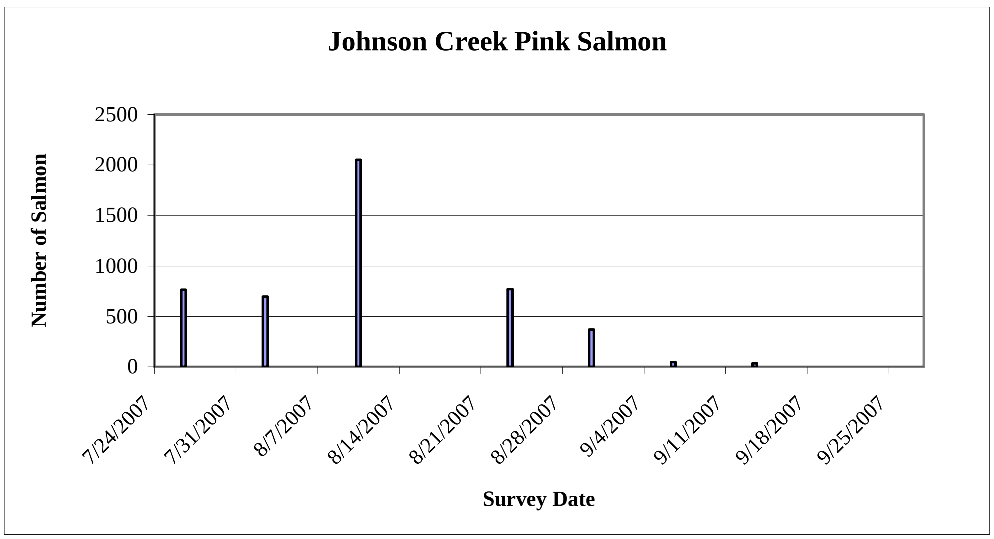
In Slate Creek, pinks were observed from July 26 to September 6 with numbers peaking at 150 on August 16. These fish remained downstream of the 100m marker due to low stream flow preventing their passage upstream. 12 pink salmon were observed up to the 400m marker on August 10, 5 pinks the following week and 7 on September 6 once flow increased, but no salmon were observed beyond 400m at any time. No chum salmon were observed in Slate Creek in 2007. Around 20 coho were observed at the mouth of Slate Creek on October 24. Numbers of pink salmon reached a peak around mid-August in each stream. The magnitude of the pink salmon escapement in Johnson Creek was around 8 times that of Sherman Creek and 36 times that of Slate Creek (Table 17).

Table 17: Salmon Escapement in Sherman, Johnson and Slate Creeks in 2007.

	Salmon Escapement		
	Sherman Creek	**Johnson Creek**	**Slate Creek**
Pink	**390**	**3160**	**88**
Chum	**0**	**140**	**0**
Coho	**0**	**50**	**20**

Figure 22: Weekly Counts of Pink Salmon in Sherman, Johnson and Slate Creeks.





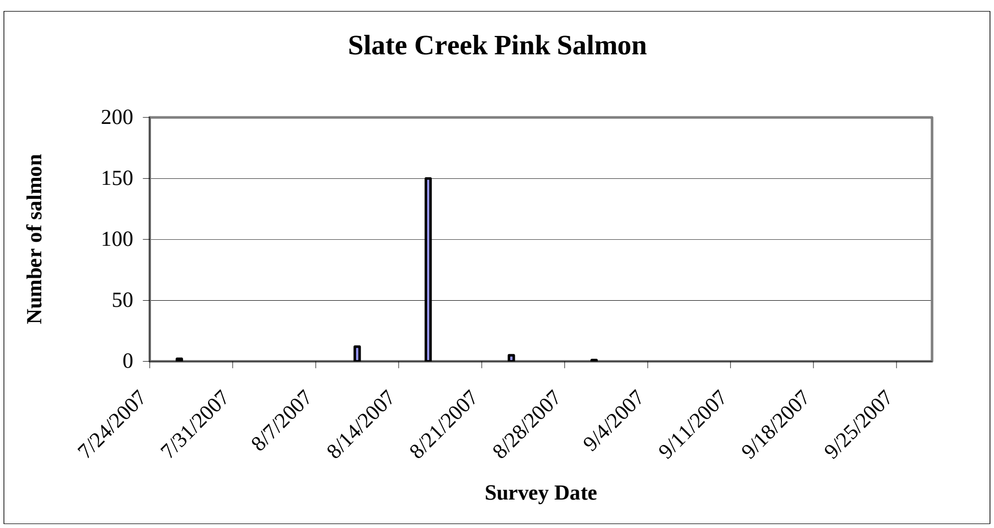
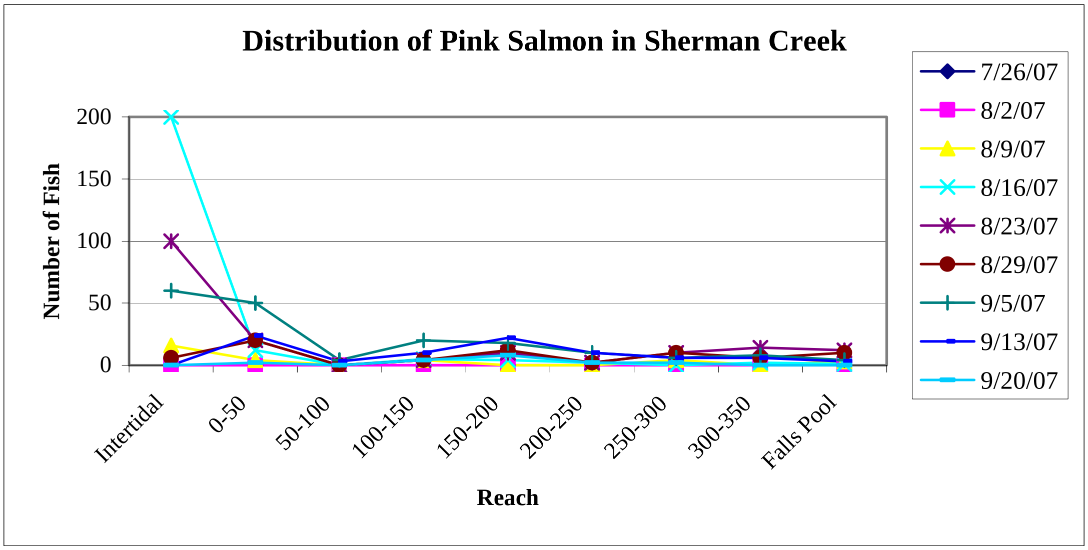
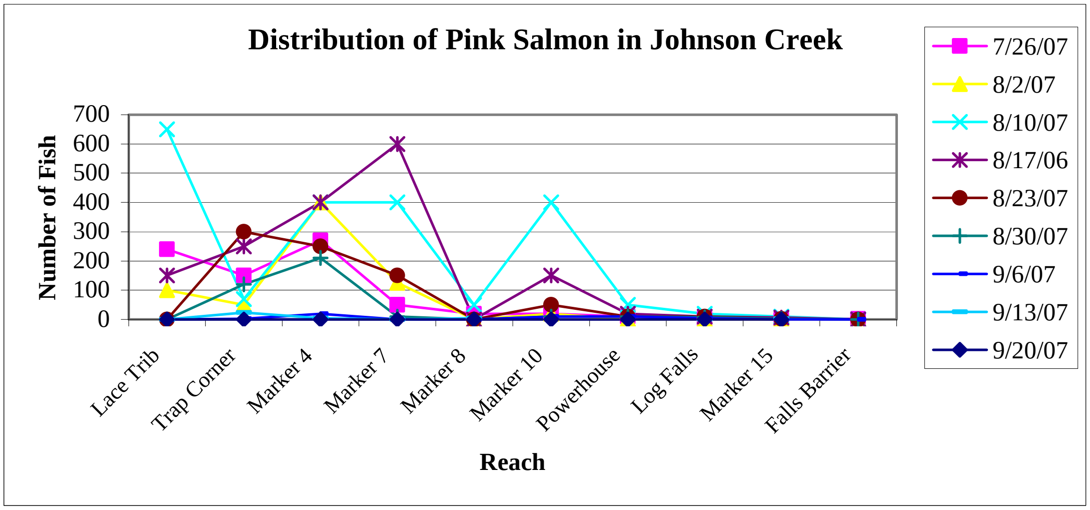
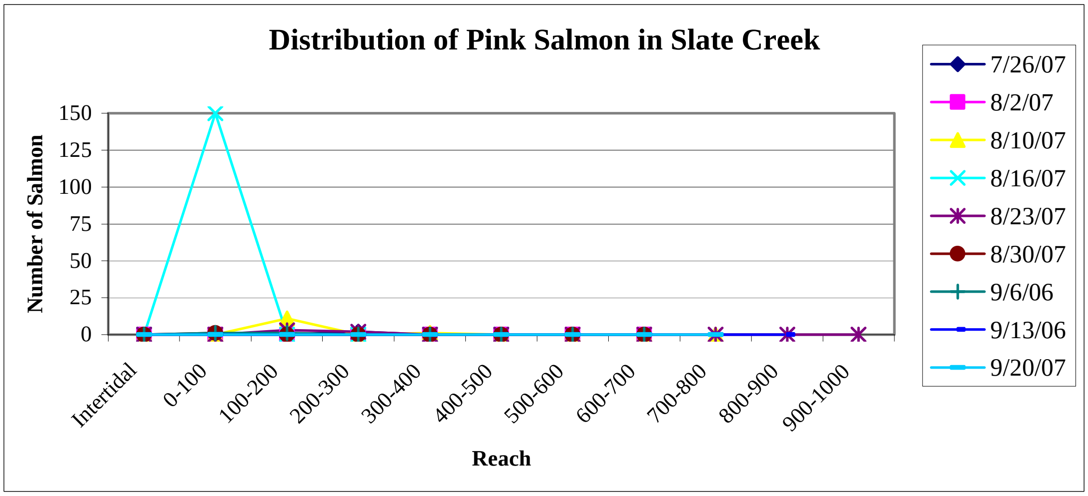


Figure 23: Distribution of Salmon in each creek in 2007.







The distribution of salmon in each stream throughout the surveys is shown in Figure 23. In Sherman and Slate Creeks, pink salmon appeared concentrated in the intertidal zone to 100m upstream. Low rainfall in August and low stream flows restricted access to upstream reaches. In Johnson Creek pink salmon were mostly observed in reaches 1 to 7, which lie between 0 and approximately 1km upstream.

7.3 Pink Salmon Escapement Comparison

A comparison of pink salmon escapement between 2005 and 2007 is shown in Figure 24. More than twice as many pink salmon were estimated to have returned to Johnson Creek in 2006 than 2005 or 2007, while returns were much higher in Slate Creek in 2006. Sherman Creek, however, had only around one third of the escapement as the previous year.

In South-East Alaska, even-year pink salmon populations are generally larger than odd-year populations due to their 2 year life cycle. Further south in their range, pink salmon are more abundant in odd years. It is thought that the odd-year salmon populations are better adapted to warmer water. The last ice age may have divided populations into a warm-water adapted southern (odd-year) population and a cooler water northern (even-year) population. Populations of salmon from an even year have no opportunity to interbreed with salmon from an odd year because all pink salmon mature at 2 years of age and all die after spawning (Quinn 2005). This can be seen in the lower numbers returning to Johnson and Slate Creeks in 2005 and 2007. Numbers returning to Sherman Creek are affected by the number of salmon that negotiate the falls near the mouth of the creek, which in turn depends on stream flow. Returns in 2006 may have been affected by the size of the stock in 2004, which was also a dry summer.

Escapement at Sherman and Slate Creeks in 2007 appeared to be affected by low flows due to dry weather in August coinciding with the peak of the salmon run. Schools of pink salmon were observed in the intertidal zones of these streams, apparently unable to ascend upstream due to lack of water. Johnson Creek appears to be fed partly by groundwater and is much less affected by dry weather and adult salmon migration did not seem to be impeded.

Figure 24: Estimated pink salmon escapement for 2005 to 2007.

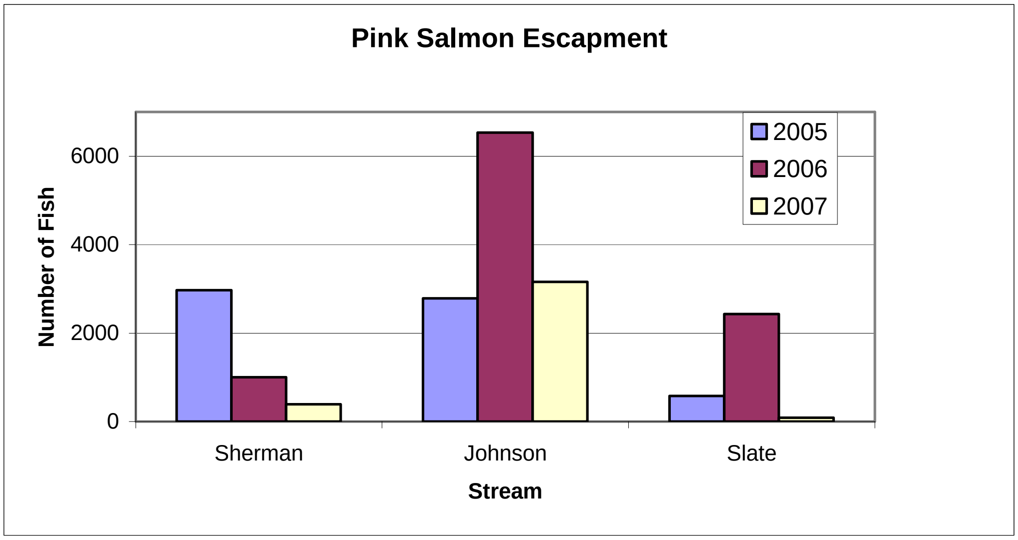


Figure 25: Pink salmon observed in Johnson Creek by helicopter.

8.0 Quality of Spawning Substrate

8.1 Sample Collection and Analysis

Core samples of spawning gravel were collected from each of two reaches in Sherman Creek on July 8-10, Slate Creek on July 12 and Johnson Creek on July 27, 2007. The two reaches in Sherman Creek lie between 3 and 29m, and between 288 and 315m from the stream mouth as defined by Konopacky (1992). The two reaches in Slate Creek are distributed between 125 and 150m, and between 175 and 200m from the stream mouth. The two reaches in Johnson Creek are located between 320 and 340m, and between 425 and 450m from the stream mouth. Four samples were collected from each reach using a McNeil-type sampler with a basal coring diameter of 15cm and a coring depth of 25cm (Figure 26). Individual sample sites were randomly chosen from all potential spawning areas that were suitable for sampling, namely, substrate size less than 15cm and water depth less than 30cm.

Figure 26: Inserting the McNeil sampler into the streambed at Sherman Creek.

Collected substrate was wet-sieved on site through the following sieve sizes in mm: 101.6, 50.8, 25.4, 12.7, 6.35, 1.68, 0.42, and 0.15, which were used by Konopacky (1992). The contents of each sieve were allowed to drain and then measured by volume of water displaced to the nearest 5ml for the 101.6 to 0.42mm sieve sizes and to the nearest 1ml for the 0.15mm sieve. Fine material that passed through the smallest sieve was placed in an Imhoff cone to settle out; and this volume read directly from the cone.

Figure 27: Fine sediment settling out in Imhoff cones at Johnson Creek.

Due to the presence of interstitial and surface water in each sample, the volumetric measurements were converted to dry weights using correction factors determined by Shirazi et al (1981) assuming a gravel density of 2.6g/cm^3. The geometric mean particle size and sorting coefficient (the distribution of grain sizes present) were calculated for each sample using methods from Lotspeich & Everest (1981).

The geometric mean particle size (d_g) is an index of the textural composition. The grain size at the midpoint of each size class is raised to a power equal to the decimal fraction of its volume. In other words, the volumes of sediment in each size class are converted to percentages of the whole sample then the midpoint of each size class is raised to this power. The products of each size class are then multiplied together to obtain the geometric mean, d_g:

$$d_g = (d_1^{v1} \times d_2^{v2} \ldots\ldots\ldots\ldots\ldots \times d_n^{vn})$$

where dg = geometric mean particle size

d = midpoint diameter of particles retained by a given sieve

v = decimal fraction by volume of particles retained by a given sieve

Sediment texture does not control survival to emergence of embryos directly, but the influence of texture on pore size and permeability affects embryo survival (Lotspeich & Everest 1981). The sorting coefficient (S_o) is an index of the size distribution of sediment particles in a sample and provides a useful indicator of the permeability of gravel for salmonid spawning. The grain size at the 75th percentile of total sample volume is divided by that at the 25th percentile. The square root of the result provides the sorting coefficient. A gravel consisting of only one grain size has a S_o of 1. A S_o greater than 1 represents gravel made up of several grain sizes with the smaller grains filling up pores between larger ones. S_o is therefore inversely proportional to permeability (Lotspeich & Everest 1981).

The Fredle index (F_i), or stream quality index, is a ratio of geometric mean particle size and sorting coefficient and provides a measure of the quality of spawning gravel for salmonid reproduction (Lotspeich and Everest, 1981). As the magnitude of the Fredle index increases, both pore size and permeability increase.

$$F_i = d_g/S_o$$

8.2 Spawning Gravel Composition

The volumetric measurements of gravel sizes retained by sieves are presented in Appendix 4. The geometric mean particle size (d_g), grain size percentiles (75th and 25th), sorting coefficient (S_o), Fredle index (F_i), and Embryo Survival Prediction (%) are presented in Table 18. Embryo survival predictions and grain size percentiles are obtained graphically from Lotspeich & Everest (1981). Geometric mean particles size was around 12.5mm for Sherman Creek samples, 11mm for Johnson Creek and 11.5 to 12.3mm for Slate Creek samples. The streams were very similar in gravel composition.

Sediment texture affects salmonid embryo survival by influencing the pore size and permeability of the gravel. These properties regulate oxygen transport to incubating embryos and control the movement of alevins within the gravel. An excess of fine sediments in spawning gravel is a direct cause of embryo and alevin mortality (Shirazi et al, 1981). The higher the numerical value of the geometric mean the higher is the survival percentage of salmonid embryos.

Based on published relationships between these indices and salmon embryo survival rates (Chapman 1988; Lotspeich and Everest 1981), the calculated indices for 2007 gravel samples, predict embryo survival to range from 41 to 51% for both reaches of Johnson and Slate Creek and from 56% to 65% for Sherman Creek.

Sample		Geometric Mean (mm)	Grain size percentile (75th and 25th)		Sorting Coefficient	Fredle Index	Embryo Survival-to-Emergence Prediction
		dg	**d75**	**d25**	**So**	**(f =dg/So)**	**(%)**
Sherman Creek							
Reach 1	1	11.62	32	3.2	3.16	3.68	52.0
	2	14.46	62	14	2.10	6.87	75.0
	3	12.63	42	8.25	2.26	5.60	71.0
	4	11.83	40	5.3	2.75	4.31	62.0
	Mean	**12.64**	**44.00**	**7.69**	**2.57**	**3.39**	**65.0**
	Standard Deviation	1.29	12.75	4.69	0.48	0.87	10.2
	95% Confidence interval	1.26	12.50	4.60	0.47	0.85	10.0
Reach 2	1	13.02	61.00	4.00	3.91	3.33	48.0
	2	13.74	65.00	6.80	3.09	4.44	63.0
	3	10.68	22.00	2.25	3.13	3.41	51.0
	4	12.64	53.00	6.80	2.79	4.53	64.0
	Mean	**12.52**	**50.25**	**4.96**	**3.23**	**2.57**	**56.5**
	Standard Deviation	1.31	19.48	2.24	0.48	0.42	8.2
	95% Confidence interval	1.28	19.09	2.19	0.47	0.41	8.0
Johnson Creek							
Reach 1	1	10.63	22.00	2.05	3.28	3.25	47.0
	2	9.94	18.00	0.98	4.29	2.32	35.0
	3	11.69	38.00	4.90	2.78	4.20	61.0
	4	12.20	37.00	4.15	2.99	4.09	60.0
	Mean	**11.11**	**28.75**	**3.02**	**3.33**	**2.21**	**50.8**
	Standard Deviation	1.02	10.24	1.82	0.67	0.58	12.3
	95% Confidence interval	1.00	10.04	1.78	0.65	0.57	12.0
Reach 2	1	10.86	32.00	1.80	4.22	2.57	38.0
	2	11.06	33.00	2.80	3.43	3.22	45.0
	3	11.19	34.00	2.80	3.48	3.21	46.0
	4	12.00	51.00	3.70	3.71	3.23	46.0
	Mean	**11.28**	37.50	2.78	3.71	1.87	**43.8**
	Standard Deviation	0.50	9.04	0.78	0.36	0.14	3.9
	95% Confidence interval	0.49	8.86	0.76	0.35	0.14	3.8

Table 18. Calculated indices for gravel samples collected from Sherman, Johnson, and Slate Creeks in July 2007. Geometric mean particle sizes are expressed in mm.

Sample		Geometric Mean (mm) dg	Grain size percentile (75th and 25th) d75	d25	Sorting Coefficient So	Fredle Index (f = dg/So)	Embryo Survival-to-Emergence Prediction (%)
Slate Creek							
Reach 1	1	10.56	38.00	1.90	4.47	2.36	36.0
	2	12.22	54.00	3.60	3.87	3.16	45.0
	3	12.06	54.00	3.50	3.93	3.07	43.0
	4	11.37	43.00	2.70	3.99	2.85	40.0
Mean		**11.55**	**47.25**	**2.93**	**4.07**	2.03	**41.0**
Standard Deviation		0.76	8.06	0.79	0.28	0.25	3.9
95% Confidence Interval		0.74	7.90	0.78	0.27	0.24	3.8
Reach 2	1	11.21	35.00	2.70	3.60	3.11	44.0
	2	11.65	45.00	3.10	3.81	3.06	43.0
	3	13.68	63.00	4.80	3.62	3.78	53.0
	4	12.63	42.00	4.80	2.96	4.27	62.0
Mean		**12.29**	**46.25**	**3.85**	**3.50**	2.16	**50.5**
Standard Deviation		1.10	11.93	1.11	0.37	0.33	8.9
95% Confidence Interval		1.08	11.69	1.09	0.36	0.32	8.7

Table 18 continued: Calculated indices for gravel samples collected from Sherman, Johnson, and Slate Creeks in July 2007. Geometric mean particle sizes expressed in mm.

		Sherman			Johnson		
		2005	**2006**	**2007**	**2005**	**2006**	**2007**
Reach 1	**1**	9.94	8.83	11.62	10.76	10.91	10.63
	2	9.57	8.84	14.46	11.04	10.41	9.94
	3	9.47	8.96	12.63	11.03	11.17	11.69
	4	9.30	10.73	11.83	10.38	11.44	12.20
Average Dg		**9.57**	**9.34**	**12.64**	**10.80**	**10.98**	**11.11**
Standard deviation		0.27	0.93	1.29	0.31	0.44	1.02
95% Confidence		0.27	0.45	1.26	0.31	0.22	1.00
Reach 2	**1**	11.52	13.74	13.02	11.80	12.08	10.86
	2	10.62	13.27	13.74	13.64	11.68	11.06
	3	10.62	15.79	10.71	12.51	13.25	11.19
	4	10.18	15.47	12.69	10.85	11.95	12.00
Average Dg		**10.74**	**14.57**	**12.54**	**12.20**	**12.24**	**11.28**
Standard deviation		0.56	1.25	1.29	1.17	0.69	0.50
95% Confidence		0.28	0.61	1.27	1.15	0.34	0.49

Table 19: Comparison of Dg for 2005, 2006, 2007.

		Slate		
		2005	**2006**	**2007**
Reach 1	**1**	11.60	11.99	10.56
	2	11.63	11.74	12.22
	3	13.60	12.12	12.06
	4	12.42	11.62	11.37
Average Dg		**12.31**	**11.87**	**11.55**
Standard deviation		0.94	0.23	0.76
95% Confidence		0.92	0.11	0.74
Reach 2	**1**	13.12	12.18	11.21
	2	13.14	12.59	11.65
	3	13.20	11.81	13.68
	4	17.47	11.47	12.63
Average Dg		**14.23**	**12.01**	**12.29**
Standard deviation		2.16	0.48	1.10
95% Confidence		2.12	0.24	1.08

Table 19 continued: Comparison of Dg for 2005, 2006, 2007.

Single Factor Anova	
2005, 2006, 2007	p value
Sherman Reach 1	0.0012
Sherman Reach 2	0.0026
Johnson Reach 1	0.8056
Johnson Reach 2	0.2395
Slate Reach 1	0.3574
Slate Reach 2	0.1080

Table 20: Significance results from ANOVA

8.3 Comparison with Geometric Mean for previous years.

The geometric mean particle size of samples from each site was compared with samples collected in 2005 and 2006 by applying a single factor ANOVA to the data. Table 19 shows geometric means for 2005 to 2007, while Table 20 summarizes p values from ANOVA. The only significant difference at the 95% level between years was for both reaches of Sherman, indicating the geometric means were greater in 2007. A larger geometric mean indicates samples contain less fine material.

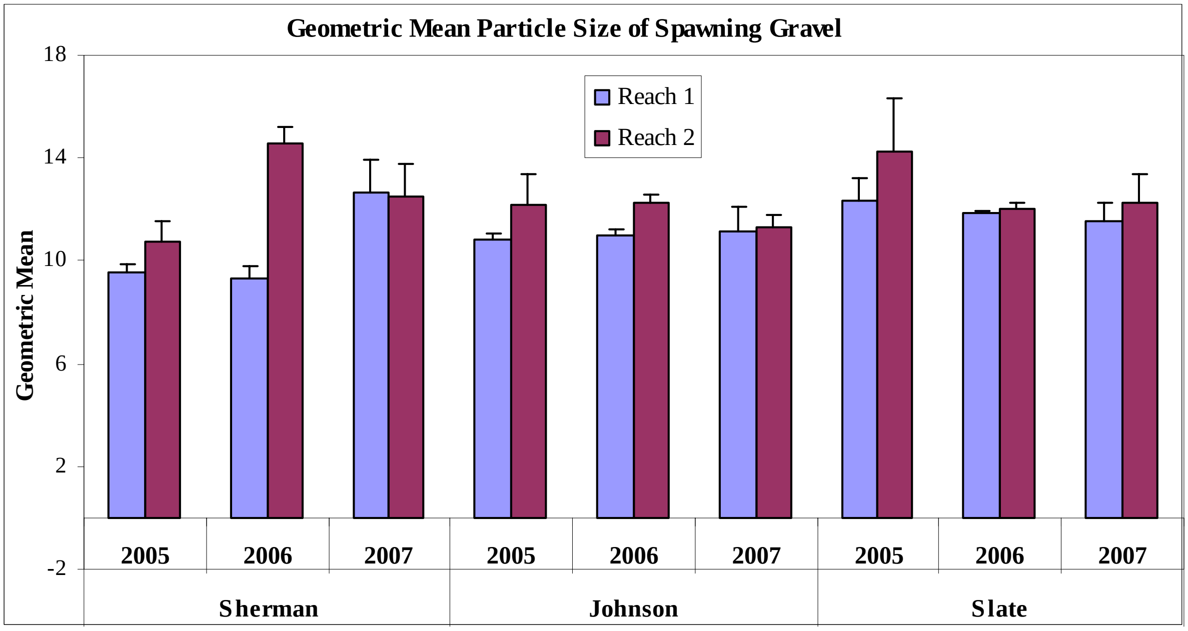


Figure 29: A comparison of geometric mean from 2005 to 2007.

Figure 28: Pink salmon in Sherman Creek.

9.0 Aquatic Vegetation

A visual survey of instream vegetation was carried out in the lower and middle reaches of Sherman, Johnson, and Slate Creeks in July and August 2007, during resident fish surveys. These reaches are downstream of outfall 001 (Sherman Creek), the proposed outfall 002 (Slate Creek) and the mill process site (Johnson Creek). There was very little aquatic vegetation in Sherman Creek, with only larger, more stable substrate having a thin algal covering (Figure 30).

Figure 29: Lower Sherman Creek; aquatic vegetation is scarce.

Johnson and Slate Creeks have more or less bare substrate with very little aquatic vegetation (Figures 30 and 31). Periodic high flows in these steep, coastal streams are likely to disturb the substrate and restrict aquatic plant growth. Some mosses and ferns are present in the splash zone, particularly near waterfalls.

Figure 30: Lower Slate Creek; negligible aquatic vegetation.

Figure 31: Lower Johnson Creek; small substrate and no aquatic vegetation.

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Report of Short-Term Toxicity of Whole Sediment to *Chironomus tentans*

Coeur Alaska, Inc.
Kensington Mine
Juneau, AK

ENSR
Environmental Toxicology
Document 08503-131-058-(016, 018, 020, 022)

ENSR | AECOM

ENSR | AECOM

Report of Short-Term Toxicity of Whole Sediment to Chironomus tentans

Project IDs: 08503-128-058-(016, 018, 020, 022)
August/September 2007

Sponsor and Laboratory Information

Sponsor	Coeur Alaska Inc. Kensington Mine 3031 Clinton Drive Suite 202 Juneau, Alaska 99801
Project Officer	John Randolph (907) 789-1591
Testing Facility	ENSR Fort Collins Environmental Toxicology Laboratory 4303 West LaPorte Ave. Fort Collins, CO 80521 Fax: (970) 490-2963 State of Florida NELAP Laboratory ID: E87972
Study Director	David A. Pillard (970) 416-0916, ext. 310

Test Information

Test	Short-term chronic screening toxicity test of sediment	
Basis	USEPA (2000) and ASTM (2001)	
Test Protocol	CT3AK.TIE058.005	
Test Period	August 31, 2007 @ 1300 to September 10, 2007 @ 1400	
Test Length	10 days	
Species	*Chironomus tentans*	
Test Material	Whole sediment	
Sediment ID	Sample ID	ENSR Laboratory ID
	Lower Johnson	20934
	Lower Slate	20935
	Lower Sherman	20938
	Middle Sherman	20939
Control Sediments	Silica Sand and Laboratory Formulated Sediment	
Overlying water	Moderately hard reconstituted water prepared according to USEPA (2002), augmented with approximately 50 mg/L Cl^- (as NaCl)	
Test Concentrations	0 (control) and 100% of each test sediment	

Sediment Collection and Receipt

Sample ID	Collection Date and Time	ENSR No.	Date of Receipt	Temp. at Arrival (°C)
Lower Johnson	08/17/07 @ 1145	20934	08/22/07	8
Lower Slate	08/16/07 @ 1200	20935	08/22/07	8
Lower Sherman	08/15/07 @ 1000	20938	08/22/07	10
Middle Sherman	08/18/07 @ 1030	20939	08/22/07	10

Note: See Appendix A for copies of chain of custody records

Control Sediment

The primary control sediment was silica sand, obtained from a local commercial supplier. A second control sediment, with a smaller grain size and higher organic matter content, was prepared in the laboratory. The composition of the formulated sediment is given in the following table (Kemble et al. 1999).

Composition of Laboratory Formulated Sediment (Control)

Material	Source	Pre-Treatment	Weight (g)
White Quartz Sand	U.S. Silica. Berkely Springs, West Virginia.	Rinsed with gentle mixing in Horsetooth water until water ran clear, then rinsed for 5 min with Milli-Q water. Air dried or dried in oven.	1242
Silt/Clay (ASP400)	Mozel, St. Louis, MO. Distributor = Englehardt	None	219
Dolomite	Grey Rock Clay Center, Ft. Collins, CO.	None	7.5
α-cellulose	Sigma	None	77.3
Humic Acid	Fluka	None	0.15
Total			1545.95

Test Sediment Preparation

Sample ID	Date Homogenized	Time Homogenized
Lower Johnson	August 30, 2007	1600-1605
Lower Slate		1545-1550
Lower Sherman		1515-1519
Middle Sherman		1525-1530

Test Conditions

Test Type	Static sediment with continuous replacement of overlying water
Test Duration	10 days
Overlying Water Delivery System	Continuous renewal (flow-through) [a]
Test Endpoints	Survival, AFDW[b] per original and surviving organism
Test Chambers	500 ml glass beakers
Test Sediment Volume	100 ml
Overlying Water Volume	175 ml
Replicates per Treatment	8
Organisms per Replicate	10
Test Temperature	23 ± 1°C; see Protocol Deviations
Lighting	Fluorescent, 16 hours light:8 hours dark
Chamber Placement	Randomized
Test Sediment Renewal	None
Test Overlying Water Renewal	Approximately two volume additions per test chamber per day

[a] Continuous replacement via a drip system
[b] Ash-Free Dry Weight
Note: See Appendix B for the Test Protocol

Test Organism

From the lot of *Chironomus tentans* received for use in the test, 20 were collected, preserved, and used to determine head capsule widths. The mean head capsule width of lot 07-030 was 0.310 mm. All organisms were, therefore, young third instars according to the range given in USEPA (2000).

Species and Lot Number	*Chironomus tentans*, Lot 07-030
Age	3rd instar
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (53 mg/L) as NaCl, RW # 8307
Reference Toxicant Testing	Initiated August 31, 2007 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Ash Free Dry Weights

Sample ID	Percent Survival[a]	Ash Free Dry Weight (mg)[a]	
		Per original organism	Per surviving organism
Sand Control	85.0	0.897	1.093
Lab. Formulated Sediment	71.25	1.091	1.594
Lower Johnson	67.5[b]	0.803[c]	1.230[c]
Lower Slate	83.75	1.050	1.305
Lower Sherman	80.0	0.845	1.079
Middle Sherman	82.5	1.024	1.292
Control Performance	Acceptable	N/A	N/A

[a] Samples were compared to the sand control
[b] Significant compared to the sand control
[c] Since survival was significantly lower in the Lower Johnson than in the sand control, Lower Johnson was excluded from statistical analysis of dry weight per surviving, and original, organism.
Note: See Appendix C for test data sheets

Data Analysis

Survival and growth data for field collected-samples were compared to the sand control data to determine statistical differences. Survival and AFDW (per original and per surviving) for the laboratory controls (sand and laboratory formulated sediment) was first compared using a t-test (α=0.05). Both survival and AFDW (per original and per surviving) for the two laboratory controls were significantly different; therefore, test sediments were only compared to the sand control.

Biological Endpoint	Comparison	Procedure
Survival	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Sand Control [a]	Dunnett's Test (α = 0.05)
Growth (AFDW per Original Organism)	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Sand Control [a]	Dunnett'sTest (α = 0.05)
Growth (AFDW per Surviving Organism)	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Sand Control [a]	Dunnett'sTest (α = 0.05)

[a] Using Toxstat Version 3.5 (WEST, Inc. and Gulley 1996)

Analytical Data

Total Metals (mg/Kg-dry)[a]	Sample ID			
	Lower Johnson	Lower Slate	Lower Sherman	Middle Sherman
Aluminum	23000	13100	16500	16700
Chromium	66.6	31.1	47.1	53.0
Nickel	42.1	ND	ND	ND
Silver	ND	ND	ND	ND
Zinc	98.6	157	100	87.0
Metals, Solid Samples (mg/Kg-dry)[b]				
Arsenic	0.892	2.81	23.7	7.71
Cadmium	0.092	0.207	0.533	0.095
Copper	8.04	10.3	98.6	22.2
Lead	1.67	2.83	19.6	3.51
Selenium	ND	ND	0.815	ND
Mercury	ND	0.0582	0.0621	0.0832
Particle Size (%)[c]				
Clay	26.0	2.0	4.0	2.0
Sand	18.0	78.0	82.0	78.0
Silt	56.0	20.0	14.0	20.0
Texture	Silt Loam	Loamy Sand	Loamy Sand	Loamy Sand
Coarse Material	0.24	ND	ND	ND
TOC[d] (%)	0.3	2.7	1.3	1.4
Acid Volatile Sulfide (umoles/g)	ND	ND	ND	ND

[a] Total metals were determined using SW-846 Method 6010B (USEPA 1986)
[b] Metals (solid sample analysis) were determined using SW-846 Method 6020 (USEPA 1986), except mercury which used Method 7471A
[c] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[d] TOC was determined using the Organic Matter-Walkley Black Method
ND = Not Detected at the method detection limit; see Appendix D for detection limits
Note: See Appendix D for a copy of the report from the analytical laboratory (MSE-TA Analytical Laboratory, Butte, MT)

Percent Total Solids and Percent Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Lower Johnson	72.5	0.80
Lower Slate	66.5	5.12
Lower Sherman	74.4	1.99
Middle Sherman	73.3	2.32
Middle Sherman (duplicate)	72.6	2.75

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
Note: See Appendix D for data sheets (these parameters were determined at ENSR/FCETL)

Physical and Chemical Data (Min/Max)

Sample ID	pH (units)	DO (mg/L)	Conductivity (µS/cm)	Temperature (°C)[a]	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	7.5-8.1	5.7-6.9	407-566	22-23	<1.0-1.1	76-108	59-87
Lab. Form. Sed.	7.5-8.1	3.7-6.9	545-599	22-23	<1.0	94-136	71-107
Lower Johnson	7.9-8.2	4.8-6.3	453-578	21-23	<1.0	106-120	69-102
Lower Slate	7.1-8.1	4.6-6.1	419-532	22-23	<1.0-1.4	90-100	57-69
Lower Sherman	7.4-8.0	4.2-6.4	490-513	22-23	<1.0-1.0	98-112	72-87
Middle Sherman	7.0-7.6	4.2-7.0	408-526	21-23	<1.0	84-96	45-63

[a] Temperature in test chambers; see Protocol Deviations

Reference Toxicant Test Results for *C. tentans*

Organism Lot Number	Test Dates	96-Hour LC_{50}	ENSR/FCETL Historical 95% Control Limits	
			Low	High
07-030	08/31/07 to 09/04/07	5380	4523	6364

Note: Values are expressed as mg/L chloride

Protocol Deviations

Temperature as measured directly in overlying water was 21˚C on day 10 for the Lower Johnson and Middle Sherman treatments, outside the range specified in the protocol (23±1˚C). Temperature was within the range specified by the protocol on all other days of the test. The impact of this deviation on test outcome is unknown.

Bath temperature (continuously measured) ranged from 21.8 to 24.0°C during testing. The low end of the temperature range fell slightly below the lower limit of 22˚C specified in the protocol. The water bath temperatures do not necessarily represent test chamber temperature, therefore the slightly warmer temperatures measured in the water bath should not be considered to be deviations from the protocol.

To the best of the Study Director's knowledge, no further deviations from the test protocol occurred during these studies.

References

APHA. 1989. Standard Methods for the Examination of Water and Wastewater. Amer. Public Health Assoc., Amer. Water Works Assoc., Water Pollut. Control Fed., APHA, Washington, DC.

ASTM. 2001. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates: Procedure 2: Conducting a 10-day Sediment Toxicity Test with *Chironomus tentans*. Method E 1706-00 In 2001 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.05, Biological Effects and Environmental Fate; Biotechnology: Pesticides. American Society of Testing and Materials. Conshohocken, PA.

Kemble, N.E., F.J. Dwyer, C.G. Ingersoll, T.D. Dawson, and T.J. Norberg-King. 1999. Tolerance of Freshwater Test Organisms to Formulated Sediments for Use as Control Materials in Whole-Sediment Toxicity Test. *Environ. Toxicol. Chem.* 18:222-230.

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USEPA. 1986. Test Methods for Evaluating Solid Waste. Third Edition. SW-846.

WEST, Inc. and D.D. Gulley. 1996. Toxstat Version 3.5. Western EcoSystems Technology, Inc., Cheyenne, WY.

Statement of Procedural Compliance

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, accurate and complete.

David A. Pillard 15 Dec 2007

David A. Pillard, Ph.D. Date
Study Director

Statement of Quality Assurance

The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with standard operating procedures, and that the resulting data and report meet the requirements of the NELAC standards. This report is an accurate reflection of the raw data.

Anita Rehner December 17, 2007

Quality Assurance Unit Date

APPENDIX A

Chain of Custody

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Number: 08503-128-058

Sampler (Print Name)/(Affiliation): LIZ FLORY - COEUR

Signature: E. Flory

Project Location: FCETL

Field Logbook No.:

Chain of Custody Tape No.: 28913 intact

Send Results/Report to: LIZ FLORY 4546 RIVER ROAD JUNEAU AK 99801

Analysis Requested

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	TOXICITY	METALS						Lab I.D.	Remarks
~~LOWER SHERMAN~~																ENSR #	
LOWER JOHNSON	8-17	1145	✓		2 × 4gal	SILT	N/A		X							ENSR # 20934	
LOWER SLATE	8-16	1200	✓		1 × 4gal	SILT	N/A		X							ENSR # 20935	
LOWER JOHNSON	8-17	1145	✓		1 × 100 ml glass	SILT	N/A			X						ENSR # 20936	
LOWER SLATE	8-16	1200	✓		1 × 100 ml glass	SILT	N/A			X						ENSR # 20937	

Relinquished by: (Print Name)/(Affiliation)	Date/Time	Received by: (Print Name)/(Affiliation)	Date/Time
LIZ FLORY . COEUR Signature: E. Flory	Date: 8-20 Time: 0830	Jordan Albert ENSR Signature: Jordan Albert	Date: 8/22/07 Time: 1015
Signature:	Date: Time:	Signature:	Date: Time:
Signature:	Date: Time:	Signature:	Date: Time:

Analytical Laboratory (Destination):

Received via FedEx on ice @ 8°C/22 JA

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 493-8935 (FAX)

Serial No. 43727

FM01008b_902

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Number: 08503-128-058

Sampler (Print Name)/(Affiliation): LIZ FLORY · COEUR

Signature: E. Flory

Project Location: FCETR

Field Logbook No.:

Chain of Custody Tape No.: 28368 intact

Send Results/Report to: LIZ FLORY 4546 RIVER ROAD JUNEAU AK 99801

Analysis Requested

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	TOXICITY	METALS	Lab I.D.	Remarks
LOWER SHERMAN	8-15	1000	✓		4 gal	SILT	N/A		X		ENSR # 20938	
MIDDLE SHERMAN	8-18	1030	✓		4 gal	SILT	N/A		X		ENSR # 20939	
LOWER SHERMAN	8-15	1000	✓		100 ml glass	SILT	N/A			X	ENSR # 20940	
MIDDLE SHERMAN	8-18	1030	✓		100 ml glass	SILT	N/A			X	ENSR # 20941	

Relinquished by: (Print Name)/(Affiliation) LIZ FLORY - COEUR
Signature: E. Flory
Date: 8-20-07 Time: 0830

Received by: (Print Name)/(Affiliation) Jordan Albert ENSR
Signature: Jordan Albert
Date: 8/22/07 Time: 1015

Relinquished by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Received by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Relinquished by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Received by: (Print Name)/(Affiliation)
Signature:
Date:
Time:

Analytical Laboratory (Destination): Received via FedEx on ice @ 10°/22 JA

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 493-8935 (FAX)

Serial No. 43722

FM01008b_902

APPENDIX B

Test Protocol

Title: Short-Term Chronic Toxicity of Bulk Sediment to the Midge, *Chironomus tentans*.

Study Sponsor:	Coeur Alaska Inc. Kensington Mine 3031 Clinton Drive Suite 202 Juneau, Alaska 99801 Phone: (907) 789-1591 John Randolph
Testing Facility	Fort Collins Environmental Toxicology Laboratory 4303 West LaPorte Avenue Fort Collins, Colorado 80521 Phone: (970) 416-0916, Ext. 310 Fax: (970) 490-2963 Project Manager/Study Director: David Pillard, Ph.D.

1.0 INTRODUCTION

1.1 Objective

To determine the short-term chronic toxicity of sediment samples to the midge, *Chironomus tentans*.

1.2 Test Substance

The sediment samples will be collected by the Study Sponsor or an agent of the Study Sponsor and shipped to ENSR's Fort Collins Laboratory. At the laboratory, sediment samples will be stored under refrigeration (4°C) until used in testing. Each sample will be mechanically homogenized prior to use in testing (ENSR SOP #5208). Endemic organisms observed in the sediment will be removed manually.

2.0 BASIS AND TEST ORGANISM

2.1 Basis

This protocol is based on USEPA (2000) guidelines and ASTM Method E 1706-00 (ASTM 2001).

2.2 Test Organism

1. Species - *Chironomus tentans*
2. Age - *Chironomus tentans* will be 2^{nd} to 3^{rd} instar (approximately 10 days). Age will be confirmed by measuring the head capsule width on a minimum of 20 organisms selected from the test population.
3. Source - Test organisms will be obtained from a commercial supplier.
4. Feeding - *Chironomus tentans* will be fed 1.5 ml of a 4 g dry solids/L (4,000 mg/1) Tetrafin® suspended in moderately hard water per exposure chamber daily.

3.0 TEST SYSTEM

3.1 Overlying Water

The overlying water used in the toxicity test will be laboratory moderately hard reconstituted water augmented prepared according to USEPA (2002), but augmented with 50 mg/L Cl^-.

3.2 Test Temperature

Test temperature will be 23 ± 1°C. Testing will be conducted in an environmental chamber or a temperature controlled water bath.

3.3 Test Containers

Test containers will be 500-ml beakers containing 100 ml of sediment and 175 ml of overlying water.

3.4 Photoperiod

The photoperiod will be 16-hours light and 8-hours dark.

3.5 Dissolved Oxygen Concentrations

Dissolved oxygen concentrations in the overlying water will be maintained >2.5 mg/L. If the dissolved oxygen concentration approaches this level, all test chambers will be gently aerated throughout the remainder of the test. If aeration is initiated, the aeration pipette will be appropriately positioned so as to avoid disturbance of the sediment.

3.6 Reference Toxicant Testing

In addition to the test material exposures, reference toxicant tests will be conducted using sodium chloride (NaCl) to determine the sensitivity range of the test organisms. Reference toxicant exposures will be conducted monthly or at the time of test initiation for in-house or commercially-supplied organisms. Reference toxicant testing will be performed according to USEPA (2000; 2002) methods.

4.0 TEST DESIGN

4.1 Test Treatments

The test concentration will be 100 percent of each test sediment. A 100 percent laboratory control sediment (see section 4.3) exposure will be conducted concurrently.

4.2 Sediment/Water Mixture

Sediment (100 ml) will be placed in each test chamber. After addition of sediment, 175 ml of overlying water will be poured into each beaker. The beakers will be left unaerated overnight to allow sediment to settle and to reduce turbidity prior to addition of test organisms.

4.3 Reference/Control Sediments

In addition to any field-collected reference sediment, at least one laboratory control sediment will be tested concurrently. The laboratory control sediment may be clean, field-collected sediment and/or a formulated sediment.

4.4 Number of Test Organisms

Eighty *Chironomus tentans* will be exposed to each treatment. Ten organisms will be assigned to each test chamber and eight replicates will be tested per treatment.

4.5 Test Initiation/Renewal Frequency

Testing will be initiated by addition of the test organisms after the overnight settling period. Each chamber will be renewed with approximately 2 volume additions per day, beginning on day 0 (after overlying water is characterized but before organisms are added).. This will be accomplished with either a flow-through drip system or a renewal box that can be filled with overlying water and allowed to drain into the test chambers.

4.6 Chemical and Physical Monitoring

At a minimum, the following measurements will be made:

1. Dissolved oxygen, temperature, and pH will be measured in the overlying water of each treatment and the control each day of testing.

2. Hardness, alkalinity, conductivity, and ammonia will be measured in the laboratory reconstituted water (used as overlying water) on day 0.

3. Hardness, alkalinity, conductivity, and ammonia will be measured in overlying water from each treatment at test initiation (just prior to renewal on day 0 or 1) and at test termination.

4. Ammonia will also be measured in each treatment on days 3 and 7.

4.7 Biological Monitoring

After ten days of exposure, sediment from each test chamber will be removed and sieved or sorted to recover living test organisms. Organisms not recovered at test termination will be presumed dead. Dry weight will be determined at 60-90°C for 24 hours, followed by ash-free dry weight determination (550°C for at least 2 hours).

4.8 Test Duration

Test duration will be 10 days. At test termination, the surviving organisms in each test chamber will be counted and preserved in preparation for ash-free dry weight (AFDW) determination according to ENSR SOP #5033.

4.9 Calculations

Survival data will be transformed by arcsine squareroot. Normality and homogeneity assumptions for survival data will be evaluated by the Shapiro-Wilk's test and Bartlett's test, respectively (α = 0.01). Data will then be evaluated (α = 0.05) using either parametric or nonparametric methods depending upon the outcome of the normality and homogeneity assessments.

Organism weights (AFDW) will be statistically compared in treatments not having significantly reduced survival. Analysis will occur in the same manner as for survival, although the weights will not be transformed using arcsine squareroot.

4.10 Quality Criterion

Survival in the controls should be 70 percent or greater and the mean weight per surviving control organism should be at least 0.48 mg AFDW. If mortality in one or more of the control treatments exceeds 30 percent or a mean control weight is less than 0.48 mg AFDW, then the test will be reviewed to determine if certain chemical or physical characteristics of the test sediment (e.g., low dissolved oxygen or unusual pH) may have contributed to poor survival. Upon review by ENSR and the Sponsor, test data may be found acceptable.

5.0 TEST REPORT

The report will be a typed document describing the results of the test and will be signed by the Study Director and Quality Assurance Unit. The report will include, but not be limited to, the following:

- A copy of all raw data.
- Name of test, Study Director, and laboratory, and date test was begun.
- A detailed description of the sediments, including their source, time of collection, composition, known physical or chemical properties, and any information that appears on the sample container or has been provided by the Sponsor.
- The source of the overlying water, its chemical characteristics.
- Detailed information about the test organisms, including scientific name, age, life stage, source, history, acclimation procedure, and food used.
- A description of the experimental design and the test chambers, the volume of solution in the chambers, the way the test was begun, the number of organisms per treatment, and the lighting.
- A description of any aeration performed on test solutions before or during the test.
- Definition of the criterion used to determine the effect and a summary of general observations on other effects or symptoms.
- Percentage of organisms that died or showed an effect.
- The minimum dissolved oxygen concentration, range in tests temperature and pH, all visual observations of test solutions.
- Any deviations from the protocol.

6.0 LITERATURE CITED

ASTM. 2001. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates: Procedure 2: Conducting a 10-day Sediment Toxicity Test with *Chironomus tentans*. Method E 1706-00 In *2001 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.05, Biological Effects and Environmental Fate; Biotechnology: Pesticides*. American Society of Testing and Materials. Conshohocken, PA

USEPA. 2000. Methods for Measuring Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064.

USEPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. EPA-821-R-02-013.

7.0 PROCEDURAL COMPLIANCE

All test procedures, documentation, records, and reports will comply with USEPA (2000, 2002) general guidance on quality assurance related to effluent and sediment toxicity testing. To this end, random audits of the test may be scheduled while the test is in progress. The raw data will be checked and compared to protocol requirements and Standard Operating Procedures, and the final report will be audited for accuracy and signed, if satisfactory, by both the Study Director and an individual from the Quality Assurance Unit.

8.0 PROTOCOL AMENDMENTS AND DEVIATIONS

All changes (i.e., amendments, deviations, and final report revisions) of the approved protocol plus the reasons for the changes must be documented in writing. The changes will be signed and dated by the Study Director and maintained with the protocol. All amendments must be authorized in advance by the Sponsor.

9.0 SPONSOR AND STUDY DIRECTOR APPROVAL

Sponsor Approval: ______________________ Date: ____________

Study Director: [signature] Date: 30 Aug. 2007

APPENDIX C

Data Sheets

C tentans — 10-day Survival and Growth, Testing Cover Page

Project Number:	8503-128-058 – (016, 018, 020, 022)	CT3AK.TIE058.005	Protocol #:	CT3AK.TIE058.005	
Test Substance:	Sediment				
Test Species:	*C. tentans*	Lot #: 07-030	Age:	3rd instar	Supplier: ABS
Test Type:	Chronic, Static Renewal				
Dilution Water:	Mod Hard with 50 mg/L Chloride		Investigators:	mm/DA [illegible]/AP/E.S.	
Sampling Date(s):	August 15,16, 17, 18 2007		Sampling Time(s):	1000 (8/15), 1200 (8/16), 1145 (8/17), 1030 (8/18)	
FCETL Sample #(s):	20934, 20935, 20938, 20939				
Test Initiation Date/Time:	8/31/07 @ 1300				
Test Termination Date/Time:	9/10/07 @ 1400				

Renewal Frequency:	* Cont. drip, 2+ vol/day	Feeding Freq:	daily	Food Type/Amount:	1.5 ml of 4g/L Tetrafin	Test Temp:	23 +/- 1 deg C
Test Chamber Capacity:	500-ML	Test Soltn. Vol:	100 mL sed/175 mL H2O	# Repl's/Trtmnt:	8		
Test Duration:	10 days	# Org.'s/Repl:	10	Env. Chmbr/Bath:	3		

Water Characterization: Minimum of Hardness, Alkalinity, & Conductivity on days 0 and 10; Ammonia on days 0, 3, 7, and 10; No TRC; pH, temperature & DO daily on overlying water

aerate if dissolved oxygen <2.5 mg/L

Test Sediment (s):

1)	Sand (cont)	2)	Form sed (cont)	3)	20934 (Lower Johnson)
4)	20935(Lower Slate)	5)	20938 (Lower Sherman)	6)	20939 (Middle Sherman)
7)		8)		9)	
10)		11)			

Reference Tox. Dates:	8/31/07–9/4/07	LC50:	5380 mg/L Cl	Hist. Limits:	4523-6364	Method:	S-K
Study Director Initials:	DAP	Date:	8/30/07				

Overlying water added at a minimum of 2 volume additions/day; equivalent to >350 ml/day or >0.24 ml/min

*RW5307, Cl – 53 mg/L

BIOLOGICAL DATA   *C. tentans*   Chronic, Static Renewal   Project 8503-128-058 -016, -018, -020, -022

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks: % survival
Sand (cont)	# Surviving	7	9	10	7 *	9	10	7	9	
	# Observed Dead	0	0	0	0	0	0	0	0	85%
	# Not Found	3	1	0	3	1	0	3	1	
Form sed (cont)	# Surviving	7	7	9	7	6	8	①5	8	
	# Observed Dead	0	0	0	0	0	0	①0	0	71.25%
	# Not Found	3	3	1	3	4	2	5	2	
20934 (Lower Johnson)	# Surviving	6	5	7	7 *	9	5	9	6	
	# Observed Dead	0	0	0	0	0	0	0	0	67.5%
	# Not Found	4	5	3	3	1	5	1	4	
20935(Lower Slate)	# Surviving	8	10	10 *	5	9 *	10	6	9	
	# Observed Dead	2	0	0	1	0	0	0	0	83.75%
	# Not Found	0	0	0	4	1	0	4	1	
20938 (Lower Sherman)	# Surviving	9 *	7 ▲	7	9	8 **	8	8 *	8	
	# Observed Dead	0	0	0	0	0	1	0	0	90%
	# Not Found	1	3	3	1	2	1	2	2	
20939 (Middle Sherman)	# Surviving	7	10	7 *	8 *	* 7 **	9	10	8	
	# Observed Dead	0	0	1	1	0	0	0	0	92.5%
	# Not Found	3	0	2	1	3	1	0	2	
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									

@ ARK 12/10/07

* 1 pupae - excluded from weights
** 1 pupae exuviae - likely emerged ①
▲ 3 pupae - excluded from weights

Middle Sherman E *, **

① ARK 9/10/07 E

QA: AR 12/11/07

CHEMICAL DATA (Composite of Overlying Water) *C. tentans* Chronic, Static Renewal Project 8503-128-058 -016, -018, -020, -022

Parameter	Sediment	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day	Meter	Date	Time	Initials
Dissolved	Sand (cont)	6.9	6.0	6.7	5.8	6.4	5.1	5.7	6.2	6.1	6.0	6.4	0	5	8/31/07	1215	EMH
Oxygen	Form sed (cont)	6.9	6.2	5.6	6.7	6.0	5.5	4.8	4.1	3.7	3.8	5.5	1	5	9/1/07	1200	MA
(mg/l)	20934 (Lower Johnson)	6.1	6.2	5.4	6.2	5.5	6.1	5.1	6.3	5.1	4.8	5.7	2	5	9/2/07	1330	SA
	20935(Lower Slate)	5.8	6.1	6.1	5.5	5.6	5.2	5.1	5.5	4.6	4.9	5.8	3	5	9/3/07	1430	SA
	20938 (Lower Sherman)	5.8	4.5	5.6	6.3	5.0	5.6	4.7	5.3	4.2	6.0	6.4	③ ~~4~~ 5	5	9/5/07	1430	AP
	20939 (Middle Sherman)	5.9	5.0	5.4	5.6	5.4	5.2	5.1	4.3	4.2	5.3	7.0	③ ~~5~~ 6	5	9/6/07	1030	E.S.
	0												③ ~~6~~ 7	5	9/7/07	1610	E.S.
	0												③ ~~7~~			~~1120~~ ①	~~AP~~ ①
	0												8	5	9/8/07	1120	AP
	0												9	5	9/9/07	0945	AP
													10	D35	9/10/07	1055	EMH
Temp	Sand (cont)	22	22	23	23	22	22	22	22	22	22	22	0	~~D36~~ ①	8/31/07	1200	[illegible]
(deg C)	Form sed (cont)	22	22	23	23	22	22	22	22	22	22	22	1	D-37	9/1/07	1200	MM
	20934 (Lower Johnson)	22	22	23	23	22	22	22	22	22	22	22	2	D-37	9/2/07	1330	SA
	20935(Lower Slate)	22	22	23	23	22	22	22	22	22	22	22	3	D-37	9/3/07	1430	SA
	20938 (Lower Sherman)	22	22	23	23	22	22	22	22	22	22	22	4	D-35	9/4/07	1730	[illegible]
	20939 (Middle Sherman)	22	22	23	23	22	22	22	22	22	22	21	5	D-35	9/5/07	~~10~~ 1430	AP
	0												6	D-36	9/6/07	1030	E.S.
	0												7	D-37	9/7/07	1610	E.S.
	0												8	D-36	9/8/07	1120	AP
	0												9	D-37	9/9/07	0945	AP
													10	D-36	9/10/07	1055	EMH
pH	Sand (cont)	8.0	7.9	8.1	7.8	8.0	7.5	7.7	7.8	7.9	7.9	7.9	0	~~16~~ 16	8/31/07	1215	EMH
	Form sed (cont)	8.0	8.1	7.8	8.0	7.8	7.6	7.6	7.5	7.6	7.6	7.8	1	~~16~~ 16	9/1/07	1200	MM
	20934 (Lower Johnson)	8.1	8.2	8.0	8.1	8.0	8.0	8.0	8.0	8.0	7.9	8.0	2	~~16~~ 16	9/2/07	1330	SA
	20935(Lower Slate)	7.1	7.9	7.7	7.4	8.0	7.3	7.3	7.4	7.4	7.4	8.1	3	~~16~~ 16	9/3/07	1430	SA
	20938 (Lower Sherman)	7.6	7.6	7.6	8.0	7.6	7.6	7.4	7.6	7.5	7.5	7.9	4	16	9/4/07	1730	[illegible]
	20939 (Middle Sherman)	7.0	7.4	7.4	7.5	7.5	7.2	7.3	7.2	7.3	7.4	7.6	5	~~16~~ 12	9/5/07	1430	AP
	0												6	16	9/6/07	1030	E.S.
	0												7	16	9/7/07	1610	E.S.
	0												8	16	9/8/07	1120	AP
	0												9	16	9/9/07	0945	AP
	Replicate					D	H	B	E	C	E		10	16	9/10/07	1055	EMH

← Day 4 9/4/07 1730 ①E

③ DAP 12-15-07 E

① AP 9/5/07 E

② 9/21/07 E

OVERLYING WATER CHARACTERIZATION | *C. tentans* | Chronic, Static Renewal | Project No. 8503-128-058 -016, -018, -020, -022

QA: AR 12/10/07

	Conductivity (s/cm)		Hardness (mg/L as CaCO3		Alkalinity (mg/l as CaCO3		Ammonia (mg/l) *			
Sediment	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 3	Day 7	Day 10
Sand (cont)	407	566	76	108	59	97	<1.0	<1.0	<1.0	1.1
Form sed (cont)	545	599	94	136	71	107	<1.0	<1.0	<1.0	<1.0
20934 (Lower Johnson)	453	578	106	120	69	102	<1.0	<1.0	<1.0	<1.0
20935(Lower Slate)	419	532	90	100	57	69	<1.0	<1.0	1.3	1.4
20938 (Lower Sherman)	490	513	112	98	97	72	1.0	<1.0	<1.0	<1.0
20939 (Middle Sherman)	408	526	84	96	45	63	<1.0	<1.0	<1.0	<1.0
0										
0										
0										
0										
Meter #	15	15	titr	titr	titr	titr	3	3	3	3
Date:	8/31/07	9/10/07	8/31/07	9/10/07	8/31/07	9/10/07	9/6/07	9/6/07	9/18/07	9/18/07
Time:	1500	1200	1500	1200	1500	1200	1615	1615	1600	1600
Initials:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*samples were preserved on test days 0, 3, 7, and 10 and measured later

DAILY TESTING LOG — *C. tentans* — Chronic, Static Renewal — Project No. 8503-128-058 -016, -018, -020, -022

Day	Bath CT	Range	Feeding	Initials/Date
Day -1	Mixed all sediments by hand for min. of 3 minutes; added sediment to beakers + added overlying water			
Day 0	Collected overlying water from each treatment. Started drips; added organisms			RAP 8/31/07
Day 1	22.8°C	21.8 - 23.0 °C	1.5 mL of 4 g/L tetrafin @ 1215	mm 9/1/07
Day 2	23.0°C	23.0 - 23.6°C	1.5 mL of 4 g/L tetrafin @ 1345	JA 9/2/07
Day 3	23.0°C	23.0 - 23.0°C	1.5 mL of 4 g/L tetrafin @ 1530	mm 9/3/07
Day 4	23.0°C	23.0 - 24.0°C	1.5 mL of 4 g/L tetrafin @ 1735	TO 9/4/07
Day 5	23.0°C	23.0 - 23.2°C	1.5 mL of 4 g/L tetrafin @ 1445	JA 9/5/07
Day 6	23.0°C	23.0 - 23.2°C	1.5 ml of 4 g/L tetrafin @ 1100	AP 9/6/07
Day 7	23.0°C	23.0 - 23.2°C	1.5 ml of 4 g/L tetrafin @ 1050	E.S. 9/7/07
Day 8	23.0°C	23.0° - 23.0°C	1.5 ml of 4 g/L tetrafin @ 1145	AP 9/8/07
Day 9	23.0°C	23.0° - 23.2°C	1.5 ml of 4 g/L tetrafin @ 1000	AP 9/9/07
Day 10				

8503-128-058 C. tentans

	CONC	REP	RANDOM	RANK	
1	Sand	A	0.608992	20	C4
		B	0.417591	30	D6
		C	0.009204	48	F8
		D	0.893313	7	A7
		E	0.278487	35	E3
		F	0.830304	14	B6
		G	0.962572	3	A3
		H	0.500195	25	D1
2	Form	A	0.787552	16	B8
		B	0.819413	15	B7
		C	0.851056	13	B5
		D	0.229853	37	E5
		E	0.423215	29	D5
		F	0.86676	12	B4
		G	0.890857	8	A8
		H	0.455821	28	D4
3	Lower Johnson	A	0.548908	23	C7
		B	0.020424	47	F7
		C	0.052079	46	F6
		D	0.215808	38	E6
		E	0.973653	1	A1
		F	0.870562	11	B3
		G	0.464465	26	D2
		H	0.633659	19	C3
4	Lower Slate	A	0.091332	45	F5
		B	0.898875	6	A6
		C	0.111714	44	F4
		D	0.885403	9	B1
		E	0.197223	39	E7
		F	0.733311	18	C2
		G	0.287818	34	E2
		H	0.348692	31	D7
5	Lower Sherman	A	0.168323	40	E8
		B	0.158635	41	F1
		C	0.552557	21	C5
		D	0.528354	24	C8
		E	0.96761	2	A2
		F	0.55122	22	C6
		G	0.130094	43	F3
		H	0.87625	10	B2
6	Middle Sherman	A	0.90058	5	A5
		B	0.9266	4	A4
		C	0.130688	42	F2
		D	0.772608	17	C1
		E	0.315999	33	E1
		F	0.233039	36	E4
		G	0.457291	27	D3
		H	0.343984	32	D8

Length/Width of Objects Using a Micrometer

Project/Study Number: 8503-128058-016,018-020,022	Project Name: — Coeur —
Study Initiation Date: 8-31-07	Species: C. tentans
Source of Organisms: ABS	Organism Batch/Lot #: 07-030
Collected by: T.Dixon	Date Collected: 8/31/07
Analyzed by: K.Tapp	Date Analyzed: 12/12/07

Specimen Number	Magnif.	# of Squares	Length of One Square (mm)	Total (mm)	Remarks
1	40X	2	0.175	0.35	
2	↓	2	↓	0.35	
3		1.5		0.26	
4		1.5		0.26	
5		1.5		0.26	
6		2		0.35	
7		2		0.35	
8		2		0.35	
9		1.5		0.26	
10		1.5		0.26	
11		2		0.35	
12		1.5		0.26	
13		~~2.0~~ 2		0.35	
14		2		0.35	
15		2		0.35	
16		1.5		0.26	
17		1.5		0.26	
18		2		0.35	
19		1.5		0.26	
20	↓	2	↓	0.35	
Total				6.19	
Mean				0.3095	

(1) DK 12/12/07 E

QA: AR 12/10/07

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

Project No: 8503-128-058-016, -018, -020, -022
Species: C. tentans
Lot/Batch No.: 07-030
Analytical Balance ID: Sart #1

TARE: Date/time: 9/16/07 @ 1445 Analyst:
DRY GROSS: Date/time: 9/27/07 @ 1450 Analyst: DK
ASHED GROSS: Date/time: 10/5/07 @ 0910 Analyst: DK

Dried in Oven # 3 from Date: 9/26/07 Time: 1235 to Date: 9/27/07 Time: 1320
Oven °C: 60-90
Ashed in Furnace from Date: 9/27/07 Time: 1430 to Date: ~~10/3/07~~ 9/27/07 Time: ~~0850~~ 1700
Furnace °C: 600

Indicate mean weight is Dry Weight or **AFDW** (circled) (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
1	Sand	A	2.17947	2.18808	0.00861		2.18023	0.00785	10			7		
2		B	2.19981	2.20814	0.00833		2.20041	0.00773	10			9		
3		C	1.97078	1.98255	0.01177		1.97178	0.01077	10			10		
4		D	2.22818	2.23976	0.01158		2.22995	0.00981	9			6		
5		E	2.35699	2.36743	0.01044		2.35857	~~0.01044~~ 0.00886	10			9		
6		F	1.95054	1.96124	0.01070		1.95256	0.00868	10			10		
7		G	2.03166	2.04449	0.01283		2.03478	0.00971	10			7		
8		H	2.18219	2.19099	0.00880		2.18371	0.00728	10			9		
Blank	A		2.35264	2.35261	-0.00003		2.35266							

[1] Add in weight loss of blank boat, if appropriate.

DK 9/27/07 @ DK 10/5/07

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

QA: AR 12/11/07

Project No: 8503-128-058-016, -018, -020, -022
Species: C. tentans
Lot/Batch No.: 07-030
Analytical Balance ID: Sart #1

TARE: Date/time: 9/18/07@1445 Analyst:
DRY GROSS: Date/time: 9/27/07@1450 Analyst: [initials]
ASHED GROSS: Date/time: 10/5/07@0910 Analyst: [initials]

Dried in Oven # 3 from Date: 9/26/07 Time: 1235
Oven °C: 60-90 to Date: 9/27/07 Time: 1320
Ashed in Furnace from Date: 9/27/07 Time: 1430
Furnace °C: 400 to Date: 9/27/07 Time: 1700

Indicate mean weight is Dry Weight or **AFDW** (Circle one) — AFDW circled

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
9	Form	A	1.94346	1.95963	0.01617		1.94776	0.01187	10			7		
10	Sed	B	2.21540	2.22635	0.01095		2.21968	0.00667	10			7		
11		C	2.26871	2.28583	0.01712		2.27315	0.01268	10			9		
12		D	2.37661	2.39160	0.01499		2.38058	0.01102	10			7		
13		E	1.99158	2.00485	0.01327		1.99496	0.00989	10			6		
14		F	2.21718	2.23443	0.01725		2.22177	0.01266	10			8		
15		G	2.29088	2.30434	0.01346		2.29466	0.00968	9			4		
16		H	1.96482	1.98052	0.01570		1.96876	0.01176	10			8		
Blank	A													

[1] Add in weight loss of blank boat, if appropriate.

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

QA: AR 12/11/07

Project No: 8503-128-058-016, -018, -020, -022
Species: C. tentans
Lot/Batch No.: 07-030
Analytical Balance ID: Sart #1

TARE: Date/time: 9/19/07 @ 1445 Analyst:
DRY GROSS: Date/time: 9/27/07 @ 1450 Analyst: [initials]
ASHED GROSS: Date/time: 10/5/07 @ 0910 Analyst: [initials]

Dried in Oven # 3 from Date: 9/26/07 Time: 1235
Oven °C: 60-90 to Date: 9/27/07 Time: 1320
Ashed in Furnace from Date: 9/27/07 Time: 1430
Furnace °C: 550 to Date: 9/27/07 Time: 1700

Indicate mean weight is Dry Weight or **AFDW** (circled) (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
17	Lower	A	2.20061	2.21442	0.01381		2.20898	0.00544	10			6		
18	Johnson	B	1.87902	1.89346	0.01444		1.88648	0.00698	10			5		
19		C	2.11457	2.12912	0.01455		2.12181	0.00731	9*			6*		
20		D	2.33450	2.34722	0.01272		2.33917	0.00805	9			6		
21		E	2.35651	2.37379	0.01728		2.36552	0.00827	10			9		
22		F	1.82776	1.84350	0.01574		1.83582	0.00768	10			5		
23		G	1.84598	1.86804	0.02206		1.85719	0.01085	10			9		
24		H	2.09773	2.11194	0.01421		2.10402	0.00792	10			6		
25	Lower	A	2.03562	2.05018	0.01456		2.03798	0.01220	10			8		
26	Slate	B	1.98167	1.99146	0.00979		1.98396	0.00750	10			10		
Blank	B		2.26186	2.26186	0.00000		2.26188	+0.00002						

[1] Add in weight loss of blank boat, if appropriate. [initials] 11/20/07

* 1 organism was lost when placing crucible in oven—and was excluded from growth

QA: AR 12/11/07

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

Project No: 8503-128-058-016, 018-020, 022
Species: C. tentans
Lot/Batch No.: 07-030
Analytical Balance ID: Sart #1

TARE: Date/time: 9/18/07 @ 1445 Analyst: JA
DRY GROSS: Date/time: 9/27/07 @ 1450 Analyst: [initials]
ASHED GROSS: Date/time: 10/5/07 @ 0910 Analyst: [initials]

Dried in Oven # 3 from Date: 9/26/07 Time: 1235 to Date: 9/27/07 Time: 1320
Oven °C: 60-90
Ashed in Furnace from Date: 9/27/07 Time: 1430 to Date: 9/27/07 Time: 1700
Furnace °C: 550

Indicate mean weight is Dry Weight or **AFDW** (circled) (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
27	Lower	C	1.98012	1.99585	0.01573		1.98302	0.01283	9			9		
28	Slate	D	2.20964	2.22057	0.01093		2.21148	0.00909	10			5		
29		E	2.24432	2.25877	0.01445		2.24735	0.01142	9			8		
30		F	2.05885	2.07341	0.01456		2.06223	0.01118	10			10		
31		G	2.23123	2.24252	0.01129		2.23385	0.00867	10			6		
32		H	1.85407	1.86609	0.01202		1.85770	0.00839	10			9		
33	Lower	A	2.24651	2.25879	0.01228		2.24892	0.00987	9			8		
34	Sherman	B	1.93107	1.93610	0.00503		1.93229	0.00381	7			4		
35		C	2.21169	2.21907	0.00738		2.21353	0.00554	10			7		
36		D	2.02146	2.03674	0.01528		2.02516	0.01158	10			9		
37		E	2.16460	2.17649	0.01189		2.16717	0.00932	9			7		
38		F	1.97771	1.98930	0.01159		1.98095	0.00835	10			① ~~8~~ 8		
39		G	1.97047	1.98113	0.01066		1.97404	0.00709	8 *			6		
Blank	B													

[1] Add in weight loss of blank boat, if appropriate.

① [initials] 9/27/07 CF ② [initials] 10/5/07 E

* 1 pupae, 1 organism NF during weighing

TEST ORGANISM DRY WEIGHT AND ASH-FREE DRY WEIGHT (AFDW)

QC: A01271-07

Project No: 8503-128-058-016,-018,-020,-022
Species: C. tentans
Lot/Batch No.: 07-030
Analytical Balance ID: Sart #1

TARE: Date/time: 9/18/07 @ 1445 Analyst: JA
DRY GROSS: Date/time: 9/27/07 @ 1450 Analyst: [illegible]
ASHED GROSS: Date/time: 10/5/07 @ 0910 Analyst: [illegible]

Dried in Oven # 3 from Date: 9/26/07 Time: 1235
Oven °C: 60-90 to Date: 9/27/07 Time: 1320
Ashed in Furnace from Date: 9/27/07 Time: 1430
Furnace °C: 550 to Date: 9/27/07 Time: 1700

Indicate mean weight is Dry Weight or **AFDW** (circled) (Circle one)

Boat No.	Treatment	Rep	Tare Weight (g) A	Dry Gross Weight (g) B	Dry Net Weight (g) (B-A)	Adjusted Dry Net Weight (g)[1]	Ashed Gross Weight (g) (D)	AFDW (g) (B-D)	No. of Original Org.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Org.	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
40	Lower Sherm	H	1.75878	1.76913	0.01035		1.76263	0.00650	10			8		
41	M.	A	1.88189	1.89719	0.01530		1.88607	0.01112	10			7		
42	Saar	B	1.93578	1.94980	0.01402		1.94001	0.00979	10			10		
43		C	2.29731	2.30710	0.00979		2.29966	0.00744	9			6		
44		D	2.24496	2.25849	0.01353		2.24905	0.00944	9			7		
45		E	2.24051	2.24890	0.00839		2.24106	0.00784	8			5		
46		F	1.87037	1.88550	0.01513		1.87416	0.01134	10			9		
47		G	1.87596	1.89145	0.01549		1.88014	0.01131	10			10		
48		H	1.98052	1.99483	0.01431		1.98505	0.00978	10			8		
Blank	B													

[1] Add in weight loss of blank boat, if appropriate.

spreadsheet for AFDW

test start date	8/31/2007	Test Substance	Sediment
Test number	8503-128-058-(016, 018, 020, 022)		
Species	C. tentans	Data entered by	KT

QA: TR 12/11/07

boat #	treatment	rep	tare wt (dry) (g)	gross wt (dry) (g)	dry net wt (g)	dry adjusted net wt (g)	ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	no orig org	mean wt per orig (mg)	mean wt per treatment (orig) (mg)	no surviving	mean wt per surviving	mean wt per treatment (surv) (mg)
1	Sand cont	A	2.17947	2.18808	0.00861	0.00864	2.18023	0.00785	0.00785	10	0.7850	0.8973	7	1.1214	1.0926
2	Sand cont	B	2.19981	2.20814	0.00833	0.00836	2.20041	0.00773	0.00773	10	0.7730		9	0.8589	
3	Sand cont	C	1.97078	1.98255	0.01177	0.01180	1.97178	0.01077	0.01077	10	1.0770		10	1.0770	
4	Sand cont	D	2.22818	2.23976	0.01158	0.01161	2.22995	0.00981	0.00981	9	1.0900		6	1.6350	
5	Sand cont	E	2.35699	2.36743	0.01044	0.01047	2.35857	0.00886	0.00886	10	0.8860		9	0.9844	
6	Sand cont	F	1.95054	1.96124	0.01070	0.01073	1.95256	0.00868	0.00868	10	0.8680		10	0.8680	
7	Sand cont	G	2.03166	2.04449	0.01283	0.01286	2.03478	0.00971	0.00971	10	0.9710		7	1.3871	
8	Sand cont	H	2.18219	2.19099	0.00880	0.00883	2.18371	0.00728	0.00728	10	0.7280		9	0.8089	
9	Form sed	A	1.94346	1.95963	0.01617	0.01620	1.94776	0.01187	0.01187	10	1.1870	1.0913	7	1.6957	1.5941
10	Form sed	B	2.21540	2.22635	0.01095	0.01098	2.21968	0.00667	0.00667	10	0.6670		7	0.9529	
11	Form sed	C	2.26871	2.28583	0.01712	0.01715	2.27315	0.01268	0.01268	10	1.2680		9	1.4089	
12	Form sed	D	2.37661	2.39160	0.01499	0.01502	2.38058	0.01102	0.01102	10	1.1020		7	1.5743	
13	Form sed	E	1.99158	2.00485	0.01327	0.01330	1.99496	0.00989	0.00989	10	0.9890		6	1.6483	
14	Form sed	F	2.21718	2.23443	0.01725	0.01728	2.22177	0.01266	0.01266	10	1.2660		8	1.5825	
15	Form sed	G	2.29088	2.30434	0.01346	0.01349	2.29466	0.00968	0.00968	9	1.0756		4	2.4200	
16	Form sed	H	1.96482	1.98052	0.01570	0.01573	1.96876	0.01176	0.01176	10	1.1760		8	1.4700	
Blank	A		2.35264	2.35261	-3E-05		2.35266	0.00005							

QA: AR 12/11/07

spreadsheet for AFDW

test start date	8/31/2007	Test Substance	Sediment
Test number	8503-128-058-(016, 018, 020, 022)		
Species	C. tentans	Data entered by	KT

boat #	treatment	rep	tare wt (dry) (g)	gross wt (dry) (g)	dry net wt (g)	dry adjusted net wt (g)	ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	no orig org	mean wt per orig (mg)	mean wt per treatment (orig) (mg)	no surviving	mean wt per surviving	mean wt per treatment (surv) (mg)
17	Lower Johnson	A	2.20061	2.21442	0.01381	0.01381	2.20898	0.00544	0.00544	10	0.5440	0.8026	6	0.9067	1.2304
18	Lower Johnson	B	1.87902	1.89346	0.01444	0.01444	1.88648	0.00698	0.00698	10	0.6980	-	5	1.3960	-
19	Lower Johnson	C	2.11457	2.12912	0.01455	0.01455	2.12181	0.00731	0.00731	9	0.8122	-	6	1.2183	-
20	Lower Johnson	D	2.33450	2.34722	0.01272	0.01272	2.33917	0.00805	0.00805	9	0.8944	-	6	1.3417	-
21	Lower Johnson	E	2.35651	2.37379	0.01728	0.01728	2.36552	0.00827	0.00827	10	0.8270	-	9	0.9189	-
22	Lower Johnson	F	1.82776	1.84350	0.01574	0.01574	1.83582	0.00768	0.00768	10	0.7680	-	5	1.5360	-
23	Lower Johnson	G	1.84598	1.86804	0.02206	0.02206	1.85719	0.01085	0.01085	10	1.0850	-	9	1.2056	-
24	Lower Johnson	H	2.09773	2.11194	0.01421	0.01421	2.10402	0.00792	0.00792	10	0.7920		6	1.3200	
25	Lower Slate	A	2.03562	2.05018	0.01456	0.01456	2.03798	0.01220	0.01220	10	1.2200	1.0497	8	1.5250	1.3052
26	Lower Slate	B	1.98167	1.99146	0.00979	0.00979	1.98396	0.00750	0.00750	10	0.7500		10	0.7500	
27	Lower Slate	C	1.98012	1.99585	0.01573	0.01573	1.98302	0.01283	0.01283	9	1.4256		9	1.4256	
28	Lower Slate	D	2.20964	2.22057	0.01093	0.01093	2.21148	0.00909	0.00909	10	0.9090		5	1.8180	
29	Lower Slate	E	2.24432	2.25877	0.01445	0.01445	2.24735	0.01142	0.01142	9	1.2689		8	1.4275	
30	Lower Slate	F	2.05885	2.07341	0.01456	0.01456	2.06223	0.01118	0.01118	10	1.1180		10	1.1180	
31	Lower Slate	G	2.23123	2.24252	0.01129	0.01129	2.23385	0.00867	0.00867	10	0.8670		6	1.4450	
32	Lower Slate	H	1.85407	1.86609	0.01202	0.01202	1.85770	0.00839	0.00839	10	0.8390		9	0.9322	
33	Lower Sherman	A	2.24651	2.25879	0.01228	0.01228	2.24892	0.00987	0.00987	9	1.0967	0.8450	8	1.2337	1.0792
34	Lower Sherman	B	1.93107	1.93610	0.00503	0.00503	1.93229	0.00381	0.00381	7	0.5443		4	0.9525	
35	Lower Sherman	C	2.21169	2.21907	0.00738	0.00738	2.21353	0.00554	0.00554	10	0.5540		7	0.7914	
36	Lower Sherman	D	2.02146	2.03674	0.01528	0.01528	2.02516	0.01158	0.01158	10	1.1580		9	1.2867	
37	Lower Sherman	E	2.16460	2.17649	0.01189	0.01189	2.16717	0.00932	0.00932	9	1.0356		7	1.3314	
38	Lower Sherman	F	1.97771	1.98930	0.01159	0.01159	1.98095	0.00835	0.00835	10	0.8350		8	1.0438	
39	Lower Sherman	G	1.97047	1.98113	0.01066	0.01066	1.97404	0.00709	0.00709	8	0.8863		6	1.1817	
40	Lower Sherman	H	1.75878	1.76913	0.01035	0.01035	1.76263	0.00650	0.00650	10	0.6500		8	0.8125	
41	Middle Sherman	A	1.88189	1.89719	0.01530	0.01530	1.88607	0.01112	0.01112	10	1.1120	1.0237	7	1.5886	1.2922
42	Middle Sherman	B	1.93578	1.94980	0.01402	0.01402	1.94001	0.00979	0.00979	10	0.9790		10	0.9790	
43	Middle Sherman	C	2.29731	2.30710	0.00979	0.00979	2.29966	0.00744	0.00744	9	0.8267		6	1.2400	
44	Middle Sherman	D	2.24496	2.25849	0.01353	0.01353	2.24905	0.00944	0.00944	9	1.0489		7	1.3486	
45	Middle Sherman	E	2.24051	2.24890	0.00839	0.00839	2.24106	0.00784	0.00784	8	0.9800		5	1.5680	
46	Middle Sherman	F	1.87037	1.88550	0.01513	0.01513	1.87416	0.01134	0.01134	10	1.1339	-	9	1.2599	-
47	Middle Sherman	G	1.87596	1.89145	0.01549	0.01549	1.88014	0.01131	0.01131	10	1.1310	-	10	1.1310	-
48	Middle Sherman	H	1.98052	1.99483	0.01431	0.01431	1.98505	0.00978	0.00978	10	0.9780		8	1.2225	
Blank	B		2.26186	2.26186	0		2.26188	0.00002							

[handwritten initials] 9/21/07
QA:MR 12/11/07

Toxstat Version 3.5
Study #8503-128-058 -016, -018, -020, -022
Coeur Sediment
Chironomus tentans 10-day Test
Summary of Survival

File: 128058cs.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand Control	8	0.7000	1.0000	0.8500
2	Form Sed	8	0.5000	0.9000	0.7125
3	Lower Johnson	8	0.5000	0.9000	0.6750
4	Lower Slate	8	0.5000	1.0000	0.8375
5	Lower Sherman	8	0.7000	0.9000	0.8000
6	Middle Sherman	8	0.7000	1.0000	0.8250

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand Control	0.0171	0.1309	0.0463	15.4036
2	Form Sed	0.0155	0.1246	0.0441	17.4937
3	Lower Johnson	0.0250	0.1581	0.0559	23.4243
4	Lower Slate	0.0370	0.1923	0.0680	22.9565
5	Lower Sherman	0.0057	0.0756	0.0267	9.4491
6	Middle Sherman	0.0164	0.1282	0.0453	15.5362

JK 9/21/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-016, -018, -020, -022
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Between the Sand Control and Formulated Sediment Control for Survival

File: 128058cs.dat   Transform: ARC SINE(SQUARE ROOT(Y))

t-Test of Solvent and Blank Controls   Ho: GRP1 Mean = GRP2 Mean

```
==========================================================================
(SAND)      GRP1 (Solvent cntl) Mean =    1.1931    Calculated t value =    2.2077
(FORM.SED)  GRP2 (Blank cntl) Mean   =    1.0135    Degrees of freedom =   14
            Difference in means      =    0.1795
==========================================================================
2-sided t value (0.05,14) = 2.1448**   Significant difference at alpha=0.05
2-sided t value (0.01,14) = 2.9768  No significant difference at alpha=0.01
```

WARNING: This procedure assumes normality and equal variances!

JK 9/21/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058 -016, -018, -020, -022
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for Survival

File: 128058cs.dat   Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 1.1766
W = 0.9516

Critical W = 0.9190 (alpha = 0.01 , N = 40)
W = 0.9400 (alpha = 0.05 , N = 40)

Data PASS normality test (alpha = 0.01). Continue analysis.

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 4.9361   (p-value = 0.2939)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 13.2767 (alpha = 0.01, df = 4)
= 9.4877 (alpha = 0.05, df = 4)

AKA 9/21/07
QA: ARR 12/11/07

Toxstat Version 3.5
Study #8503-128-058 -016, -018, -020, -022
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for Survival
File: 128058cs.dat Transform: ARC SINE(SQUARE ROOT(Y))

ANOVA Table

SOURCE	DF	SS	MS	F
Between	4	0.2525	0.0631	1.8777
Within (Error)	35	1.1766	0.0336	
Total	39	1.4291		

(p-value = 0.1363)

Critical F = 3.9082 (alpha = 0.01, df = 4,35)
= 2.6415 (alpha = 0.05, df = 4,35)
Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	Sand Control	1.1931	0.8500		
2	Lower Johnson	0.9779	0.6750	2.3470	*
3	Lower Slate	1.1891	0.8375	0.0435	
4	Lower Sherman	1.1136	0.8000	0.8667	
5	Middle Sherman	1.1576	0.8250	0.3870	

Dunnett critical value = 2.2500 (1 Tailed, alpha = 0.05, df [used] = 4,30)
(Actual df = 4,35)

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Sand Control	8			
2	Lower Johnson	8	0.1680	19.4	0.1750
3	Lower Slate	8	0.1680	19.4	0.0125
4	Lower Sherman	8	0.1680	19.4	0.0500
5	Middle Sherman	8	0.1680	19.4	0.0250

SB 11/16/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Between Sand Control and
Formulated Sediment Control for Growth (AFDW per original organism)

File: 058016go.dat   Transform: NO TRANSFORMATION

t-Test of Solvent and Blank Controls   Ho: GRP1 Mean =
GRP2 Mean

===

SAND GRP1 (Solvent cntl) Mean = 0.8973   Calculated t value = -
2.2927
GRP2 (Blank cntl) Mean = 1.0914   Degrees of freedom = 14
FORMSED Difference in means = -0.1941

===

2-sided t value (0.05,14) = 2.1448**   Significant difference at
alpha=0.05
2-sided t value (0.01,14) = 2.9768 No significant difference at
alpha=0.01

WARNING: This procedure assumes normality and equal variances!

11/16/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
List Data for Growth (AFDW per original organism)
File: 058016go.dat Transform: NO TRANSFORMATION

Note: weight values were entered only to thousandths of a mg, after rounding

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand Control	1	0.7850	0.7850
1	Sand Control	2	0.7730	0.7730
1	Sand Control	3	1.0770	1.0770
1	Sand Control	4	1.0900	1.0900
1	Sand Control	5	0.8860	0.8860
1	Sand Control	6	0.8680	0.8680
1	Sand Control	7	0.9710	0.9710
1	Sand Control	8	0.7280	0.7280
2	Form Sed	1	1.1870	1.1870
2	Form Sed	2	0.6670	0.6670
2	Form Sed	3	1.2680	1.2680
2	Form Sed	4	1.1020	1.1020
2	Form Sed	5	0.9890	0.9890
2	Form Sed	6	1.2660	1.2660
2	Form Sed	7	1.0760	1.0760
2	Form Sed	8	1.1760	1.1760
3	Lower Johnson	1	0.5440	0.5440
3	Lower Johnson	2	0.6980	0.6980
3	Lower Johnson	3	0.8120	0.8120
3	Lower Johnson	4	0.8940	0.8940
3	Lower Johnson	5	0.8270	0.8270
3	Lower Johnson	6	0.7680	0.7680
3	Lower Johnson	7	1.0850	1.0850
3	Lower Johnson	8	0.7920	0.7920
4	Lower Slate	1	1.2200	1.2200
4	Lower Slate	2	0.7500	0.7500
4	Lower Slate	3	1.4260	1.4260
4	Lower Slate	4	0.9090	0.9090
4	Lower Slate	5	1.2690	1.2690
4	Lower Slate	6	1.1180	1.1180
4	Lower Slate	7	0.8670	0.8670
4	Lower Slate	8	0.8390	0.8390
5	Lower Sherman	1	1.0970	1.0970
5	Lower Sherman	2	0.5440	0.5440
5	Lower Sherman	3	0.5540	0.5540
5	Lower Sherman	4	1.1580	1.1580
5	Lower Sherman	5	1.0360	1.0360
5	Lower Sherman	6	0.8350	0.8350
5	Lower Sherman	7	0.8860	0.8860
5	Lower Sherman	8	0.6500	0.6500
6	Middle Sherman	1	1.1120	1.1120
6	Middle Sherman	2	0.9790	0.9790
6	Middle Sherman	3	0.8270	0.8270
6	Middle Sherman	4	1.0490	1.0490
6	Middle Sherman	5	0.9800	0.9800
6	Middle Sherman	6	1.1340	1.1340
6	Middle Sherman	7	1.1310	1.1310
6	Middle Sherman	8	0.9780	0.9780

AR 11/16/07

QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Summary of Growth (AFDW per original organism)

File: 058016go.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand Control	8	0.7280	1.0900	0.8973
2	Form Sed	8	0.6670	1.2680	1.0914
3	Lower Johnson	8	0.5440	1.0850	0.8025
4	Lower Slate	8	0.7500	1.4260	1.0498
5	Lower Sherman	8	0.5440	1.1580	0.8450
6	Middle Sherman	8	0.8270	1.1340	1.0238

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand Control	0.0189	0.1376	0.0487	15.3376
2	Form Sed	0.0384	0.1960	0.0693	17.9593
3	Lower Johnson	0.0240	0.1549	0.0548	19.2995
4	Lower Slate	0.0587	0.2422	0.0856	23.0757
5	Lower Sherman	0.0590	0.2429	0.0859	28.7469
6	Middle Sherman	0.0110	0.1047	0.0370	10.2317

(Note: Lower Johnson excluded from further analysis of growth due to the fact that it had a statistically significant reduction in survival from the Sand Control – AR 12/11/07)

SK 11/16/07

QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for
Growth (AFDW per original organism)

File: 058016g.dat Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 1.0332
W = 0.9697

Critical W = 0.9040 (alpha = 0.01 , N = 32)
W = 0.9300 (alpha = 0.05 , N = 32)

Data PASS normality test (alpha = 0.01). Continue analysis.

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 6.2531 (p-value = 0.0999)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 11.3449 (alpha = 0.01, df = 3)
= 7.8147 (alpha = 0.05, df = 3)

SJ 11/10/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for Growth (AFDW per original organism)

File: 058016g.dat Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	3	0.2331	0.0777	2.1056
Within (Error)	28	1.0332	0.0369	
Total	31	1.2662		

(p-value = 0.1220)

Critical F = 4.5681 (alpha = 0.01, df = 3,28)
= 2.9467 (alpha = 0.05, df = 3,28)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Sand Control	0.8973	0.8973		
2	Lower Slate	1.0498	1.0498	-1.5878	
3	Lower Sherman	0.8450	0.8450	0.5440	
4	Middle Sherman	1.0238	1.0238	-1.3171	

Dunnett critical value = 2.1700 (1 Tailed, alpha = 0.05, df [used] = 3,24)
(Actual df = 3,28)

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Sand Control	8			
2	Lower Slate	8	0.2084	23.2	-0.1525
3	Lower Sherman	8	0.2084	23.2	0.0523
4	Middle Sherman	8	0.2084	23.2	-0.1265

JK 11/16/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Between Sand Control and
Formulated Sediment Control for Growth (AFDW per surviving organism)

File: 058016gs.dat Transform: NO TRANSFORMATION

t-Test of Solvent and Blank Controls Ho: GRP1 Mean = GRP2 Mean

==

SAND GRP1 (Solvent cntl) Mean = 1.0925 Calculated t value = -2.8485
FORM SED GRP2 (Blank cntl) Mean = 1.5940 Degrees of freedom = 14
Difference in means = -0.5015

==

2-sided t value (0.05,14) = 2.1448** Significant difference at alpha=0.05
2-sided t value (0.01,14) = 2.9768 No significant difference at alpha=0.01

WARNING: This procedure assumes normality and equal variances!

AF 11/16/07
AF: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test Note: weight values entered only to thousandths of a mg., after rounding
List Data for Growth (AFDW per surviving organism)
File: 058016gs.dat Transform: NO TRANSFORMATION

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand Control	1	1.1210	1.1210
1	Sand Control	2	0.8590	0.8590
1	Sand Control	3	1.0770	1.0770
1	Sand Control	4	1.6350	1.6350
1	Sand Control	5	0.9840	0.9840
1	Sand Control	6	0.8680	0.8680
1	Sand Control	7	1.3870	1.3870
1	Sand Control	8	0.8090	0.8090
2	Form Sed	1	1.6960	1.6960
2	Form Sed	2	0.9530	0.9530
2	Form Sed	3	1.4090	1.4090
2	Form Sed	4	1.5740	1.5740
2	Form Sed	5	1.6480	1.6480
2	Form Sed	6	1.5820	1.5820
2	Form Sed	7	2.4200	2.4200
2	Form Sed	8	1.4700	1.4700
3	Lower Johnson	1	0.9070	0.9070
3	Lower Johnson	2	1.3960	1.3960
3	Lower Johnson	3	1.2180	1.2180
3	Lower Johnson	4	1.3420	1.3420
3	Lower Johnson	5	0.9190	0.9190
3	Lower Johnson	6	1.5360	1.5360
3	Lower Johnson	7	1.2060	1.2060
3	Lower Johnson	8	1.3200	1.3200
4	Lower Slate	1	1.5250	1.5250
4	Lower Slate	2	0.7500	0.7500
4	Lower Slate	3	1.4260	1.4260
4	Lower Slate	4	1.8180	1.8180
4	Lower Slate	5	1.4280	1.4280
4	Lower Slate	6	1.1180	1.1180
4	Lower Slate	7	1.4450	1.4450
4	Lower Slate	8	0.9320	0.9320
5	Lower Sherman	1	1.2340	1.2340
5	Lower Sherman	2	0.9520	0.9520
5	Lower Sherman	3	0.7910	0.7910
5	Lower Sherman	4	1.2870	1.2870
5	Lower Sherman	5	1.3310	1.3310
5	Lower Sherman	6	1.0440	1.0440
5	Lower Sherman	7	1.1820	1.1820
5	Lower Sherman	8	0.8120	0.8120
6	Middle Sherman	1	1.5890	1.5890
6	Middle Sherman	2	0.9790	0.9790
6	Middle Sherman	3	1.2400	1.2400
6	Middle Sherman	4	1.3490	1.3490
6	Middle Sherman	5	1.5680	1.5680
6	Middle Sherman	6	1.2600	1.2600
6	Middle Sherman	7	1.1310	1.1310
6	Middle Sherman	8	1.2220	1.2220

SK 11/16/07
QA: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Summary of Growth (AFDW per surviving organism)

File: 058016gs.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand Control	8	0.8090	1.6350	1.0925
2	Form Sed	8	0.9530	2.4200	1.5940
3	Lower Johnson	8	0.9070	1.5360	1.2305
4	Lower Slate	8	0.7500	1.8180	1.3053
5	Lower Sherman	8	0.7910	1.3310	1.0791
6	Middle Sherman	8	0.9790	1.5890	1.2922

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand Control	0.0827	0.2876	0.1017	26.3286
2	Form Sed	0.1652	0.4065	0.1437	25.5011
3	Lower Johnson	0.0491	0.2216	0.0783	18.0052
4	Lower Slate	0.1204	0.3470	0.1227	26.5881
5	Lower Sherman	0.0447	0.2115	0.0748	19.5949
6	Middle Sherman	0.0429	0.2071	0.0732	16.0241

(Note: Lower Johnson excluded from further analysis of growth due to the fact that it had a statistically significant reduction in survival from the sand control – AR 12/11/07)

SK 11/16/07
AT: AR 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for
Growth (AFDW per ~~original~~ organism)
surviving ①

File: 5816gs.dat Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 2.0354
W = 0.9842

Critical W = 0.9040 (alpha = 0.01 , N = 32)
W = 0.9300 (alpha = 0.05 , N = 32)

Data PASS normality test (alpha = 0.01). Continue analysis.

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 2.5070 (p-value = 0.4740)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 11.3449 (alpha = 0.01, df = 3)
= 7.8147 (alpha = 0.05, df = 3)

① AR for KT 12/11/07 E

SJ 11/16/07
QA: AE 12/11/07

Toxstat Version 3.5
Study #8503-128-058-(016, 018, 020, 022)
Coeur Sediment
Chironomus tentans 10-day Test
Determination of Significant Difference Compared to the Sand Control for Growth (AFDW per surviving organism)

File: 5816gs.dat Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	3	0.3641	0.1214	1.6698
Within (Error)	28	2.0354	0.0727	
Total	31	2.3995		

(p-value = 0.1961)

Critical F = 4.5681 (alpha = 0.01, df = 3,28)
= 2.9467 (alpha = 0.05, df = 3,28)

Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	Sand Control	1.0925	1.0925		
2	Lower Slate	1.3053	1.3053	-1.5782	
3	Lower Sherman	1.0791	1.0791	0.0992	
4	Middle Sherman	1.2922	1.2922	-1.4818	

Dunnett critical value = 2.1700 (1 Tailed, alpha = 0.05, df [used] = 3,24)
(Actual df = 3,28)

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	Sand Control	8			
2	Lower Slate	8	0.2925	26.8	-0.2128
3	Lower Sherman	8	0.2925	26.8	0.0134
4	Middle Sherman	8	0.2925	26.8	-0.1997

APPENDIX D

Analytical Data

Thursday, October 04, 2007

Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR AK

Work Order: 0709048

Dear Dave Pillard:

MSE Lab Services received 4 sample(s) on 9/6/2007 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Marcee Cameron

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SHERMAN
Lab Order:	0709048	**Collection Date:**	8/15/2007 10:00:00 AM
Project:	COEUR AK		
Lab ID:	0709048-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	16500	57.6		mg/Kg-dry	5	10/1/2007
Chromium	47.1	25.6		mg/Kg-dry	5	10/1/2007
Nickel	ND	32.0		mg/Kg-dry	5	10/1/2007
Silver	ND	6.39		mg/Kg-dry	5	10/1/2007
Zinc	100	12.8		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	23.7	0.398		mg/Kg-dry	2	9/27/2007
Cadmium	0.533	0.027		mg/Kg-dry	2	9/27/2007
Copper	98.6	0.331		mg/Kg-dry	2	9/27/2007
Lead	19.6	0.053		mg/Kg-dry	2	9/27/2007
Selenium	0.815	0.530		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0621	0.0297	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	1.3	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

lum **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	MIDDLE SHERMAN
Lab Order:	0709048	**Collection Date:**	8/18/2007 10:30:00 AM
Project:	COEUR AK		
Lab ID:	0709048-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	16700	61.1		mg/Kg-dry	5	10/1/2007
Chromium	53.0	27.1		mg/Kg-dry	5	10/1/2007
Nickel	ND	33.9		mg/Kg-dry	5	10/1/2007
Silver	ND	6.79		mg/Kg-dry	5	10/1/2007
Zinc	87.0	13.6		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	7.71	0.410		mg/Kg-dry	2	9/27/2007
Cadmium	0.095	0.027		mg/Kg-dry	2	9/27/2007
Copper	22.2	0.342		mg/Kg-dry	2	9/27/2007
Lead	3.51	0.055		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.547		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0832	0.0334	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	1.4	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

MM **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

CLIENT:	ENSR International	**Client Sample ID:**	LOWER JOHNSON
Lab Order:	0709048	**Collection Date:**	8/17/2007 11:45:00 AM
Project:	COEUR AK		
Lab ID:	0709048-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	23000	63.3		mg/Kg-dry	5	10/1/2007
Chromium	66.6	28.1		mg/Kg-dry	5	10/1/2007
Nickel	42.1	35.2		mg/Kg-dry	5	10/1/2007
Silver	ND	7.03		mg/Kg-dry	5	10/1/2007
Zinc	98.6	14.1		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	0.892	0.431		mg/Kg-dry	2	9/27/2007
Cadmium	0.092	0.029		mg/Kg-dry	2	9/27/2007
Copper	8.04	0.359		mg/Kg-dry	2	9/27/2007
Lead	1.67	0.057		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.575		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	ND	0.0303	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	0.3	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	0.24	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SLATE
Lab Order:	0709048	**Collection Date:**	8/16/2007 12:00:00 PM
Project:	COEUR AK		
Lab ID:	0709048-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	13100	60.3		mg/Kg-dry	5	10/1/2007
Chromium	31.1	26.8		mg/Kg-dry	5	10/1/2007
Nickel	ND	33.5		mg/Kg-dry	5	10/1/2007
Silver	ND	6.70		mg/Kg-dry	5	10/1/2007
Zinc	157	13.4		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	2.81	0.411		mg/Kg-dry	2	9/27/2007
Cadmium	0.207	0.027		mg/Kg-dry	2	9/27/2007
Copper	10.3	0.342		mg/Kg-dry	2	9/27/2007
Lead	2.83	0.055		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.548		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0582	0.0302	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	2.7	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

Wuw **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Analytical Laboratory
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Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1212

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***1212-PB UNFILTERED***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	ND	9.00	mg/Kg							
Chromium	ND	4.00	mg/Kg							
Nickel	ND	5.00	mg/Kg							
Silver	ND	1.00	mg/Kg							
Zinc	ND	2.00	mg/Kg							
Sample ID: ***1212-PB FILTERED***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	ND	9.00	mg/Kg							
Chromium	ND	4.00	mg/Kg							
Nickel	ND	5.00	mg/Kg							
Silver	ND	1.00	mg/Kg							
Zinc	ND	2.00	mg/Kg							
Sample ID: ***1212-LCS***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	7450	8.74	mg/Kg	7146	104	80	120			
Chromium	123	3.88	mg/Kg	116.5	106	80	120			
Nickel	97.3	4.85	mg/Kg	99.03	98.2	80	120			
Silver	98.0	0.971	mg/Kg	93.98	104	80	120			
Zinc	115	1.94	mg/Kg	133.0	86.6	80	120			
Sample ID: ***0709048-001B MS***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	26700	58.1	mg/Kg-dry	9505	107	75	125			
Chromium	221	25.8	mg/Kg-dry	155.0	112	75	125			
Nickel	169	32.3	mg/Kg-dry	131.7	128	75	125			S
Silver	129	6.46	mg/Kg-dry	125.0	104	75	125			
Zinc	257	12.9	mg/Kg-dry	176.9	88.7	75	125			
Sample ID: ***0709048-001B MSD***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	25600	58.1	mg/Kg-dry	9505	97.8	75	125	3.44	20	
Chromium	197	25.8	mg/Kg-dry	155.0	96.7	75	125	11.5	20	
Nickel	139	32.3	mg/Kg-dry	131.7	106	75	125	19.4	20	
Silver	123	6.46	mg/Kg-dry	125.0	98.3	75	125	5.13	20	
Zinc	261	12.9	mg/Kg-dry	176.9	91.0	75	125	1.57	20	
Sample ID: ***0709048-001B MST***			*Method:* ***SW6010B***		*Batch ID:* ***1212***			*Analysis Date:* ***10/1/2007***		
Aluminum	25200	58.1	mg/Kg-dry	9505	92.4	75	125	5.46	20	
Chromium	214	25.8	mg/Kg-dry	155.0	107	75	125	3.43	20	
Nickel	161	32.3	mg/Kg-dry	131.7	122	75	125	4.64	20	
Silver	117	6.46	mg/Kg-dry	125.0	93.5	75	125	10.2	20	
Zinc	250	12.9	mg/Kg-dry	176.9	85.0	75	125	2.63	20	

mm **Review**

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1213

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***1213-PB UNFILTERED***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	0.015	0.020	mg/Kg							J
Selenium	ND	0.200	mg/Kg							
Sample ID: ***1213-PB FILTERED***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Sample ID: ***1213-LCS***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	155	0.295	mg/Kg	158.2	97.7	80	120			
Cadmium	101	0.020	mg/Kg	96.42	105	80	120			
Copper	85.6	0.246	mg/Kg	83.94	102	80	120			
Lead	122	0.039	mg/Kg	123.8	98.5	80	120			
Selenium	147	0.393	mg/Kg	139.6	105	80	120			
Sample ID: ***0709048-001B-MS***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	231	0.391	mg/Kg-dry	209.9	98.9	75	125			
Cadmium	133	0.026	mg/Kg-dry	127.9	104	75	125			
Copper	224	0.326	mg/Kg-dry	111.3	113	75	125			
Lead	185	0.052	mg/Kg-dry	164.3	100	75	125			
Selenium	194	0.522	mg/Kg-dry	185.1	105	75	125			
Sample ID: ***0709048-001B-MSD***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	229	0.394	mg/Kg-dry	211.7	97.2	75	125	0.828	20	
Cadmium	132	0.026	mg/Kg-dry	129.0	102	75	125	0.914	20	
Copper	236	0.329	mg/Kg-dry	112.3	122	75	125	4.99	20	
Lead	184	0.053	mg/Kg-dry	165.6	99.3	75	125	0.263	20	
Selenium	193	0.526	mg/Kg-dry	186.7	103	75	125	0.855	20	
Sample ID: ***0709048-001B MST***			*Method:* ***SW6020***		*Batch ID:* ***1213***		*Analysis Date:*	***9/27/2007***		
Arsenic	237	0.394	mg/Kg-dry	211.4	101	75	125	2.44	20	
Cadmium	133	0.026	mg/Kg-dry	128.8	103	75	125	0.310	20	
Copper	226	0.328	mg/Kg-dry	112.1	114	75	125	0.858	20	
Lead	190	0.053	mg/Kg-dry	165.4	103	75	125	3.07	20	
Selenium	203	0.525	mg/Kg-dry	186.4	108	75	125	4.25	20	

MW Review

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

MSE Analytical Laboratory
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200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1226

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***1226-PB***			*Method:* ***E245.5***		*Batch ID:* ***1226***		*Analysis Date:*		***9/26/2007***	
Mercury	ND	0.0200	mg/Kg							
Sample ID: ***LCS-1226***			*Method:* ***E245.5***		*Batch ID:* ***1226***		*Analysis Date:*		***9/26/2007***	
Mercury	1.64	0.0222	mg/Kg	1.555	106	80	120			
Sample ID: ***0709048-001B-MS***			*Method:* ***E245.5***		*Batch ID:* ***1226***		*Analysis Date:*		***9/26/2007***	
Mercury	2.11	0.0276	mg/Kg-dry	1.933	106	75	125			H
Sample ID: ***0709048-001B-MSD***			*Method:* ***E245.5***		*Batch ID:* ***1226***		*Analysis Date:*		***9/26/2007***	
Mercury	2.03	0.0276	mg/Kg-dry	1.934	102	75	125	3.65	20	H

Review

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

MSE Analytical Laboratory
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Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: R4725

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: **0709048-001A-D**			*Method:* **AVS-SEM**		*Batch ID:* **R4725**		*Analysis Date:*		**9/12/2007**	
Sulfide	ND	15.0	umoles/g					0	20	
Sample ID: **0709048-001A-S**			*Method:* **AVS-SEM**		*Batch ID:* **R4725**		*Analysis Date:*		**9/12/2007**	
Sulfide	4.87	15.0	umoles/g	4.955	98.3	80	120			J
Sample ID: **LFB**			*Method:* **AVS-SEM**		*Batch ID:* **R4725**		*Analysis Date:*		**9/12/2007**	
Sulfide	6.13	15.0	umoles/g	6.240	98.3	80	120			J
Sample ID: **LCS**			*Method:* **AVS-SEM**		*Batch ID:* **R4725**		*Analysis Date:*		**9/12/2007**	
Sulfide	6.34	15.0	umoles/g	6.240	102	85	105			J
Sample ID: **BLANK**			*Method:* **AVS-SEM**		*Batch ID:* **R4725**		*Analysis Date:*		**9/12/2007**	
Sulfide	ND	15.0	umoles/g							

Review

Qualifiers: N/A Sample concentration is greater than 4*spike level R RPD outside accepted recovery limits S Spike Recovery outside accepted recovery limits

Friday, December 07, 2007

MSE
Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR AK

Work Order: 0709048

Dear Dave Pillard:

MSE Lab Services received 4 sample(s) on 9/6/2007 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Sara Ward for MC

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SHERMAN
Lab Order:	0709048	**Collection Date:**	8/15/2007 10:00:00 AM
Project:	COEUR AK		
Lab ID:	0709048-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	4.0	0.1		%	1	12/6/2007
% Sand	82.0	0.1		%	1	12/6/2007
% Silt	14.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

MLM **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	MIDDLE SHERMAN
Lab Order:	0709048	**Collection Date:**	8/18/2007 10:30:00 AM
Project:	COEUR AK		
Lab ID:	0709048-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: HC
% Clay	2.0	0.1		%	1	12/6/2007
% Sand	78.0	0.1		%	1	12/6/2007
% Silt	20.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER JOHNSON
Lab Order:	0709048	**Collection Date:**	8/17/2007 11:45:00 AM
Project:	COEUR AK		
Lab ID:	0709048-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	26.0	0.1		%	1	12/6/2007
% Sand	18.0	0.1		%	1	12/6/2007
% Silt	56.0	0.1		%	1	12/6/2007
Soil Class	Silt loam			%	1	12/6/2007

______ **Review**

Qualifiers:
- H Holding times for preparation or analysis exceeded
- Limit Instrument Reporting Limit
- ND Not Detected at the Method Detection Limit (MDL)
- J Analyte detected below the Reporting Limit
- MDL Method Detection Limit

MSE-TA Analytical Laboratory
P.O. Box 4078
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Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SLATE
Lab Order:	0709048	**Collection Date:**	8/16/2007 12:00:00 PM
Project:	COEUR AK		
Lab ID:	0709048-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	2.0	0.1		%	1	12/6/2007
% Sand	78.0	0.1		%	1	12/6/2007
% Silt	20.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 07-Dec-07
Report Date: 07-Dec-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: R5390

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID **0709048-001B D**			*Method:* **MSA15-5**		*Batch ID:* **R5390**			*Analysis Date:*	**12/6/2007**	
% Clay	4.0	0.1	%					0	20	
% Sand	82.0	0.1	%					0	20	
% Silt	14.0	0.1	%					0	20	
Soil Class	Loamy sand		%					0	0	

Review

Qualifiers: J Analyte detected below the Reporting Limit; N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Page ___ of ___

Client/Project Name: Coeur AK

Project Location:

Project Number: 08503-128-058

Field Logbook No.:

Chain of Custody Tape No.: 21693

Sampler (Print Name)/(Affiliation): Liz Flory - Coeur / Ted Dixon - ENSR subsampler

Signature:

Send Results/Report to: David Pillard

0909048

Analysis Requested: Al, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn, Hg | TOC | Grain Size | AVS

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	Al, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn, Hg	TOC	Grain Size	AVS				Lab I.D.	Remarks
LOWER SHERMAN METALS, TOC, Grain size	8/15/07	1000	X		500 mL HDPE	SEDIMENT	ICE		X	X	X					20938	001B
LOWER SHERMAN AVS	↓	↓	X		100 mL Septa	↓	↓					X				20938	001A
MIDDLE SHERMAN METALS, TOC, Grain size	8/18/07	1030	X		500 mL HDPE	↓	↓		X	X	X					20939	002B
MIDDLE SHERMAN AVS	↓	↓	X		100 mL Septa	↓	↓					X				20939	002A
LOWER JOHNSON METALS, TOC, Grain size	8/17/07	1145	X		500 mL HDPE	↓	↓		X	X	X					20934	003B
LOWER JOHNSON AVS	↓	↓	X		100 mL Septa	↓	↓					X				20934	003A
LOWER SLATE METALS, TOC, Grain size	8/16/07	1200	X		500 mL HDPE	↓	↓		X	X	X					20935	004B
LOWER SLATE AVS	↓	↓	X		100 mL Septa	↓	↓					X				20935	004A

All samples subsampled 8/30/07 @ 1600 by Ted Dixon (ENSR) for

Relinquished by: (Print Name)/(Affiliation)	Date / Time	Received by: (Print Name)/(Affiliation)	Date / Time
Ted Dixon Signature: [signature]	Date: 9/5/07 Time: 1500	Marcee Cameron / MSE Signature: [signature]	Date: 9/6/07 Time: 1140
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:

Analytical Laboratory (Destination): FEDEX

T = 6.0°C

rcvd in sealed cooler, on ice

~~ENSR Toxicology Lab~~ MSE LAB

~~4303 W. Laporte Avenue~~

~~Fort Collins, CO 80521~~

~~(970) 416-0916~~

~~(970) 493-8935 (FAX)~~

Serial No. 43814

FM01008b_902

FCETL QA Form No.131
Revision 0
Effective 10/06

(ENSR)

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

QA: AR 12/10/07

Project No: 8503-128-058

Analytical Balance ID: AND

TARE: Date/time: 8/30/07@1600 Analyst: TD
DRY GROSS: Date/time: 9/5/07@1445 Analyst: TD
ASHED GROSS: Date/time: 9/6/07@1005 Analyst: TD

Dried in Oven # 2 from Date: 8/30/07 Time: 1715 to Date: 9/5/07 Time: 1125
Oven °C: 101

Ashed in Furnace from Date: 9/5/07 Time: 1455 to Date: 9/5/07 Time: 1700
Furnace °C: 550

Dish No.	Treatment	Rep	Tare Weight of Dish (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Ashed Gross Weight (dish + sample)(g) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)
1A	Johnson		12.4274	37.7118	30.7628	72.5	30.6165	0.798
2A	Mid. Shor		12.3630	37.3072	30.6529	73.3	30.2284	2.32
3A	Low. Shor.		10.4975	35.5889	29.1588	74.4	28.7871	1.99
4A	Slate		10.7727	35.8363	27.4472	66.5	26.5929	5.12
5A	Mid Shor (Dup)		12.0062	37.6376	30.6056	72.6	~~26.5929~~ 30.0942	2.75
Blank			12.1409		12.1409		12.1409	

[1] Add in weight loss of blank boat, if appropriate.

① TD 9/6/07 WP

Report of Short-Term Toxicity of Whole Sediment to *Hyalella azteca*

Coeur Alaska, Inc.
Kensington Mine
Juneau, AK

ENSR
Environmental Toxicology
Document 08503-128-058-(015, 017, 019, 021)
08503-131-058-024

ENSR | AECOM

Report of Short-Term Toxicity of Whole Sediment to Hyalella azteca

Project IDs: 08503-128-058-(015, 017, 019, 021) & 08503-131-058-024
August/September 2007 & November 2007

Sponsor and Laboratory Information

Sponsor	Coeur Alaska Inc. Kensington Mine 3031 Clinton Drive Suite 202 Juneau, Alaska 99801
Project Officer	John Randolph (907) 789-1591
Testing Facility	ENSR Fort Collins Environmental Toxicology Laboratory 4303 West LaPorte Ave. Fort Collins, CO 80521 Fax: (970) 490-2963 State of Florida NELAP Laboratory ID: E87972
Study Director	David A. Pillard (970) 416-0916, ext. 310

Test Information

Test	Short-term chronic screening toxicity test of sediment	
Basis	USEPA (2000) and ASTM (2001)	
Test Protocol	HA3AK.TIE058.006	
Test Period	August 31, 2007 @ 1520 to September 10, 2007 @ 1200-1700 November 20, 2007 @ 1540 to November 30, 2007 @ 1530	
Test Length	10 days	
Species	*Hyalella azteca*	
Test Material	Whole sediment	
Sediment ID	Sample ID	ENSR Laboratory ID
	Lower Johnson	20934
	Lower Slate	20935
	Lower Sherman	20938
	Middle Sherman	20939
Control Sediments	Silica Sand and Laboratory Formulated Sediment	
Overlying water	Moderately hard reconstituted water prepared according to USEPA (2002), augmented with approximately 50 mg/L Cl^- (as NaCl)	
Test Concentrations	0 (control) and 100% of each test sediment	

TESTING

Control performance was unacceptable (survival < 80%) in the studies conducted August 31 to September 10, 2007 (see Test Results on Page 5). There was insufficient sediment remaining from the Lower Slate, Lower Sherman and Middle Sherman samples to conduct followup tests. There was sufficient Lower Johnson sediment remaining to conduct a followup test, which was completed November 20 to November 30, 2007. Results from all tests are included in this report.

Sediment Collection and Receipt

Sample ID	Collection Date and Time	ENSR No.	Date of Receipt	Temp. at Arrival (°C)
Lower Johnson	08/17/07 @ 1145	20934	08/22/07	8
Lower Slate	08/16/07 @ 1200	20935	08/22/07	8
Lower Sherman	08/15/07 @ 1000	20938	08/22/07	10
Middle Sherman	08/18/07 @ 1030	20939	08/22/07	10

Control Sediment

The primary control sediment was silica sand, obtained from a local commercial supplier. A second control sediment, with a smaller grain size and higher organic matter content, was prepared in the laboratory. The composition of the formulated sediment is given in the following table (Kemble et al. 1999).

Composition of Laboratory Formulated Sediment (Control)

Material	Source	Pre-Treatment	Weight (g)
White Quartz Sand	U.S. Silica. Berkely Springs, West Virginia.	Rinsed with gentle mixing in Horsetooth water until water ran clear, then rinsed for 5 min with Milli-Q water. Air dried or dried in oven.	1242
Silt/Clay (ASP400)	Mozel, St. Louis, MO. Distributor = Englehardt	None	219
Dolomite	Grey Rock Clay Center, Ft. Collins	None	7.5
α-cellulose	Sigma	None	77.3
Humic Acid	Fluka	None	0.15
Total			1545.95

Test Sediment Preparation

Sample ID	Date Homogenized	Time Homogenized
Lower Johnson	August 30, 2007	1600-1605
Lower Slate		1545-1550
Lower Sherman		1515-1519
Middle Sherman		1525-1530

Note: Lower Johnson sediment, along with control sediment, was re-homogenized on November 19, on day -1 of the retest

Test Conditions

Test Type	Static sediment with continuous replacement of overlying water
Test Duration	10 days
Overlying Water Delivery System	Continuous renewal (flow-through) [a]
Test Endpoints	Survival, Dry Weight per original and surviving organism
Test Chambers	500 ml glass beakers
Test Sediment Volume	100 ml
Overlying Water Volume	175 ml
Replicates per Treatment	8
Organisms per Replicate	10
Test Temperature	23 ± 1°C; see Protocol Deviations
Lighting	Fluorescent, 16 hours light:8 hours dark
Chamber Placement	Randomized
Test Sediment Renewal	None
Test Overlying Water Renewal	Approximately two volume additions per test chamber per day

[a] Continuous replacement via a drip system
Note: See Appendix B for the Test Protocol

Test Organism

Study 08503-128-058-(015, 017, 019, 021) – Aug. 31- Sept. 1, 2007

Species and Lot Number	*Hyalella azteca*, Lot 07-029
Age	8-10 days
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (53 mg/L) as NaCl, RW # 8307
Reference Toxicant Testing	Initiated August 31, 2007 using sodium chloride (NaCl)

Study 08503-131-058-024 – Nov. 20-30, 2007

Species and Lot Number	*Hyalella azteca*, Lot 07-047
Age	10-12 days
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (53 mg/L) as NaCl, RW # 8422
Reference Toxicant Testing	Initiated November 20, 2007 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Dry Weights

Study 08503-128-058-(015, 017, 019, 021) – Aug. 31- Sept. 1, 2007

Sample ID	Percent Survival	Dry Weight (mg)	
		Per original organism	Per surviving organism
Sand Control	50.00[a]	0.029	0.057
Lab. Formulated Sediment	57.50	0.017	0.027
Lower Johnson	68.75	0.026	0.036
Lower Slate	78.75	0.041	0.052
Lower Sherman	78.75	0.047	0.060
Middle Sherman	80.00	0.044	0.054
Control Performance	Unacceptable[b]	N/A	N/A

[a] Excluding replicate A, no live or dead organisms were found at test termination in this replicate; organisms were likely not added to test chamber at initiation
[b] Control performance was less than 80%, and thus unacceptable
Note: See Appendix C for test data sheets

Study 08503-131-058-024 – Nov. 20-30, 2007

Sample ID	Percent Survival[a]	Dry Weight (mg)[a]	
		Per original organism	Per surviving organism
Sand Control	98.75	0.107	0.108
Lab. Formulated Sediment	92.50	0.068	0.074
Lower Johnson	91.25	0.049[b]	0.054[b]
Control Performance	Acceptable	N/A	N/A

[a] Lower Johnson was compared to the Sand control
[b] Statistically significant reduction compared to the Sand control
Note: See Appendix D for test data sheets

Data Analysis

The poor control performance in the first set of studies suggests that organisms may have been unhealthy, despite the acceptable organism performance in the reference toxicant study. It is also possible that overlying water renewal rates may have been higher than the recommended two volume additions per day, which may have diluted and reduced the concentration of available food. The poor organism performance in the controls is probably also reflected in lower organism performance (survival and perhaps growth) in the test sediments themselves. Because of poor control performance, statistical comparisons against the controls would not have been meaningful, and were not completed.

Survival of control organisms in the retest with Lower Johnson sediment, conducted in November, was very good and statistical comparisons were possible. Survival and growth in the two control sediments (Sand and Formulated sediment) were first compared to each other. While survival was not significantly different between the controls, growth (per original organism and per surviving organism) was significantly lower in the Formulated sediment. Therefore, the Formulated sediment was excluded and statistical comparisons to Lower Johnson were made only against the Sand control.

Statistical Methods

Biological Endpoint	Comparison	Procedure
Survival	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Difference Between Sand and Formulated Sediment Controls[b]	Kruskal-Wallis Test (α=0.05)
	Significant Reduction Relative to the Sand Control[b]	Kruskal-Wallis Test (α = 0.05)
Growth (Dry weight per Original Organism)	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Difference Between Sand and Formulated Sediment Controls[b]	Two-Sample t-test (α=0.05)
	Significant Reduction Relative to the Sand Control[b]	Two-Sample t-test (α=0.05)
Growth (Dry weight per Surviving Organism)	Normality[a]	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance[a]	Bartlett's Test (α=0.01)
	Significant Difference Between Sand and Formulated Sediment Controls[b]	Two-Sample t-test (α=0.05)
	Significant Reduction Relative to the Sand Control[b]	Two-Sample t-test (α=0.05)

[a] Using Toxstat Version 3.5 (WEST, Inc. and Gulley 1996)
[b] Statistix 8.0 (Analytical Software, 2003)

Toxicity Data Interpretation

To provide additional information regarding the relationship between response of *H. azteca* in the test sediments and the controls, test results from the 2007 studies (conducted August 31 – September 10) were compared to 2006 survival and growth responses, as shown in the following table:

Sample ID	2006 Toxicity Test Results			2007 Toxicity Test Results		
	Survival (%)	Dry Weight (mg)		Survival (%)	Dry Weight (mg)	
		Per original organism	Per surviving organism		Per original organism	Per surviving organism
Sand Control	83.75	0.041	0.049	50.00	0.029	0.057
Lab. Formulated Sediment	88.75	0.017	0.018	57.50	0.017	0.027
Lower Johnson	82.00	0.024[a]	0.029[a]	68.75	0.026	0.036
Lower Slate	91.25	0.041	0.045	78.75	0.041	0.052
Lower Sherman	95.00	0.062	0.064	78.75	0.047	0.060
Middle Sherman	NA	NA	NA	80.00	0.044	0.054

[a] Weights (per original and per surviving) were significantly lower than the Sand control in 2006

Despite the poor control survival in the first set of tests in 2007, the growth responses were similar to those in 2006 for Lower Johnson, Lower Slate and Lower Sherman; Middle Sherman was not tested in 2006. In 2007, as in 2006, the lowest survival and dry weights among the test sediments were found in Lower Johnson sediment.

Response data in the first set of toxicity studies conducted in 2007 indicate a pattern similar to what was observed in previous years. In order to assist in the interpretation of the 2007 toxicity data, survival and growth results from each of the four test sediments collected in 2007 were compared to each other using one-way analysis of variance (AOV) and a LSD (least significant difference) multiple comparison test (Statistix, α=0.05). The results of those analyses are shown in the following table:

Sample ID	Survival	Growth (Dry Wt./Original)		Growth (Dry Wt./Surviving)	
	AOV Results: p=0.537	AOV Results: p=0.047		AOV Results: p=0.006	
	Mean (%)	Mean (mg)	LSD Results[a]	Mean (mg)	LSD Results[a]
Lower Sherman	78.75	0.047	A	0.060	A
Middle Sherman	80.00	0.044	A	0.054	A
Lower Slate	78.75	0.041	A B	0.052	A
Lower Johnson	68.75	0.026	B	0.036	B

[a] Samples with the same letter are not significantly different
Note: See Appendix E for printouts of the statistical analyses

While survival in Lower Johnson was not significantly different from the other sites (p=0.537), *H. azteca* dry weights were significantly less than the other sites, based on surviving organisms, and significantly less than Lower Sherman and Middle Sherman, based on original organisms.

Conclusions from Toxicity Studies

Sediments from Lower Johnson appear to be chronically toxic to *H. azteca*, resulting in reduced growth. This conclusion is supported by:

- The retest of the *H. azteca* study, which showed significantly reduced growth
- Comparison of all four sediments in the original toxicity tests, which indicated *H. azteca* in Lower Johnson sediment had significantly lower growth, and
- Response that is consistent with results seen in 2006

Because of the poor control survival performance in the original toxicity tests, sediments from Lower Sherman, Middle Sherman or Lower Slate cannot be definitively judged nontoxic. However, existing and historical data indicate that this is likely the case.

Analytical Data

Total Metals (mg/Kg-dry)[a]	Sample ID			
	Lower Johnson	**Lower Slate**	**Lower Sherman**	**Middle Sherman**
Aluminum	23000	13100	16500	16700
Chromium	66.6	31.1	47.1	53.0
Nickel	42.1	ND	ND	ND
Silver	ND	ND	ND	ND
Zinc	98.6	157	100	87.0
Metals, Solid Samples (mg/Kg-dry)[b]				
Arsenic	0.892	2.81	23.7	7.71
Cadmium	0.092	0.207	0.533	0.095
Copper	8.04	10.3	98.6	22.2
Lead	1.67	2.83	19.6	3.51
Selenium	ND	ND	0.815	ND
Mercury	ND	0.0582	0.0621	0.0832
Particle Size (%)[c]				
Clay	26.0	2.0	4.0	2.0
Sand	18.0	78.0	82.0	78.0
Silt	56.0	20.0	14.0	20.0
Texture	Silt Loam	Loamy Sand	Loamy Sand	Loamy Sand
Coarse Material	0.24	ND	ND	ND
TOC[d] (%)	0.3	2.7	1.3	1.4
Acid Volatile Sulfide (umoles/g)	ND	ND	ND	ND

[a] Total metals were determined using SW-846 Method 6010B (USEPA 1986).
[b] Metals (solid sample analysis) were determined using SW-846 Method 6020 (USEPA 1986), except mercury which used Method 7471A
[c] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[d] TOC was determined using the Organic Matter-Walkley Black Method
ND = Not Detected at the method detection limit; see Appendix F for detection limits
Note: See Appendix F for a copy of the analytical laboratory report (MSE-TA Analytical Laboratory, Butte, MT)

Percent Total Solids and Percent Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Lower Johnson	72.5	0.80
Lower Slate	66.5	5.12
Lower Sherman	74.4	1.99
Middle Sherman	73.3	2.32
Middle Sherman (duplicate)	72.6	2.75

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
Note: See Appendix F for data sheets (these parameters were determined at ENSR/FCETL)

Physical and Chemical Data

Study 8503-128-058-(015, 017, 019, 021) – Aug. 31- Sept. 1, 2007

Sample ID	pH (units)	DO (mg/L)	Conductivity (µS/cm)	Temperature (°C)	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	7.7-8.1	6.2-6.9	420-558	22-23	<1.0	82-108	61-81
Lab. Form. Sed.	7.8-8.2	5.4-6.9	541-556	22-23	<1.0	90-112	75-90
Lower Johnson	8.0-8.2	5.6-6.5	452-557	22-23	<1.0-1.6	106-122	70-86
Lower Slate	7.2-8.0	5.5-6.4	414-525	22-23	<1.0	98-124	54-63
Lower Sherman	7.6-8.0	5.7-6.3	487-599	22-23	<1.0	114-132	70-96
Middle Sherman	7.1-7.8	5.8-6.3	409-560	22-23	<1.0	86-108	43-64

Study 08503-131-058-024 – Nov. 20 - 30, 2007

Sample ID	pH (units)	DO (mg/L)	Conductivity (µS/cm)	Temperature (°C)[a]	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	7.7-8.1	6.4-6.9	466-530	21-23	<1.0	102-104	60-75
Lab. Form. Sed.	6.4-8.0	5.9-6.8	423-550	21-23	<1.0	60-106	10-77
Lower Johnson	8.0-8.2	6.3-6.7	518-540	21-23	<1.0	136-148	34-97

[a] Temperature in test chambers; see Protocol Deviations

Reference Toxicant Test Results for *H. azteca*

Organism Lot Number	Test Dates	96-Hour LC_{50}	ENSR/FCETL Historical 95% Control Limits	
			Low	High
07-029	Aug. 31 – Sept. 4, 2007	2,040	868	3,058
07-047	Nov. 20 – 24, 2007	2,530	877	3,037

Note: Values are expressed as mg/L chloride

Protocol Deviations

Survival in the Sand and Formulated sediment controls in the first set of studies conducted August 31 – September 10 was less than 80% and was therefore unacceptable. Because of this deviation, statistical comparisons to the control were not possible. Organisms were not added to replicate A of the Sand control at test initiation due to technician error; this replicate was excluded from analysis. Because of the unacceptable control survival, this deviation probably did not affect test outcome.

Minimum bath temperature (continuously measured) on day 1 of the study conducted August 31 – September 10, 2007 was 21.8°C. Temperatures measured directly in the overlying water in the test chambers were within the acceptable range of 23 ± 1°C throughout the test. The water bath temperatures do not necessarily represent test chamber temperature, therefore the slightly cooler temperature measured in the water bath should not be considered to be a deviation from the protocol.

Temperature measured directly in overlying water was 21˚C on day 1 in all three sediments in the retest conducted November 20-30, 2007, which is outside the range specified in the protocol (23 ± 1˚C). Temperature was within the acceptable range on all other days of the test. The effect of this deviation is unknown, although it is unlikely to have impacted test outcome. Bath temperature (continuously measured) ranged from 16.2 to 27.0°C during testing. The low end of the temperature range (16.2°C) occurred only on day 1 of the test (corresponding to the day overlying water temperature was low at 21°C). Elevated temperatures occurred on every day except days 9 and 10. Despite the high bath temperatures, the temperature of the overlying water in the test chambers was within range (except for day 1, as noted above). The water bath temperatures do not necessarily represent test chamber temperature, therefore the slightly warmer temperatures measured in the water bath should not be considered to be deviations from the protocol.

Ammonia was not measured in the Formulated sediment control on day 0 of the November 2007 study; ammonia was not measured in any test treatments on day 3 of the November study. These deviations did not affect test outcome.

To the best of the Study Director's knowledge, no further deviations from the test protocol occurred during these studies.

References

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Kemble, N.E., F.J. Dwyer, C.G. Ingersoll, T.D. Dawson, and T.J. Norberg-King. 1999. Tolerance of Freshwater Test Organisms to Formulated Sediments for Use as Control Materials in Whole-Sediment Toxicity Test. *Environ. Toxicol. Chem.* 18:222-230.

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USEPA. 1986. Test Methods for Evaluating Solid Waste. Third Edition. SW-846.

WEST, Inc. and D.D. Gulley. 1996. Toxstat Version 3.5. Western EcoSystems Technology, Inc., Cheyenne, WY.

Statement of Procedural Compliance

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, accurate and complete.

David A. Pillard 20 Dec 2007

David A. Pillard, Ph.D. Date
Study Director

Statement of Quality Assurance

The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with standard operating procedures, and that the resulting data and report meet the requirements of the NELAC standards. This report is an accurate reflection of the raw data.

Anita Rellner December 20, 2007

Quality Assurance Unit Date

APPENDIX A

Chain of Custody

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Number: 08503-128-058

Sampler (Print Name)/(Affiliation): LIZ FLORY - COEUR

Signature: E. Flory

Project Location: FCETL

Field Logbook No.:

Chain of Custody Tape No.: 28913 intact

Send Results/Report to: LIZ FLORY 4546 RIVER ROAD JUNEAU AK 99801

Analysis Requested: TOXICITY, METALS

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	TOXICITY	METALS						Lab I.D.	Remarks
~~LOWER SHERMAN~~																ENSR #	
LOWER JOHNSON	8-17	1145	✓		2 × 4gal	SILT	N/A		X							ENSR # 20934	
LOWER SLATE	8-16	1200	✓		1 × 4gal	SILT	N/A		X							ENSR # 20935	
LOWER JOHNSON	8-17	1145	✓		1 × 100ml glass	SILT	N/A			X						ENSR # 20936	
LOWER SLATE	8-16	1200	✓		1 × 100ml glass	SILT	N/A			X						ENSR # 20937	

Relinquished by	Date/Time	Received by	Date/Time
Relinquished by: (Print Name)/(Affiliation) LIZ FLORY - COEUR Signature: E. Flory	Date: 8-20 Time: 0830	Received by: (Print Name)/(Affiliation) Jordan Albert ENSR Signature: Jordan Albert	Date: 8/22/07 Time: 1015
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:

Analytical Laboratory (Destination): Received via FedEx on ice @ 8°/22 JA

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 493-8935 (FAX)

Serial No. 43727

01008b_902

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client/Project Name: Coeur Alaska

Project Number: 08503-128-058

Sampler (Print Name)/(Affiliation): LIZ FLORY · COEUR

Signature: E. Flory

Project Location: FCETR

Field Logbook No.:

Chain of Custody Tape No.: 28368 intact

Send Results/Report to: LIZ FLORY 4546 RIVER ROAD JUNEAU AK 99801

Analysis Requested: TOXICITY, METALS

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	TOXICITY	METALS	Lab I.D.	Remarks
LOWER SHERMAN	8-15	1000	✓		4 gal	SILT	N/A		X		ENSR # 20938	
MIDDLE SHERMAN	8-18	1030	✓		4 gal	SILT	N/A		X		ENSR # 20939	
LOWER SHERMAN	8-15	1000	✓		100 ml glass	SILT	N/A			X	ENSR # 20940	
MIDDLE SHERMAN	8-18	1030	✓		100 ml glass	SILT	N/A			X	ENSR # 20941	

Relinquished by: (Print Name)/(Affiliation)	Date/Time	Received by: (Print Name)/(Affiliation)	Date/Time
LIZ FLORY - COEUR; Signature: E. Flory	Date: 8-20-07; Time: 0830	Jordan Albert ENSR; Signature: Jordan Albert	Date: 8/22/07; Time: 1015
Relinquished by: (Print Name)/(Affiliation); Signature:	Date:; Time:	Received by: (Print Name)/(Affiliation); Signature:	Date:; Time:
Relinquished by: (Print Name)/(Affiliation); Signature:	Date:; Time:	Received by: (Print Name)/(Affiliation); Signature:	Date:; Time:

Analytical Laboratory (Destination):
Received via FedEx on ice @ 10°/22 JA

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 493-8935 (FAX)

Serial No. 43722

10008b_902

APPENDIX B

Test Protocol

Title: Short-Term Chronic Toxicity of Bulk Sediment to the Amphipod, *Hyalella azteca*

Study Sponsor:

Coeur Alaska Inc.
Kensington Mine
3031 Clinton Drive
Suite 202
Juneau, Alaska 99801
Phone: (907) 789-1591

John Randolph

Testing Facility

Fort Collins Environmental Toxicology Laboratory
4303 West LaPorte Avenue
Fort Collins, Colorado 80521
Phone: (970) 416-0916, Ext. 310
Fax: (970) 490-2963
Project Manager/Study Director: David Pillard, Ph.D.

1.0 INTRODUCTION

1.1 Objective

To determine the short-term chronic toxicity of sediment samples to the amphipod, *Hyalella azteca*.

1.2 Sediment Sample

The sediment samples will be collected by the Study Sponsor or an agent of the Study Sponsor and shipped to ENSR's Fort Collins Laboratory. At the laboratory, sediment samples will be stored under refrigeration (4°C) until used in testing (preferably less than 4 weeks of storage). Each sample will be mechanically homogenized prior to use in testing (ENSR SOP #5208). Endemic organisms observed in the sediment will be removed manually.

2.0 BASIS AND TEST ORGANISM

2.1 Basis

This protocol is based on USEPA (2000) guidelines and ASTM Method E 1706-00 (ASTM 2001).

2.2 Test Organism

1. Species - *Hyalella azteca*
2. Age – 7-14 days old at the start of the test. Initial dry weight will be determined on a minimum of eighty organisms selected from the test population at test initiation.
3. Source - Test organisms will be obtained from a commercial supplier.
4. Feeding - *Hyalella azteca* will be fed 1.0 ml of a yeast-trout chow-Cerophyl suspension (YTC; USEPA 2002) per test chamber on a daily basis.

3.0 TEST SYSTEM

3.1 Overlying Water

The overlying water used in the toxicity test will be laboratory moderately hard reconstituted water prepared according to USEPA (2002). The water will be augmented with 50 mg/L Cl^-. Previous research has indicated that added Cl^- may be critical for maintaining organism health during the test.

3.2 Test Temperature

Test temperature will be 23 ± 1°C. Testing will be conducted in a temperature-controlled water bath or in an environmental chamber.

3.3 Test Containers

Test containers will be 500-ml beakers containing 100 ml of sediment and 175 ml of overlying water.

3.4 Photoperiod

The photoperiod will be 16-hours light and 8-hours dark.

3.5 Dissolved Oxygen Concentrations

Dissolved oxygen concentrations in the overlying water will be maintained >2.5 mg/L. If the dissolved oxygen concentration in the overlying water approaches this level, all test chambers will be gently aerated throughout the remainder of the test. If aeration is initiated, the aeration pipette will be appropriately positioned so as to avoid disturbance of the sediment.

3.6 Reference Toxicant Testing

In addition to the test material exposures, reference toxicant tests will be conducted using sodium chloride (NaCl) to determine the sensitivity range of the test organisms. Reference toxicant exposures will be conducted monthly or at the time of test initiation for in-house or commercially-supplied organisms. Reference toxicant testing will be performed according to USEPA (2000; 2002) methods.

4.0 TEST DESIGN

4.1 Test Concentrations

The test concentration will be 100 percent of each test sediment. A 100 percent laboratory control sediment (see section 4.3) exposure will be conducted concurrently.

4.2 Sediment/Water Mixture

Sediment (100 ml) will be placed in each test chamber. After addition of sediment, 175 ml of overlying water will be poured into each beaker. The beakers will be left unaerated overnight to allow sediment to settle and to reduce turbidity prior to addition of test organisms.

4.3 Reference/Control Sediment

In addition to any field-collected reference sediment, at least one laboratory control sediment will be tested concurrently. The laboratory control sediment may be clean, field-collected sediment and/or a formulated sediment.

4.4 Number of Test Organisms

Eighty *Hyalella azteca* will be exposed to each treatment. Ten organisms will be randomly assigned to each test chamber and eight replicates will be tested per treatment.

4.5 Test Initiation/Renewal Frequency

Testing will be initiated by addition of the test organisms after the overnight settling period. Each chamber will be renewed with approximately 2 volume additions per day, beginning on day 0 (after overlying water is characterized but before organisms are added). This will be accomplished with either a flow-through drip system or a renewal box that can be filled with overlying water and allowed to drain into the test chambers.

4.6 Chemical and Physical Monitoring

At a minimum, the following measurements will be made:

1. Dissolved oxygen, temperature, and pH will be measured in the overlying water of each treatment and the control each day of testing.

2. Hardness, alkalinity, conductivity, and ammonia will be measured in the laboratory reconstituted water (used as overlying water) on day 0.

3. Hardness, alkalinity, conductivity, and ammonia will be measured in overlying water from each treatment at test initiation (just prior to renewal on day 0 or 1) and at test termination.

4. Ammonia will also be measured in each treatment on days 3 and 7.

4.7 Biological Monitoring

After ten days of exposure, sediment from each test chamber will be removed and sieved or sorted to recover living test organisms. Organisms not recovered at test termination will be presumed dead. Dry weight will be determined at 60-90°C.

4.8 Test Duration

The test duration is 10 days. At test termination, the surviving organisms in each test chamber will be counted and transferred to a tared weighing boat and dried at 60-90°C for a minimum of 24 hours. Immediately after removal from the drying oven, the weigh boats will be placed in a dessicator to prevent absorption of moisture from the air, until they can be weighed. Weights will be measured to the nearest 0.01mg.

4.9 Calculations

Survival data will be transformed by arcsine squareroot. Normality and homogeneity assumptions for survival data will be evaluated by the Shapiro-Wilk's test and Bartlett's test, respectively (α = 0.01). Data will then be evaluated (α = 0.05) using either parametric or nonparametric methods, depending upon the outcome of the normality and homogeneity assessments.

Organism weights will be statistically compared in treatments not having significantly reduced survival. Analysis will occur in the same manner as for survival, although the weights will not be transformed using arcsine squareroot.

4.10 Quality Criterion

The test will not be considered acceptable if mortality in the control sediment exceeds 20 percent or if there is no measurable growth of test organisms in the control sediment. If mortality in one or more of the control treatments exceeds 20 percent or there is no measurable growth in the control, then the test will be reviewed to determine if certain chemical or physical characteristics of the test sediment (e.g., low dissolved oxygen or unusual pH) may have contributed to poor performance. Upon review by ENSR and the Sponsor, test data may be found acceptable.

5.0 TEST REPORT

The report will be a typed document describing the results of the test and will be signed by the Study Director and Quality Assurance Unit. The report will include, but not be limited to, the following:

- A copy of all raw data.
- Name of test, Study Director, and laboratory, and date test was begun.
- A detailed description of the sediment, including its source, time of collection, composition, known physical or chemical properties, and any information that appears on the sample container or has been provided by the Sponsor.
- The source of the overlying water, its chemical characteristics, and a description of any pretreatment.
- Detailed information about the test organisms, including scientific name, age, life stage, source, history, acclimation procedure, and food used.
- A description of the experimental design and the test chambers, the volume of solution in the chambers, the way the test was begun, the number of organisms per treatment, and the lighting.
- A description of any aeration performed on test solutions before or during the test.
- Definition of the criterion used to determine the effect and a summary of general observations on other effects or symptoms.
- Percentage of organisms that died or showed the effect.
- Anything unusual about the test, any deviations from the protocol, and any other relevant information.

6.0 LITERATURE CITED

ASTM. 2001. Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates: Procedure 1: Conducting a 10-day Sediment Toxicity Test with *Hyalella azteca*. Method E 1706-00 In *2001 Annual Book of ASTM Standards, Section 11, Water and Environmental Technology, Volume 11.05, Biological Effects and Environmental Fate; Biotechnology: Pesticides.* American Society of Testing and Materials. Conshohocken, PA

USEPA. 2000. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates. Second Edition. EPA/600/R-99/064.

USEPA. 2002. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Fourth Edition. EPA-821-R-02-013.

7.0 PROCEDURAL COMPLIANCE

All test procedures, documentation, records, and reports will comply with USEPA (2000, 2002) general guidance on quality assurance related to effluent and sediment toxicity testing. To this end, random audits of the test may be scheduled while the test is in progress. The raw data will be checked and compared to protocol requirements and Standard Operating Procedures, and the final report will be audited for accuracy and signed, if satisfactory, by both the Study Director and an individual from the Quality Assurance Unit.

8.0 PROTOCOL AMENDMENTS AND DEVIATIONS

All changes (i.e., amendments, deviations, and final report revisions) of the approved protocol plus the reasons for the changes must be documented in writing. The changes will be signed and dated by the Study Director and maintained with the protocol. All amendments must be authorized in advance by the Sponsor.

9.0 SPONSOR AND STUDY DIRECTOR APPROVAL

Sponsor Approval: ______________________ Date: __________

Study Director: [signature] Date: 30 Aug 2007

APPENDIX C

Data Sheets for First Set of Toxicity Tests
August 31 – September 10, 2007

DAP 12-15-07
QA: AR 12/19/07

H. azteca 10-day Survival and Growth, Testing Cover Page

Project Number:	8503-128-058 – (015, 017, 019, 021)			Protocol #:	HA3AK.TIE058.006
Test Substance:	Sediment				
Test Species:	*H. azteca*	Lot #:	07-029	Age:	8-10 (1) ~~7-14~~ days — Supplier: ABS
Test Type:	Chronic, Static Renewal				
Dilution Water:	Mod Hard with 50 mg/L Chloride (RW 8307)			Investigators:	DA / MR / [illegible] / AP / DAP
Sampling Date(s):	August 15,16, 17, 18 2007			Sampling Time(s):	1000 (8/15), 1200 (8/16), 1145 (8/17), 630 (8/18) #20938, #20935, #20934, #20939
FCETL Sample #(s):	20934, 20935, 20938, 20939 + 20936				
Test Initiation Date/Time:	8/31/07 @ 1520				
Test Termination Date/Time:	9/10/07 @ 1200-1700				
Renewal Frequency:	Cont. drip, 2+ vol/da	Feeding Freq:	daily	Food Type/Amount:	1 ml YTC daily — Test Temp: 23 +/- 1 deg C
Test Chamber Capacity:	500-ML	Test Soltn. Vol:	100 mL sed/175 mL H2O	# Repl's/Trtmnt:	8
Test Duration:	10 days	# Org.'s/Repl:	10	Env. Chmbr/Bath: (Bath circled)	3

Water Characterization: Minimum of Hardness, Alkalinity, & Conductivity on days 0 and 10; Ammonia on days 0, 3, 7, and 10; No TRC; pH, temperature & DO daily on overlying water

aerate if dissolved oxygen <2.5 mg/L

Test Sediment (s):

1) Sand (cont)	2) Form sed (cont)	3) 20934 (Lower Johnson)	
4) 20935(Lower Slate)	5) 20938 (Lower Sherma	6) 20939 (Middle Sherman)	+ 20936
7)	8)	9)	
10)	11)		

Reference Tox. Dates:	8/31/07 – 9/4/07	LC50:	2040 mg/L Cl⁻	Hist. Limits:	868-3058	Method:	S-K
Study Director Initials:	DAP	Date:	8/30/07				

Overlying water added at a minimum of 2 volume additions/day; equivalent to >350 ml/day or >0.24 ml/min

(1) DAP 12-15-07 E

DAP 12-15-07
QA: AR 12/19/07

BIOLOGICAL DATA H. *azteca* Chronic, Static Renewal Project 8503-128-058 – (015, 017, 019, 021)

Sediment	Test Termination	A	B	C ①	D	E	F	G	H	Remarks:
Sand (cont)	# Surviving (*)	0	10	~~8~~ 1	7	0	7*	4	6°	* 1 org. lost °2NF, 2 Dead
	# Observed Dead	0		0		5	0	1	2	43.75% with All reps
	# Not Found	10		9		5	3	5	2	50% w/o Rep A
Form sed (cont)	# Surviving ①	~~4~~ 7	6	~~4~~ 6 ②	4	5	5	9	4	③ 57.50%
	# Observed Dead	0	0	0 ②	0	0	0	0	0	~~56.25%~~
	# Not Found ②	~~6~~ 3	4	~~6~~ 4 ②	6	5	5	1	6	
20934 (Lower Johnson)	# Surviving	7	8	8*	9	6	3	9	5	* 1 org. lost
	# Observed Dead	0	0	0	0	0	1	0	0	68.75%
	# Not Found	3	2	2	1	4	6	1	5	
20935(Lower Slate)	# Surviving	5	9	10*	7	7	10 ①	9	6	* 1 org. lost
	# Observed Dead	0	0	0	0	0	0	0	0	78.75%
	# Not Found	5	1	0	3	3	0	1	4	
20938 (Lower Sherman)	# Surviving	4	7	10	9	9	8	8	8	
	# Observed Dead	0	0	0	0	0	0	0	0	78.75%
	# Not Found	6	3	0	1	1	2	2	2	
20939 (Middle Sherman)	# Surviving	6	9	7	9	9	10	6	8	
	# Observed Dead	0	0	0		0	–	0	0	80%
	# Not Found	4	1	3		1	–	4	2	
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
	# Surviving									
	# Observed Dead									
	# Not Found									

(*) no organisms found – most likely not added at test initiation

① AB 9/10/07 E
② Form sed, Rep. C, has 6 organisms surviving DAP 12-15-07
③ DAP 12-20-07 E

DAP 12-15-07
QA MR 12/19/07

OVERLYING WATER CHARACTERIZATION   *H. azteca*   Chronic, Static Renewal   Project No. 8503-128-058 – (015, 017, 019, 021)

	Conductivity (s/cm)		Hardness (mg/L as CaCO3		Alkalinity (mg/l as CaCO3		Ammonia (mg/l) *			
Sediment	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 3	Day 7	Day 10
Sand (cont)	420	558	92	108	61	81	<1.0	<1.0	<1.0	<1.0
Form sed (cont)	541	556	90	112	75	90	<1.0	<1.0	<1.0	<1.0
20934 (Lower Johnson)	452	557	106	122	70	86	~~<1.0~~ 1.6	<1.0	<1.0	<1.0
20935(Lower Slate)	414	525	124	98	54	63	<1.0	<1.0	<1.0	<1.0
20938 (Lower Sherman)	487	599	114	132	70	96	<1.0	<1.0	<1.0	<1.0
20939 (Middle Sherman)	409	560	86	108	43	64	<1.0	<1.0	<1.0	<1.0
0										
0										
0										
0										
Meter #	15	15	titr	titr	titr	titr	3	3	3	3
Date:	8/31/07	9/10/07	8/31/07	9/10/07	8/31/07	9/10/07	9/6/07	9/6/07	9/18/07	9/18/07
Time:	1500	1200	1500	1200	1500	1200	1615	1615	1600	1600
Initials:	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Samples were preserved on days 0, 3, 7, and 10 and measured later

[illegible] 12/dore

DAP 12-15-07
QA: AR 12/19/07

CHEMICAL DATA (Composite of Overlying Water) *H. azteca* Chronic, Static Renewal Project 8503-128-058 – (015, 017, 019, 021)

Parameter	Sediment	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day	Meter	Date	Time	Initials
Dissolved Oxygen (mg/l)	Sand (cont)	6.9	6.5	6.8	6.5	6.8	6.4	6.3	6.5	6.2	6.3	6.7	0	5	8/31/07	1215	EMH
	Form sed (cont)	6.9	6.4	6.8	6.4	6.6	5.7	6.0	6.2	5.4	5.4	6.2	1	5	9/1/07	1200	mm
	20934 (Lower Johnson)	6.2	6.1	6.5	6.4	6.4	5.9	5.8	6.2	~~6.9~~ 5.9	5.6	6.5	2	5	9/2/07	1400	SA
	20935(Lower Slate)	6.2	6.4	6.2	6.4	6.0	6.0	6.1	6.1	5.5	6.3	6.2	3	5	9/3/07	1430	SA
	20938 (Lower Sherman)	6.0	6.3	5.9	5.8	6.1	5.7	5.8	5.8	6.2	6.2	6.3	4	5	9/4/07	1730	9/R
	20939 (Middle Sherman)	6.2	6.3	6.3	6.3	6.2	6.1	5.9	5.9	6.0	5.8	6.1	5	5	9/5/07	1415	AP
	0												6	5	9/6/07	1030	AP
	0												7	5	9/7/07	1545	AP
	0												8	5	9/8/07	1130	AP
	0												9	5	9/9/07	0950	AP
													10	5	9/10/07	1055	TO
Temp (deg C)	Sand (cont)	22	22	23	23	22	22	22	22	22	22	22	0	D35	8/31/07	1200	AJ
	Form sed (cont)	22	22	23	23	22	22	22	22	22	22	22	1	D-37	9/1/07	1200	mm
	20934 (Lower Johnson)	22	22	23	23	22	22	22	22	22	22	22	2	D-37	9/2/07	1400	SA
	20935(Lower Slate)	22	22	23	23	22	22	22	22	22	22	22	3	D-37	9/3/07	1430	SA
	20938 (Lower Sherman)	22	22	23	23	22	22	22	22	22	22	22	4	D-35	9/4/07	1730	9/R
	20939 (Middle Sherman)	22	22	23	23	22	22	22	22	22	22	22	5	D-35	9/5/07	1415	AP
	0												6	D-37	9/6/07	1030	AP
	0												7	D-37	9/7/07	1545	AP
	0												8	D-36	9/8/07	1130	AP
	0												9	D-36	9/9/07	0950	AP
													10	D-36	9/10/07	1055	TO
pH	Sand (cont)	8.0	8.1	8.1	8.0	7.7	7.9	8.0	8.0	8.0	8.0	8.1	0	5	8/31/07	1215	EMH
	Form sed (cont)	7.8	8.1	8.2	8.0	8.0	7.8	7.8	7.9	7.9	7.8	7.9	1	16	9/1/07	1200	mm
	20934 (Lower Johnson)	8.1	8.2	8.1	8.2	8.0	8.1	8.0	8.0	8.2	8.1	8.2	2	16	9/2/07	1400	SA
	20935(Lower Slate)	7.2	8.0	7.4	7.9	7.6	7.7	7.7	7.6	7.5	8.0	7.8	3	16	9/3/07	1430	SA
	20938 (Lower Sherman)	7.6	7.6	7.8	7.8	7.8	7.7	7.7	7.8	8.0	8.0	7.9	4	16	9/4/07	1730	9/R
	20939 (Middle Sherman)	7.1	7.7	7.5	7.8	7.6	7.8	7.6	7.6	7.6	7.7	7.7	5	16	9/5/07	1415	AP
	0												6	16	9/6/07	1030	AP
	0												7	16	9/7/07	1545	AP
	0												8	16	9/8/07	1130	AP
	0												9	16	9/9/07	0950	AP
	Replicate	A	B	C	D	E	E	B	G	C	D	H	10	16	9/10/07	1055	TO

0494HOE

DAILY TESTING LOG — *H. azteca* — Chronic, Static Renewal — Project No. 8503-128-058 – (015, 017, 019, 021)

Day	Bath CT	Range	Feeding	Initials/Date
Day -1	Mixed all sediments by hand for min. of 3 minutes; added sediment to beakers + added overlying water			
Day 0	Started drips, added organisms; collected overlying water from each treatment.		1.0 ml YTC @ 1700 DAP	DAP 8/31/07
Day 1	22.8°C	21.8 – 23.0°C	1.0 mL YTC @ 1215 mm	mm 9/1/07
Day 2	23.0°C	23.0 – 23.6°C	1.0 mL YTC @ 1400 SA	SA 9/2/07
Day 3	23.0°C	23.0 – 23.0°C	1.0 mL YTC @ 1530 mm	mm 9/3/07
Day 4	23.0°C	23.0 – 23.2°C	1.0 mL YTC @ ~~1445 SA~~ (1) @ 1735 (2) DAP for TD	~~SA~~ (1) (2) DAP for TD 9/4/07
Day 5	23.0°C	23.0 – 23.2°C	1.0 mL @ 1445 SA	SA 9/5/07
Day 6	23.0°C	23.0 – 23.2°C	1.0 mL YTC @ 1100 AP	AP 9/6/07
Day 7	23.0°C	23.0°C – 23.2°C	1.0 ml YTC @ 1700 AP	AP 9/7/07
Day 8	23.0°C	23.0°C – 23.0°C	1.0 ml YTC @ 1145	AP 9/8/07
Day 9	23.0°C	23.0° – 23.2°C	1.0 ml YTC @ 1000	AP 9/9/07
Day 10	23.0°C	23.0 – 23.2°C	NA	TD 9/10/07

(1) SA 9/5/07 E (2) DAP 12-20-07 – Entered For TD

DAP 12-15-07
QA: AR 12/19/07

8503-128-058 - (015, 017, 019, 021) H. azteca

Chamber Randomization

CONC	REP	RANDOM	RANK	
Sand	A	0.950693	5	A5
	B	0.219865	40	E8
	C	0.545308	25	D1
	D	0.56322	24	C8
	E	0.957808	4	A4
	F	0.471609	30	D6
	G	0.31373	37	E5
	H	0.027451	47	F7
Form	A	0.582723	22	C6
	B	0.189416	41	F1
	C	0.535141	26	D2
	D	0.933434	8	A8
	E	0.031942	46	F6
	F	0.626097	19	C3
	G	0.991302	1	A1
	H	0.933599	7	A7
Lower Johnson	A	0.686043	16	B8
	B	0.290956	38	E6
	C	0.282652	39	E7
	D	0.716167	15	B7
	E	0.655763	18	C2
	F	0.890815	11	B3
	G	0.346946	35	E3
	H	0.12749	43	F3
Lower Slate	A	0.422492	33	E1
	B	0.459339	31	D7
	C	0.495582	28	D4
	D	0.94173	6	A6
	E	0.885998	12	B4
	F	0.609503	21	C5
	G	0.524796	27	D3
	H	0.928737	10	B2
Lower Sherman	A	0.362406	34	E2
	B	0.085397	44	F4
	C	0.671109	17	C1
	D	0.931822	9	B1
	E	0.619742	20	C4
	F	0.574455	23	C7
	G	0.977279	2	A2
	H	0.153997	42	F2
Middle Sherman	A	0.752704	14	B6
	B	0.473198	29	D5
	C	0.004558	48	F8
	D	0.053209	45	F5
	E	0.319449	36	E4
	F	0.434852	32	D8
	G	0.964246	3	A3
	H	0.798811	13	B5

DAP 12-15-07
QA: [illegible] 12/19/07

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 8503-128-058-(019,027, 028,020)	Test Substance: Sediment	Comments:
Species: H. azteca	Analyst Tare: mm Analyst Gross: SA	Analytical Balance ID: Sart #1 ⑦ Dried in Oven # 3 from Date:____ Time:____ to Date:____ Time:____
Date/Time of Tare Wt.: 9/12/07 @ 1130	Date/Time of Gross Wt.: 9/17/07 @ 1430	

Weight Type (Circle): Wet Blot Dry **(Dry)** ~~(>100°C)~~ 60-90°C ⑤ AFDW (>500°C) — Lot or Batch Number: 07-029

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Sand	SA		1.09345	① —			0 ③		⑥ 0.029	0	—	
		SB		1.10223	1.10270	0.00047		④ 10(9)	0.052		② ~~10~~ 9*	0.052	0.057
		SC		1.08882	1.08888	0.00006		⑤ 10(~~9~~)	0.006		1	0.060	
		SD		1.06990	1.07052	0.00062		10	0.062		7	0.088	
		SE		1.10804	—			10	⑤ ≠ 0		0	—	
		SF		1.09305	1.09340	0.00035		④ 10(9)	0.039		6*	0.058	
		SG		1.10259	1.10273	0.00014		10	0.014		4	0.035	
		SH		1.08350	1.08380 ②	0.00030		10	0.030		6	0.050	
	Form Sed	FSA		1.10034	1.10054	0.00020		10	0.020	0.017	7	0.028	0.027
		FSB		1.09194	1.09221	0.00027		10	0.027		6	0.045	
		FSC		1.08730	1.08742	0.00012		10	0.012		6 •	0.020	
		FSD		1.08093	1.08101	0.00008		10	0.008		4	0.020	
Blank				1.08176	1.08176	0.00000							
Range													
Mean													

Test Solution Volume: Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① SA 9/17/07 WP
② SA 9/17/07 E
* 1 Less than biological sheet
• 1 more than biological sheet
③ Prob. no organisms added (DAP)
④ 1 org lost in transfer, use # in parentheses (DAP)
⑤ DAP 12-15-07 E
⑥ Excluding Rep A (DAP)
⑦ Drying times not recorded (DAP 12-18-07)

DAP 12-15-07 E①
QA: AC 12/19/07

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 8503-128-058
Species: H. azteca
Date/Time of Tare Wt.: 9/12/07 @ 1130

Test Substance: Sediment
Analyst Tare: MM Analyst Gross: JA
Date/Time of Gross Wt.: 9/17/07 @ 1430

Comments:
Analytical Balance ID: Sart #1
Dried in Oven # 3 from Date:____ Time:____ ②
to Date:____ Time:____

Weight Type (Circle): Wet Blot Dry (Dry) ~~(>100°C)~~ 60-90① AFDW (>500°C)

Lot or Batch Number: 07-029

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Form Sed	FSE		1.09589	1.09602	0.00013		10	0.013		5	0.026	
		FSF		1.07528	1.07540	0.00012		10	0.012		5	0.024	
		FSG		1.09669	1.09706	0.00037		10	0.037		9	0.041	
		FSH		1.11698	1.11704	0.00006		10	0.006		4	0.015	
	Lower Johnson	LJA		1.10092	1.10117	0.00025		10	0.025	0.026	7	0.036	0.036
		LJB		1.07896	1.07928	0.00032		10	0.032		8	0.040	
		LJC		1.11084	1.11116	0.00032		③ 10 (9)	~~0.032~~ 0.036④		7	0.046	
		LJD		1.09679	1.09718	0.00039		10	0.039		9	0.043	
		LJE		1.06151	1.06173	0.00022		10	0.022		6	0.037	
		LJF		1.08130	1.08136	0.00006		10	0.006		3	0.020	
		LJG		1.10172	1.10210	0.00038		10	0.038		9	0.042	
		LJH		1.08898	1.08909	0.00011		10	0.011		5	0.022	
Blank													
Range													
Mean													

Test Solution Volume:
Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

① DAP 12-15-07 E
② Drying times not recorded (12-18-07 DAP)
③ 1 org. lost in transfer, used # in parentheses (DAP)
④ DAP 12-20-07 E

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

DAP 12-15-07
QA: AR 12/19/07

Project Number: 8503-128-058	Test Substance: Sediment	Comments:
Species: H. azteca	Analyst Tare: MM Analyst Gross: SA	Analytical Balance ID: Sart #1
Date/Time of Tare Wt.: 9/12/07 @ 1130	Date/Time of Gross Wt.: 9/17/07 @ 1430	Dried in Oven # 3 from Date:____ Time:____ (2) to Date:____ Time:____

Weight Type (Circle): Wet Blot Dry **(Dry)** (~~>100°C~~ 60-90°C (1)) AFDW (>500°C)

Lot or Batch Number: 07-029

Boat No.	Treatment	Rep.	Length Units: ____	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Lower Slate	SLA		1.09683	1.09716	0.00033		10	0.033	~~0.040~~	5	0.066	0.052
		SLB		1.06617	1.06678	0.00061		10	0.061	0.041 (4)	9	0.068	
		SLC		1.09729	1.09763	0.00034		(3) 10 (9)	0.03~~4~~9 (4)		9	0.038	
		SLD		1.11559	1.11598	0.00039		10	0.039		7	0.056	
		SLE		1.06861	1.06893	0.00032		10	0.032		7	0.046	
		SLF		1.12061	1.12110	0.00049		10	0.049		10	0.049	
		SLG		1.10050	1.10102	0.00052		10	0.052		9	0.058	
		SLH		1.08997	1.09019	0.00022		10	0.022		6	0.037	
	Lower Sherman	SHA		1.07854	1.07877	0.00023		10	0.023	~~0.47~~ 0.047 (1)	4	0.058	0.060
		SHB		1.08392	1.08426	0.00034		10	0.034		7	0.048	
		SHC		1.08131	1.08199	0.00068		10	0.068		10	0.068	
		SHD		1.05514	1.05576	0.00062		10	0.062		9	0.069	
Blank													
Range													
Mean													

Test Solution Volume:	Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

(1) DAP 12/15/07 E
(2) Drying times not recorded (DAP 12-18-07)
(3) 1 org lost in transfer, use # in parentheses (DAP)
(4) DAP 12-20-07 E

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

DAP 12-15-07
QA: AR 12/19/07

Project Number: 8503-128-058
Species: H. azteca
Date/Time of Tare Wt.: 9/12/07 @ 1130
Test Substance: Sediment
Analyst Tare: mm Analyst Gross: SA
Date/Time of Gross Wt.: 9/17/07 @ 1430
Comments:
Analytical Balance ID: Sart #1
Dried in Oven # 3 from Date:____ Time:____ (4)
to Date:____ Time:____

Weight Type (Circle): Wet Blot Dry (Dry) ~~(>100°C)~~ 60-90°C (3) AFDW (>500°C)
Lot or Batch Number: 07-029

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Lower Sherman	SHE		1.09382	1.09434	0.00052		10	0.052		9	0.058	
		SHF		1.08103	1.08157	0.00054		10	0.054		8	0.068	
		SHG		1.06963	1.07017	0.00054		10	0.054		8	0.068	
		SHH		1.07752	1.07784	0.00032		10	0.032		8	0.040	
	Middle Sherman	MSA		1.09730	1.09752	0.00022		10	0.022	0.044	6	0.037	0.054
		MSB		1.12357	1.12409	0.00052		10	0.052		9	0.058	
		MSC		1.09536	1.09573	0.00037		10	0.037		7	0.053	
		MSD		1.08206	1.08270	0.00064		10	0.064		9	0.071	
		MSE		1.10280	1.10298	0.00018		10 (5) (2)	0.036		4*	0.045	
		MSF		1.06973	1.07040	0.00067		10	0.067		10	0.067	
		MSG		1.06494	1.06510	0.00016		10	0.016		6	0.027	
		MSH		1.08286	1.08348	0.00062		10	0.062		8	0.078	
Blank													
Range													
Mean													

Test Solution Volume: Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

*5 less than biological sheet. OSA 9/17/07E
(2) 5 organisms spilled, use number in parentheses for original wt calcs. DAP 12-15-07
(3) DAP 12-15-07E
(4) Drying times not recorded (DAP 12-15-07)

APPENDIX D

Data Sheets for Toxicity Retest November 20 –30, 2007

DAP 12-19-07
QA: AR12/19/07

H. azteca 10-day Survival and Growth, Testing Cover Page

Project Number:	8503-131-058-024		Protocol #:	HA3AK.TIE058.006	
Test Substance:	Sediment				
Test Species:	*H. azteca*	Lot #: 07-047	Age:	10-12 ② ~~7-14~~ days	Supplier: ABS
Test Type:	Chronic, Static Renewal				
Dilution Water:	Mod Hard with 50 mg/L Chloride RW 8422 (Cl⁻ = 530 ① ~~51~~ mg/L)		Investigators:	GUM/~~JK~~/TD/ES/DAP	
Sampling Date(s):	August 17, 2007		Sampling Time(s):	1145 (8/17)	
FCETL Sample #(s):	20934				
Test Initiation Date/Time:	11/20/07 @ 1540				
Test Termination Date/Time:	11/30/07 @ 1530				

Renewal Frequency:	Cont. drip, 2+ vol/da	Feeding Freq:	daily	Food Type/Amount:	1 ml YTC daily	Test Temp:	23 +/- 1 deg C
Test Chamber Capacity:	500-ML	Test Soltn. Vol:	100 mL sed/175 mL H2O	# Repl's/Trtmnt:	8		
Test Duration:	10 days	# Org.'s/Repl:	10	Env. Chmbr/Bath:	#5		

Water Characterization: Minimum of Hardness, Alkalinity, & Conductivity on days 0 and 10; Ammonia on days 0, 3, 7, and 10; No TRC; pH, temperature & DO daily on overlying water
aerate if dissolved oxygen <2.5 mg/L

Test Sediment (s):

1)	Sand (cont)	2)	Form sed (cont)	3)	20934 (Lower Johnson)
4)		5)		6)	
7)		8)		9)	
10)		11)			

Reference Tox. Dates:	Nov 20-24, 2007	LC50:	2,530 mg/L Cl⁻	Hist. Limits:	877-3,037	Method:	S-K
Study Director Initials:	DAP	Date:	11-20-07				

Overlying water added at a minimum of 2 volume additions/day; equivalent to >350 ml/day or >0.24 ml/min

① DAP 12-15-07 E ② DAP 12-20-07 E

DSP 12-18-07
QA: AR 12/19/07

BIOLOGICAL DATA
(11/30/07)

H. azteca Chronic, Static Renewal Project 8503-131-058-024

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks: % survival
Sand (cont)	# Surviving	10	9	10	10	10	10	10*	10	*only 9 transferred to pan (1 lost TE)
	# Observed Dead	0	0	0	0	0	0	0	0	98.75%
	# Not Found	0	1	0	0	0	0	0	0	
Form sed (cont)	# Surviving	9	10	7	9	10	10	10	9*	*only 8 transferred to pan (1 lost TE)
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	1	0	3	1	0	0	0	1	92.5%
20934 (Lower Johnson)	# Surviving	10	9	10	7	10	8	10	9	
	# Observed Dead	0	0	0	0	0	0	0	0	91.25%
	# Not Found	0	1	0	3	0	2	0	1	
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
	# Surviving									
	# Observed Dead									
	# Not Found									

Page 3 of 17
DAP 12-19-07
QA: AR 12/19/07

CHEMICAL DATA (Composite of Overlying Water) *H. azteca* Chronic, Static Renewal Project 8503-131-058-024

Parameter	Sediment	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day	Meter	Date	Time	Initials
Dissolved Oxygen (mg/l)	Sand (cont)	6.8	6.8	6.8	6.9	6.9	6.7	6.4	6.5	6.6	6.6	6.4	0	5	11/20/07	1550	GMM
	Form sed (cont)	6.8	6.3	6.5	6.7	6.6	6.6	6.3	5.9	6.4	6.3	6.5	1	5	11/21/07	1400	AP
	20934 (Lower Johnson)	6.7	6.6	6.6	6.4	6.7	6.4	6.3	6.3	6.3	6.3	6.3	2	5	11/22/07	1520	[illegible]
	0												3	5	11/23/07	1700	[illegible]
	0												4	5	11/24/07	1530	AP
	0												5	5	11/25/07	1300	DAP
	0												6	5	11/26/07	1550	TD
	0												7	5	11/27/07	1620	TD
	0												8	5	11/28/07	1625	ES
	0												9	5	11/29/07	1650	TD
													10	5	11/30/07	0945	[illegible]
Temp (deg C)	Sand (cont)	22	21	22	22	22	22	23	22	22	23	22	0		11/20/07	1550	GMM
	Form sed (cont)	22	21	21	22	22	22	23	23	23	23	22	1	0-36	11/21/07	1400	AP
	20934 (Lower Johnson)	22	21	21	22	22	22	23	23	23	22	23	2	D35	11/22/07	1520	[illegible]
	0												3	D35	11/23/07	1700	[illegible]
	0												4	D37	11/24/07	1530	AP
	0												5	D35	11/25/07	1250	DAP
	0												6	D35	11/26/07	1550	TD
	0												7	D38	11/27/07	1620	TD
	0												8	D36	11/28/07	1625	ES
	0												9	D38	11/29/07	1650	TD
													10	D38	11/30/07	0930	[illegible]
pH	Sand (cont)	7.8	7.7	8.0	8.1	8.0	8.1	8.0	8.0	8.0	8.0	8.1	0	16	11/20/07	1550	GMM
	Form sed (cont)	6.4	6.7	6.9	7.7	7.6	7.8	7.7	7.8	7.8	7.8	8.0	1	16	11/21/07	1400	AP
	20934 (Lower Johnson)	8.0	8.2	8.2	8.2	8.1	8.1	8.2	8.0	8.1	8.2	8.2	2	16	11/22/07	1520	[illegible]
	0												3	16	11/23/07	1700	[illegible]
	0												4	16	11/24/07	1530	AP
	0												5	16	11/25/07	1300	DAP
	0												6	16	11/26/07	1550	TD
	0												7	16	11/27/07	1620	TD
	0												8	16	11/28/07	1625	ES
	0												9	16	11/29/07	1650	TD
	Replicate	A	B	C	D	E	F	G	H	C	B	A	10	16	11/30/07	0945	[illegible]

[illegible] for TD 11/30/07 E

DAP 12-19-07

OVERLYING WATER CHARACTERIZATION | *H. azteca* | Chronic, Static Renewal | Project No. 8503-131-058-024 QA: AR 12/19/07

	Conductivity (µs/cm)		Hardness (mg/L as CaCO3)		Alkalinity (mg/l as CaCO3)		Ammonia (mg/l)			
Sediment	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10	Day 0	Day 3	Day 7	Day 10
Sand (cont)	466	530	104	102	60	75	<1.0		<1.0	<1.0
Form sed (cont)	423	550	60	106	10	77	NM⊙		<1.0	<1.0
20934 (Lower Johnson)	518	540	136	148	34	97	<1.0		<1.0	<1.0
0										
0										
0										
0										
0										
0										
0										
Meter #	15	15	titr	titr	titr	titr	3		3	3
Date:	11/20/07	11/30/07	11/20/07	11/30/07	11/20/07	11/30/07	11/27/07		11/27/07	12/7/07
Time:	1100	1030	1100	1030	1100	1030	1600		1600	1600
Initials:	gw	gw	gw	gw	gw	gw	TD		TD	SA

⊙ Not measured on Day 0 DAP 12-18-07

DAILY TESTING LOG *H. azteca* Chronic, Static Renewal Project No. 8503-131-058-024

Day	Bath CT	Range	Feeding	Initials/Date
Day -1	Mixed all sediments by hand for a minimum of 3 minutes; added sediment to beakers + add organisms			
Day 0	Collected overlying water from each treatment. Started drips + added organisms.		1 ml YTC / chmbr/day	DAP 11-20-07
Day 1	22.8°C	16.2 - 24.8°C	1 ml YTC / chmbr /day	AP 11/21/07
Day 2	23.8°C	23.3 - 24.8°C	1ml YTC/chbr @1525	[illegible] 11/22/07
Day 3	24.4°C	23.4 - 24.8°C	①	
Day 4	24.6°C	24.4 - 25.2°C	1 ml YTC/chmbr @ 1630	DAP 11/24/07
Day 5	24.8°C	24.4 - 25.4°C	①	
Day 6	25.6°C	24.4 - 27.0°C	1mL YTC/chmbr @ 1545	TD 11/26/07
Day 7	25.0°C	23.4 - 27.0°C	1mL YTC/chmbr @ 1640	TD 11/27/07
Day 8	23.6°C	23.0 - 24.4°C	1mL YTC chmbr @1630	TD 11/28/07
Day 9	23.4°C	23.4 - 24.0°C	1mL YTC chmbr @1200	TD 11/29/07
Day 10	23.6°C	23.0 - 24.0°C	None	[illegible] 11/30/07

① organisms were fed on those days, but notations were not made DAP 12-19-07

DAP 12-19-07
QA: AR 12/19/07

THREE TREATMENTS EIGHT REPLICATES
RANDOM CHAMBER LOCATION "Griff"

Project No. 8503-131-058-024

2F	1H	3B
3A	2D	1D
3H	1E	2B
1A	1F	3F
3E	3D	2G
3G	2A	3C
1C	1B	2C
2H	2E	1G

1=Sand Control
2=Form Sediment Control
3=Lower Johnson

FCETL QA Form No.010
Revision 5
Effective 08/99
QA: AR12/19/07

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 8503-134-058
Species: H. azteca
Date/Time of Tare Wt.: 11/30/07 - 1540

Test Substance: Sediment
Analyst Tare: EMH   Analyst Gross: ~~[illegible]~~
Date/Time of Gross Wt.: 12/4/07 @0950

Comments:
Analytical Balance ID: Sart #1
Dried in Oven # 3 from Date: ____ Time: ____
to Date: ____ Time: ____ ③

Weight Type (Circle): Wet Blot Dry Dry ~~(>100°C)~~ 60-90°C ② AFDW (>500°C)

Lot or Batch Number: 07-047 (circled)

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Sand	A		1.08976	1.09066			10			10		
	Control	B		1.07312	1.07401			10			9		
		C		1.09512	1.09623			10			10		
		D		1.08975	1.09076			10			10		
		E		1.09701	1.09801			10			10		
		F		1.10416	1.10536			10			10		
		G		1.09744	1.09838			10 (9) ①			(10) 9 ①		
		H		1.08060	1.08116			10			10		
	Form	A		1.07087	1.07143			10			9		
	Sediment	B		1.09685	1.09763			10			10		
		C		1.10999	1.11051			10			7		
		D		1.06350	1.06445			10			9		
Blank				1.10148	1.10144	-0.00004		~~10~~ ④					
Range													
Mean													

Test Solution Volume:
Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

④ AR for DAP 12/19/07 NA

① 1 lost during transfer, use '9' to calc. wt/orig organism (DAP 12-17-07)
② DAP 12/17/07 E
③ Dates + times for drying not recorded DAP 12-17-07

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 8503-131-058	Test Substance: Sediment	Comments:
Species: H. azteca	Analyst Tare: EMH Analyst Gross: [initials]	Analytical Balance ID: Sart #1
Date/Time of Tare Wt.: 11/30/07 1540	Date/Time of Gross Wt.: 12/4/07 @ 0950	Dried in Oven # 3 from Date: ____ Time: ____ to Date: ____ Time: ____ (3)

Weight Type (Circle): Wet Blot Dry Dry ~~(>100°C)~~ 60-90°C (2) AFDW (>500°C)

(Lot) or Batch Number: 07-047

Boat No.	Treatment	Rep.	Length Units:	Tare Weight (g)	Gross Weight (g)	Net Weight (g)	Adjusted Net Weight (g)[1]	No. of Orig. Organisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	Form	E		1.08552	1.08634			10			10		
	Sed.	F		1.09525	1.09573			10			10		
		G		1.07475	1.07544			10 ~~(9)~~ (2) (1)			10		
		H		1.08549	1.08604			10 (9) (1)			(9) 8 (1)		
	Lower	A		1.10368	1.10416			10			10		
	Johnson	B		1.08673	1.08722			10			9		
		C		1.11162	1.11219			10			10		
		D		1.09393	1.09426			10			7		
		E		1.10846	1.10882			10			(4) ~~8~~ 10		
		F		1.11049	1.11092			10			8		
		G		1.10898	1.10945			10			10		
		H		1.05853	1.05901			10			9		
Blank													
Range													
Mean													

Test Solution Volume:	Loading Rate:

[1] Add in weight loss of blank boat, if appropriate.

(1) 1 Lost during transfer, use '9' to calc. wt/orig organism (DAP 12-12-07)
(2) DAP 12/12/07 E
(3) Dates + Times for drying not recorded DAP 12-17-07
(4) Arc for DAP 12/19/07 E

DAP 12-20-07

QA: [illegible] 12/20/07

spreadsheet for lengths, weights, etc

Test number	8503-131-058-024	Test Substance	Sediment
Species	H. azteca lot 07-047	Data entered by	Pillard

Boat #	Treatment	Rep	Length	Tare wt (g)	Gross wt (g)	Net wt (g)	Adjusted Net wt (g)	No. of Original Organisms	Mean wt per Orig (mg)	Mean wt per Treatment (orig) (mg)	No. of Surviving Organisms	Mean wt per Surviving (mg)	Mean wt per Treatment (surv) (mg)
	Sand Control	A		1.08976	1.09066	0.00090	0.00094	10	0.094	0.107	10	0.094	0.108
	Sand Control	B		1.07312	1.07401	0.00089	0.00093	10	0.093	-	9	0.103333	
	Sand Control	C		1.09512	1.09623	0.00111	0.00115	10	0.115	-	10	0.115	
	Sand Control	D		1.08975	1.09076	0.00101	0.00105	10	0.105	-	10	0.105	
	Sand Control	E		1.09701	1.09801	0.00100	0.00104	10	0.104	-	10	0.104	
	Sand Control	F		1.10416	1.10536	0.00120	0.00124	10	0.124	-	10	0.124	
	Sand Control	G		1.09744	1.09838	0.00094	0.00098	9	0.109	-	9	0.108889	
	Sand Control	H		1.08010	1.08116	0.00106	0.00110	10	0.110		10	0.11	
	Form Sediment	A		1.07087	1.07143	0.00056	0.00060	10	0.060	0.068	9	0.066667	0.074
	Form Sediment	B		1.09685	1.09763	0.00078	0.00082	10	0.082	-	10	0.082	
	Form Sediment	C		1.10999	1.11051	0.00052	0.00056	10	0.056	-	7	0.08	
	Form Sediment	D		1.06380	1.06445	0.00065	0.00069	10	0.069	-	9	0.076667	
	Form Sediment	E		1.08552	1.08634	0.00082	0.00086	10	0.086	-	10	0.086	
	Form Sediment	F		1.09525	1.09573	0.00048	0.00052	10	0.052	-	10	0.052	
	Form Sediment	G		1.07475	1.07544	0.00069	0.00073	10	0.073	-	10	0.073	
	Form Sediment	H		1.08549	1.08604	0.00055	0.00059	9	0.066		8	0.07375	
	Lower Johnson	A		1.10368	1.10416	0.00048	0.00052	10	0.052	0.049	10	0.052	0.054
	Lower Johnson	B		1.08673	1.08722	0.00049	0.00053	10	0.053	-	9	0.058889	
	Lower Johnson	C		1.11162	1.11219	0.00057	0.00061	10	0.061	-	10	0.061	
	Lower Johnson	D		1.09393	1.09426	0.00033	0.00037	10	0.037	-	7	0.052857	
	Lower Johnson	E		1.10846	1.10882	0.00036	0.00040	10	0.040	-	10	0.04	
	Lower Johnson	F		1.11049	1.11092	0.00043	0.00047	10	0.047	-	8	0.05875	
	Lower Johnson	G		1.10898	1.10945	0.00047	0.00051	10	0.051	-	10	0.051	
	Lower Johnson	H		1.05853	1.05901	0.00048	0.00052	10	0.052		9	0.057778	
Blank				1.10148	1.10144	-4E-05							

DAP 12-20-07

Statistix 8.0 131-058-024 comparin..., 12/18/2007,
8:49:10 AM

QA: AR 12/20/07

Descriptive Statistics - Survival

	Sand	Formulated	Lower Johnson
N	8	8	8
Mean	0.9875	0.9250	0.9125
SD	0.0354	0.1035	0.1126
SE Mean	0.0125	0.0366	0.0398
C.V.	3.5803	11.190	12.340
Minimum	0.9000	0.7000	0.7000
Median	1.0000	0.9500	0.9500
Maximum	1.0000	1.0000	1.0000

Statistix 8.0 131-058-024 comparin..., 12/18/2007,
8:50:54 AM

Descriptive Statistics - Weight (mg) per Original Organism

	Sand	Formulated	Lower Johnson
N	8	8	8
Mean	0.1068	0.0680	0.0491
SD	0.0103	0.0120	7.661E-03
SE Mean	3.644E-03	4.255E-03	2.709E-03
C.V.	9.6544	17.700	15.596
Minimum	0.0930	0.0520	0.0370
Median	0.1070	0.0675	0.0515
Maximum	0.1240	0.0860	0.0610

Statistix 8.0 131-058-024 comparin..., 12/18/2007,
8:52:07 AM

Descriptive Statistics - Weight (mg) per Surviving Organism

	Sand	Formulated	Lower Johnson
N	8	8	8
Mean	0.1080	0.0739	0.0541
SD	8.912E-03	0.0106	6.813E-03
SE Mean	3.151E-03	3.749E-03	2.409E-03
C.V.	8.2521	14.352	12.587
Minimum	0.0940	0.0520	0.0400
Median	0.1070	0.0755	0.0555
Maximum	0.1240	0.0860	0.0610

DRP 12-19-07
QA: AR 12/20/07

Title: 08503-131-058-024 Hyalella sediment survival
File: 131058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.3615
W = 0.8579

Critical W = 0.8840 (alpha = 0.01 , N = 24)
W = 0.9160 (alpha = 0.05 , N = 24)

Data FAIL normality test (alpha = 0.01). Try another transformation.

Warning - The first three homogeneity tests are sensitive to non-normality and should not be performed with this data as is.

Title: 08503-131-058-024 Hyalella sediment,control comparison
File: 131058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 6.4277 (p-value = 0.0402)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 9.2103 (alpha = 0.01, df = 2)
= 5.9915 (alpha = 0.05, df = 2)

DAP 12-19-07
QA: AR 12/20/07

Statistix 8.0 12/17/2007,
11:39:52 AM

Kruskal-Wallis One-Way Nonparametric AOV
Comparison of survival in Sand Control and Formulated Sediment Control

Variable	Mean Rank	Sample Size
tformulat	6.9	8
tsand	10.1	8
Total	8.5	16

Kruskal-Wallis Statistic 2.6042
P-Value, Using Chi-Squared Approximation 0.1066

P > 0.05
No sign. Diff

Parametric AOV Applied to Ranks

Source	DF	SS	MS	F	P
Between	1	39.063	39.0625	2.94	0.1084
Within	14	185.938	13.2813		
Total	15	225.000			

Total number of values that were tied 15
Max. diff. allowed between ties 0.00001

Cases Included 16 Missing Cases 0

DAP 12-19-07

Statistix 8.0 131-058-024 comparin..., 12/17/2007, QA: ARV 12/20/07
4:00:21 PM

Kruskal-Wallis One-Way Nonparametric AOV
Comparison of survival in Sand Control and Lower Johnson

Variable	Mean Rank	Sample Size
tsand	10.1	8
tLJohn	6.9	8
Total	8.5	16

Kruskal-Wallis Statistic 2.7796
P-Value, Using Chi-Squared Approximation 0.0955

P > 0.05
No sign. Diff

Parametric AOV Applied to Ranks

Source	DF	SS	MS	F	P
Between	1	42.250	42.2500	3.18	0.0960
Within	14	185.750	13.2679		
Total	15	228.000			

Total number of values that were tied 14
Max. diff. allowed between ties 0.00001

Cases Included 16 Missing Cases 0

DAP 12-19-07
QA: AR 12/19/07

Title: 08503-131-058-024 H azteca wt per original organism
File: 058024WT.ORG Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 0.0022
W = 0.9553

Critical W = 0.8840 (alpha = 0.01 , N = 24)
W = 0.9160 (alpha = 0.05 , N = 24)

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: 08503-131-058-024 H azteca wt per original organism
File: 058024WT.ORG Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 1.3036 (p-value = 0.5211)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

Critical B = 9.2103 (alpha = 0.01, df = 2)
= 5.9915 (alpha = 0.05, df = 2)

DAP 12-20-07
QA: AR 12/20/07

```
Title:  08503-131-058-024 H azteca wt per surviving organism
File:      058024WT.SUR             Transform:            NO TRANSFORMATION

                  Shapiro - Wilk's Test for Normality
-----------------------------------------------------------------------------

     D =   0.0017
     W =   0.9605

     Critical W  = 0.8840 (alpha = 0.01 , N = 24)
              W  = 0.9160 (alpha = 0.05 , N = 24)

-----------------------------------------------------------------------------

Data PASS normality test (alpha = 0.01). Continue analysis.


Title:  08503-131-058-024 H azteca wt per surviving organism
File:      058024WT.SUR             Transform:            NO TRANSFORMATION

               Bartlett's Test for Homogeneity of Variance
-----------------------------------------------------------------------------

Calculated B1 statistic =  1.2478               (p-value = 0.5358)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

-----------------------------------------------------------------------------

Critical B =  9.2103  (alpha = 0.01, df =  2)
           =  5.9915  (alpha = 0.05, df =  2)
```

DAP 12-19-07
QA: AR12/19/07

Statistix 8.0 131-058-024 comparin..., 12/18/2007, 8:36:00 AM

Two-Sample T Tests for sandwtnor vs formwtnor
Comparison of weight per original organisms in Sand Control and Formulated Sediment Control

Variable	Mean	N	SD	SE
sandwtnor	0.1068	8	0.0103	3.64E-03
formwtnor	0.0680	8	0.0120	4.26E-03
Difference	0.0387			

Null Hypothesis: difference = 0
Alternative Hyp: difference <> 0

Assumption	T	DF	P	95% CI for Difference Lower	Upper
Equal Variances	6.92	14	0.0000	0.0267	0.0508
Unequal Variances	6.92	13.7	0.0000	0.0267	0.0508

Test for Equality of Variances	F	DF	P
	1.36	7,7	0.3463

Cases Included 16 Missing Cases 0

$p < 0.05$ Sign. Diff

Statistix 8.0 131-058-024 comparin..., 12/18/2007, 8:37:58 AM

Two-Sample T Tests for sandwtsur vs formwtsur
Comparison of weight per surviving organisms in Sand Control and Formulated Sediment Control

Variable	Mean	N	SD	SE
sandwtsur	0.1080	8	8.91E-03	3.15E-03
formwtsur	0.0739	8	0.0106	3.75E-03
Difference	0.0341			

Null Hypothesis: difference = 0
Alternative Hyp: difference <> 0

Assumption	T	DF	P	95% CI for Difference Lower	Upper
Equal Variances	6.97	14	0.0000	0.0236	0.0446
Unequal Variances	6.97	13.6	0.0000	0.0236	0.0447

Test for Equality of Variances	F	DF	P
	1.42	7,7	0.3291

Cases Included 16 Missing Cases 0

$p < 0.05$ Sign. Diff

DAP 12-20-07
QA: AK 12/20/07

Statistix 8.0 131-058-024 comparin..., 12/17/2007, 4:42:49 PM

Two-Sample T Test for sandwtnor vs LJohnwtor
Comparison of weight per original organisms in Sand Control and Lower Johnson

Variable	**Mean**	**N**	**SD**	**SE**
sandwtnor	0.1068	8	0.0103	3.64E-03
LJohnwtor	0.0491	8	7.66E-03	2.71E-03
Difference	0.0576			

Null Hypothesis: difference = 0
Alternative Hyp: difference <> 0

				95% CI for Difference	
Assumption	**T**	**DF**	**P**	**Lower**	**Upper**
Equal Variances	12.69	14	0.0000	0.0479	0.0674
Unequal Variances	12.69	12.9	0.0000	0.0478	0.0674

Test for Equality of Variances	**F**	**DF**	**P**
	1.81	7,7	0.2261

Cases Included 16 Missing Cases 0

P < 0.05
Sign. Diff

Statistix 8.0 131-058-024 comparin..., 12/17/2007, 4:44:36 PM

Two-Sample T Tests for sandwtsur vs LJohnwtsu
Comparison of weight per surviving organisms in Sand Control and Lower Johnson

Variable	**Mean**	**N**	**SD**	**SE**
sandwtsur	0.1080	8	8.91E-03	3.15E-03
LJohnwtsu	0.0541	8	6.81E-03	2.41E-03
Difference	0.0539			

Null Hypothesis: difference = 0
Alternative Hyp: difference <> 0

				95% CI for Difference	
Assumption	**T**	**DF**	**P**	**Lower**	**Upper**
Equal Variances	13.58	14	0.0000	0.0454	0.0624
Unequal Variances	13.58	13.1	0.0000	0.0453	0.0624

Test for Equality of Variances	**F**	**DF**	**P**
	1.71	7,7	0.2476

Cases Included 16 Missing Cases 0

P < 0.05
Sign. Diff.

APPENDIX E

Analysis of Variance and Multiple Comparison Statistics Among the Four Test Sediments

DAP 12-20-07

Statistix 8.0
9:40:20 AM

12/18/2007, QPT:AR12/20/07

Descriptive Statistics - Survival

	LJohnson	LSlate	LSherman	MSherman
N	8	8	8	8
Mean	0.6875	0.7875	0.7875	0.8000
SD	0.2100	0.1885	0.1808	0.1512
SE Mean	0.0743	0.0666	0.0639	0.0535
C.V.	30.548	23.938	22.955	18.898
Minimum	0.3000	0.5000	0.4000	0.6000
Median	0.7500	0.8000	0.8000	0.8500
Maximum	0.9000	1.0000	1.0000	1.0000

Statistix 8.0
9:42:27 AM

12/18/2007,

Descriptive Statistics - Weight (mg) per Original Organism

	LJohnwtor	LSlatewto	LShermwto	MShermwto
N	8	8	8	8
Mean	0.0261	0.0408	0.0474	0.0445
SD	0.0125	0.0126	0.0158	0.0196
SE Mean	4.414E-03	4.439E-03	5.603E-03	6.939E-03
C.V.	47.784	30.811	33.450	44.101
Minimum	6.000E-03	0.0220	0.0230	0.0160
Median	0.0285	0.0385	0.0530	0.0445
Maximum	0.0390	0.0610	0.0680	0.0670

Statistix 8.0
9:44:03 AM

12/18/2007,

Descriptive Statistics - Weight (mg) per Surviving Organism

	LJohnwtsr	LSlatewts	LShermwts	MShermwts
N	8	8	8	8
Mean	0.0358	0.0523	0.0596	0.0545
SD	9.662E-03	0.0118	0.0108	0.0175
SE Mean	3.416E-03	4.161E-03	3.836E-03	6.193E-03
C.V.	27.027	22.524	18.195	32.142
Minimum	0.0200	0.0370	0.0400	0.0270
Median	0.0385	0.0525	0.0630	0.0555
Maximum	0.0460	0.0680	0.0690	0.0780

DRP 12-19-07

Statistix 8.0 12/18/2007, QA: AR 12/20/07
9:48:21 AM

Shapiro-Wilk Normality Test

Variable	N	W	P
tLJohn	8	0.9315	0.5295
tLSlate	8	0.9026	0.3049
tLSherm	8	0.9348	0.5605
tMSherm	8	0.9093	0.3493

Statistix 8.0 12/18/2007,
9:49:34 AM

Comparison of survival Data among sites

One-Way AOV for: tLJohn tLSlate tLSherm tMSherm

Source	DF	SS	MS	F	P
Between	3	0.14461	0.04820	0.74	0.5369
Within	28	1.82282	0.06510		
Total	31	1.96744			

P > 0.05
No Sign. Diff

Grand Mean 1.1095 CV 23.00

		Chi-Sq	DF	P
Bartlett's Test of Equal Variances		0.59	3	0.8980
Cochran's Q	0.3433			
Largest Var / Smallest Var	1.6782			

Component of variance for between groups -0.00211
Effective cell size 8.0

Variable	Mean
tLJohn	0.9943
tLSlate	1.1617
tLSherm	1.1333
tMSherm	1.1485

Observations per Mean 8
Standard Error of a Mean 0.0902
Std Error (Diff of 2 Means) 0.1276

DAP 12-20-07
QA: AR 12/20/07

Statistix 8.0 12/20/2007,
10:12:44 AM

Shapiro-Wilk Normality Test

Variable	N	W	P
LJohnwtor	8	0.9012	0.2961
LSlatewto	8	0.9738	0.9264
LShermwto	8	0.9254	0.4749
MShermwto	8	0.9104	0.3571

Statistix 8.0 12/20/2007,
10:09:55 AM

Comparison of dry wt/original organism among sites

One-Way AOV for: LJohnwtor LSlatewto LShermwto MShermwto

Source	DF	SS	MS	F	P
Between	3	0.00214	7.129E-04	3.00	0.0472
Within	28	0.00665	2.374E-04		
Total	31	0.00879			

— $p < 0.05$ Sign. Diff

Grand Mean 0.0397 CV 38.83

	Chi-Sq	DF	P
Bartlett's Test of Equal Variances	1.92	3	0.5888
Cochran's Q	0.4055		
Largest Var / Smallest Var	2.4714		

Component of variance for between groups 5.943E-05
Effective cell size 8.0

Variable	Mean
LJohnwtor	0.0261
LSlatewto	0.0408
LShermwto	0.0474
MShermwto	0.0445

Observations per Mean 8
Standard Error of a Mean 5.448E-03
Std Error (Diff of 2 Means) 7.705E-03

LSD All-Pairwise Comparisons Test

Variable	Mean	Homogeneous Groups
LShermwto	0.0474	A
MShermwto	0.0445	A
LSlatewto	0.0408	AB
LJohnwtor	0.0261	B

Alpha 0.05 Standard Error for Comparison 7.705E-03
Critical T Value 2.048 Critical Value for Comparison 0.0158
There are 2 groups (A and B) in which the means
are not significantly different from one another.

DRP (2-19-07)

Statistix 8.0 12/18/2007, QA: ARE 12/20/07
10:13:59 AM

Shapiro-Wilk Normality Test

Variable	N	W	P
LJohnwtsr	8	0.8518	0.0994
LSlatewts	8	0.9351	0.5640
LShermwts	8	0.8325	0.0630
MShermwts	8	0.9743	0.9295

Statistix 8.0 Comparison of dry wt/surviving organism among sites 12/18/2007,
10:15:09 AM

One-Way AOV for: LJohnwtsr LSlatewts LShermwts MShermwts

Source	DF	SS	MS	F	P
Between	3	0.00256	8.530E-04	5.20	0.0056
Within	28	0.00459	1.641E-04		
Total	31	0.00715			

$p < 0.05$ Sign. Diff

Grand Mean 0.0505 CV 25.35

		Chi-Sq	DF	P
Bartlett's Test of Equal Variances		2.91	3	0.4060
Cochran's Q	0.4675			
Largest Var / Smallest Var	3.2869			

Component of variance for between groups 8.612E-05
Effective cell size 8.0

Variable	Mean
LJohnwtsr	0.0358
LSlatewts	0.0523
LShermwts	0.0596
MShermwts	0.0545
Observations per Mean	8
Standard Error of a Mean	4.529E-03
Std Error (Diff of 2 Means)	6.405E-03

Statistix 8.0 12/18/2007,
10:15:42 AM

LSD All-Pairwise Comparisons Test

Variable	Mean	Homogeneous Groups
LShermwts	0.0596	A
MShermwts	0.0545	A
LSlatewts	0.0523	A
LJohnwtsr	0.0358	B

Alpha 0.05 Standard Error for Comparison 6.405E-03
Critical T Value 2.048 Critical Value for Comparison 0.0131
There are 2 groups (A and B) in which the means
are not significantly different from one another.

APPENDIX F

Analytical Data

Thursday, October 04, 2007

MSE Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR AK

Work Order: 0709048

Dear Dave Pillard:

MSE Lab Services received 4 sample(s) on 9/6/2007 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Marcee Cameron

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SHERMAN
Lab Order:	0709048	**Collection Date:**	8/15/2007 10:00:00 AM
Project:	COEUR AK		
Lab ID:	0709048-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	16500	57.6		mg/Kg-dry	5	10/1/2007
Chromium	47.1	25.6		mg/Kg-dry	5	10/1/2007
Nickel	ND	32.0		mg/Kg-dry	5	10/1/2007
Silver	ND	6.39		mg/Kg-dry	5	10/1/2007
Zinc	100	12.8		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	23.7	0.398		mg/Kg-dry	2	9/27/2007
Cadmium	0.533	0.027		mg/Kg-dry	2	9/27/2007
Copper	98.6	0.331		mg/Kg-dry	2	9/27/2007
Lead	19.6	0.053		mg/Kg-dry	2	9/27/2007
Selenium	0.815	0.530		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0621	0.0297	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	1.3	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

wm **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	MIDDLE SHERMAN
Lab Order:	0709048	**Collection Date:**	8/18/2007 10:30:00 AM
Project:	COEUR AK		
Lab ID:	0709048-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	16700	61.1		mg/Kg-dry	5	10/1/2007
Chromium	53.0	27.1		mg/Kg-dry	5	10/1/2007
Nickel	ND	33.9		mg/Kg-dry	5	10/1/2007
Silver	ND	6.79		mg/Kg-dry	5	10/1/2007
Zinc	87.0	13.6		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	7.71	0.410		mg/Kg-dry	2	9/27/2007
Cadmium	0.095	0.027		mg/Kg-dry	2	9/27/2007
Copper	22.2	0.342		mg/Kg-dry	2	9/27/2007
Lead	3.51	0.055		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.547		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0832	0.0334	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	1.4	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

mm **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE-TA Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER JOHNSON
Lab Order:	0709048	**Collection Date:**	8/17/2007 11:45:00 AM
Project:	COEUR AK		
Lab ID:	0709048-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	23000	63.3		mg/Kg-dry	5	10/1/2007
Chromium	66.6	28.1		mg/Kg-dry	5	10/1/2007
Nickel	42.1	35.2		mg/Kg-dry	5	10/1/2007
Silver	ND	7.03		mg/Kg-dry	5	10/1/2007
Zinc	98.6	14.1		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	0.892	0.431		mg/Kg-dry	2	9/27/2007
Cadmium	0.092	0.029		mg/Kg-dry	2	9/27/2007
Copper	8.04	0.359		mg/Kg-dry	2	9/27/2007
Lead	1.67	0.057		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.575		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	ND	0.0303	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	0.3	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	0.24	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

mw **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *04-Oct-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SLATE
Lab Order:	0709048	**Collection Date:**	8/16/2007 12:00:00 PM
Project:	COEUR AK		
Lab ID:	0709048-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**SW3050B**		Analyst: **CJR**
Aluminum	13100	60.3		mg/Kg-dry	5	10/1/2007
Chromium	31.1	26.8		mg/Kg-dry	5	10/1/2007
Nickel	ND	33.5		mg/Kg-dry	5	10/1/2007
Silver	ND	6.70		mg/Kg-dry	5	10/1/2007
Zinc	157	13.4		mg/Kg-dry	5	10/1/2007
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**SW3050B**		Analyst: **SW**
Arsenic	2.81	0.411		mg/Kg-dry	2	9/27/2007
Cadmium	0.207	0.027		mg/Kg-dry	2	9/27/2007
Copper	10.3	0.342		mg/Kg-dry	2	9/27/2007
Lead	2.83	0.055		mg/Kg-dry	2	9/27/2007
Selenium	ND	0.548		mg/Kg-dry	2	9/27/2007
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**		Analyst: **KJ**
Mercury	0.0582	0.0302	H	mg/Kg-dry	1	9/26/2007
ORGANIC MATTER-TOTAL ORGANIC CARBON		**OM_WALKLEYBLACK**				Analyst: **HC**
TOC	2.7	0.05		%	1	10/1/2007
PERCENT COARSE MATERIAL		**ASTMD422**				Analyst: **HC**
Percent Coarse Material	ND	0.05		%	1	9/24/2007
ACID VOLATILE SULFIDE-SIM. EXT. METALS		**AVS-SEM**				Analyst: **CJR**
Sulfide	ND	15.0		umoles/g	1	9/12/2007

mm Review

Qualifiers:

- H Holding times for preparation or analysis exceeded
- Limit Instrument Reporting Limit
- ND Not Detected at the Method Detection Limit (MDL)
- J Analyte detected below the Reporting Limit
- MDL Method Detection Limit

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1212

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: **1212-PB UNFILTERED**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	ND	9.00	mg/Kg							
Chromium	ND	4.00	mg/Kg							
Nickel	ND	5.00	mg/Kg							
Silver	ND	1.00	mg/Kg							
Zinc	ND	2.00	mg/Kg							
Sample ID: **1212-PB FILTERED**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	ND	9.00	mg/Kg							
Chromium	ND	4.00	mg/Kg							
Nickel	ND	5.00	mg/Kg							
Silver	ND	1.00	mg/Kg							
Zinc	ND	2.00	mg/Kg							
Sample ID: **1212-LCS**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	7450	8.74	mg/Kg	7146	104	80	120			
Chromium	123	3.88	mg/Kg	116.5	106	80	120			
Nickel	97.3	4.85	mg/Kg	99.03	98.2	80	120			
Silver	98.0	0.971	mg/Kg	93.98	104	80	120			
Zinc	115	1.94	mg/Kg	133.0	86.6	80	120			
Sample ID: **0709048-001B MS**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	26700	58.1	mg/Kg-dry	9505	107	75	125			
Chromium	221	25.8	mg/Kg-dry	155.0	112	75	125			
Nickel	169	32.3	mg/Kg-dry	131.7	128	75	125			S
Silver	129	6.46	mg/Kg-dry	125.0	104	75	125			
Zinc	257	12.9	mg/Kg-dry	176.9	88.7	75	125			
Sample ID: **0709048-001B MSD**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	25800	58.1	mg/Kg-dry	9505	97.8	75	125	3.44	20	
Chromium	197	25.8	mg/Kg-dry	155.0	96.7	75	125	11.5	20	
Nickel	139	32.3	mg/Kg-dry	131.7	106	75	125	19.4	20	
Silver	123	6.46	mg/Kg-dry	125.0	98.3	75	125	5.13	20	
Zinc	261	12.9	mg/Kg-dry	176.9	91.0	75	125	1.57	20	
Sample ID: **0709048-001B MST**			*Method:* **SW6010B**		*Batch ID:* **1212**		*Analysis Date:*	**10/1/2007**		
Aluminum	25200	58.1	mg/Kg-dry	9505	92.4	75	125	5.46	20	
Chromium	214	25.8	mg/Kg-dry	155.0	107	75	125	3.43	20	
Nickel	161	32.3	mg/Kg-dry	131.7	122	75	125	4.64	20	
Silver	117	6.46	mg/Kg-dry	125.0	93.5	75	125	10.2	20	
Zinc	250	12.9	mg/Kg-dry	176.9	85.0	75	125	2.63	20	

WM Review

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1213

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: **1213-PB UNFILTERED**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	0.015	0.020	mg/Kg							J
Selenium	ND	0.200	mg/Kg							
Sample ID: **1213-PB FILTERED**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	ND	0.150	mg/Kg							
Cadmium	ND	0.010	mg/Kg							
Copper	ND	0.125	mg/Kg							
Lead	ND	0.020	mg/Kg							
Selenium	ND	0.200	mg/Kg							
Sample ID: **1213-LCS**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	155	0.295	mg/Kg	158.2	97.7	80	120			
Cadmium	101	0.020	mg/Kg	96.42	105	80	120			
Copper	85.6	0.246	mg/Kg	83.94	102	80	120			
Lead	122	0.039	mg/Kg	123.8	98.5	80	120			
Selenium	147	0.393	mg/Kg	139.6	105	80	120			
Sample ID: **0709048-001B-MS**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	231	0.391	mg/Kg-dry	209.9	98.9	75	125			
Cadmium	133	0.026	mg/Kg-dry	127.9	104	75	125			
Copper	224	0.326	mg/Kg-dry	111.3	113	75	125			
Lead	185	0.052	mg/Kg-dry	164.3	100	75	125			
Selenium	194	0.522	mg/Kg-dry	185.1	105	75	125			
Sample ID: **0709048-001B-MSD**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	229	0.394	mg/Kg-dry	211.7	97.2	75	125	0.828	20	
Cadmium	132	0.026	mg/Kg-dry	129.0	102	75	125	0.914	20	
Copper	236	0.329	mg/Kg-dry	112.3	122	75	125	4.99	20	
Lead	184	0.053	mg/Kg-dry	165.6	99.3	75	125	0.263	20	
Selenium	193	0.526	mg/Kg-dry	186.7	103	75	125	0.855	20	
Sample ID: **0709048-001B MST**			*Method:* **SW6020**		*Batch ID:* **1213**		*Analysis Date:*	**9/27/2007**		
Arsenic	237	0.394	mg/Kg-dry	211.4	101	75	125	2.44	20	
Cadmium	133	0.026	mg/Kg-dry	128.8	103	75	125	0.310	20	
Copper	226	0.328	mg/Kg-dry	112.1	114	75	125	0.858	20	
Lead	190	0.053	mg/Kg-dry	165.4	103	75	125	3.07	20	
Selenium	203	0.525	mg/Kg-dry	186.4	108	75	125	4.25	20	

MM Review

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

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labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: 1226

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: **1226-PB**			*Method:* **E245.5**		*Batch ID:* **1226**		*Analysis Date:*		**9/26/2007**	
Mercury	ND	0.0200	mg/Kg							
Sample ID: **LCS-1226**			*Method:* **E245.5**		*Batch ID:* **1226**		*Analysis Date:*		**9/26/2007**	
Mercury	1.64	0.0222	mg/Kg	1.555	106	80	120			
Sample ID: **0709048-001B-MS**			*Method:* **E245.5**		*Batch ID:* **1226**		*Analysis Date:*		**9/26/2007**	
Mercury	2.11	0.0276	mg/Kg-dry	1.933	106	75	125			H
Sample ID: **0709048-001B-MSD**			*Method:* **E245.5**		*Batch ID:* **1226**		*Analysis Date:*		**9/26/2007**	
Mercury	2.03	0.0276	mg/Kg-dry	1.934	102	75	125	3.65	20	H

Review

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

MSE Analytical Laboratory
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Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 04-Oct-07
Report Date: 04-Oct-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: R4725

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID: ***0709048-001A-D***			*Method:* ***AVS-SEM***		*Batch ID:* ***R4725***			*Analysis Date:*	***9/12/2007***	
Sulfide	ND	15.0	umoles/g					0	20	
Sample ID: ***0709048-001A-S***			*Method:* ***AVS-SEM***		*Batch ID:* ***R4725***			*Analysis Date:*	***9/12/2007***	
Sulfide	4.87	15.0	umoles/g	4.955	98.3	80	120			J
Sample ID: ***LFB***			*Method:* ***AVS-SEM***		*Batch ID:* ***R4725***			*Analysis Date:*	***9/12/2007***	
Sulfide	6.13	15.0	umoles/g	6.240	98.3	80	120			J
Sample ID: ***LCS***			*Method:* ***AVS-SEM***		*Batch ID:* ***R4725***			*Analysis Date:*	***9/12/2007***	
Sulfide	6.34	15.0	umoles/g	6.240	102	85	105			J
Sample ID: ***BLANK***			*Method:* ***AVS-SEM***		*Batch ID:* ***R4725***			*Analysis Date:*	***9/12/2007***	
Sulfide	ND	15.0	umoles/g							

[signature] **Review**

Qualifiers: N/A Sample concentration is greater than 4*spike level; R RPD outside accepted recovery limits; S Spike Recovery outside accepted recovery limits

Friday, December 07, 2007

MSE Analytical Laboratory

Dave Pillard
ENSR International
4303 W. LaPorte Ave
Fort Collins, CO 80521

RE: COEUR AK

Work Order: 0709048

Dear Dave Pillard:

MSE Lab Services received 4 sample(s) on 9/6/2007 for the analyses presented in the following report.

Please find enclosed analytical results for the sample(s) received at the MSE Laboratory.

If you have any questions regarding these test results, please feel free to call.

Sincerely,

Sara Ward for MC

Marcee Cameron
Laboratory Director/ Chemist
406-494-7371

Enclosure

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SHERMAN
Lab Order:	0709048	**Collection Date:**	8/15/2007 10:00:00 AM
Project:	COEUR AK		
Lab ID:	0709048-001	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	4.0	0.1		%	1	12/6/2007
% Sand	82.0	0.1		%	1	12/6/2007
% Silt	14.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

MLM **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	MIDDLE SHERMAN
Lab Order:	0709048	**Collection Date:**	8/18/2007 10:30:00 AM
Project:	COEUR AK		
Lab ID:	0709048-002	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: HC
% Clay	2.0	0.1		%	1	12/6/2007
% Sand	78.0	0.1		%	1	12/6/2007
% Silt	20.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

mlw **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER JOHNSON
Lab Order:	0709048	**Collection Date:**	8/17/2007 11:45:00 AM
Project:	COEUR AK		
Lab ID:	0709048-003	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	26.0	0.1		%	1	12/6/2007
% Sand	18.0	0.1		%	1	12/6/2007
% Silt	56.0	0.1		%	1	12/6/2007
Soil Class	Silt loam			%	1	12/6/2007

Review

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Lab Services

Date: *07-Dec-07*

CLIENT:	ENSR International	**Client Sample ID:**	LOWER SLATE
Lab Order:	0709048	**Collection Date:**	8/16/2007 12:00:00 PM
Project:	COEUR AK		
Lab ID:	0709048-004	**Matrix:**	SEDIMENT

Analyses	Result	Limit	Qualifier	Units	DF	Date Analyzed
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**				Analyst: **HC**
% Clay	2.0	0.1		%	1	12/6/2007
% Sand	78.0	0.1		%	1	12/6/2007
% Silt	20.0	0.1		%	1	12/6/2007
Soil Class	Loamy sand			%	1	12/6/2007

mw **Review**

Qualifiers:

H	Holding times for preparation or analysis exceeded	J	Analyte detected below the Reporting Limit
Limit	Instrument Reporting Limit	MDL	Method Detection Limit
ND	Not Detected at the Method Detection Limit (MDL)		

MSE Analytical Laboratory
P.O. Box 4078
200 Technology Way
Butte, MT 59701
Lab: 406-494-7334
Fax: 406-494-7230
labinfo@mse-ta.com

Date: 07-Dec-07
Report Date: 07-Dec-07

QA/QC SUMMARY REPORT

Client: ENSR International
Project: COEUR AK
Work Order: 0709048
BatchID: R5390

Analyte	Result	RL	Units	Spike Lvl	% Rec	Low Limit	High Limit	RPD	RPD Limit	Qualifier
Sample ID ***0709048-001B D***			*Method:* ***MSA15-5***		*Batch ID:* ***R5390***		*Analysis Date:*		***12/6/2007***	
% Clay	4.0	0.1	%					0	20	
% Sand	82.0	0.1	%					0	20	
% Silt	14.0	0.1	%					0	20	
Soil Class	Loamy sand		%					0	0	

Review

Qualifiers: J Analyte detected below the Reporting Limit N/A Sample concentration is greater than 4*spike level R RPD outside accepted recovery limits

ENSR INTERNATIONAL

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name: Coeur AK

Project Location:

Project Number: 08503-128-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): Liz Flory - Coeur / Ted Dixon - ENSR Subsampler

Signature: T.D.

Chain of Custody Tape No.: 26693

Send Results/Report to: David Pillard

Analysis Requested: Al, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn, Hg | TOC | Grain Size | AVS

0709048

Field Sample No./Identification	Date	Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preservative	Field Filtered	Al, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn, Hg	TOC	Grain Size	AVS				Lab I.D.	Remarks
LOWER SHERMAN METALS, TOC, Grain size	8/15/07	1000	X		500 mL HDPE	SEDIMENT	ICE		X	X	X					20938	001B
LOWER SHERMAN AVS	↓	↓	X		100 mL Septa	↓	↓					X				20938	001A
MIDDLE SHERMAN METALS, TOC, Grain size	8/18/07	1030	X		500 mL HDPE	↓	↓		X	X	X					20939	002B
MIDDLE SHERMAN AVS	↓	↓	X		100 mL Septa	↓	↓					X				20939	002A
LOWER JOHNSON METALS, TOC, Grain size	8/17/07	1145	X		500 mL HDPE	↓	↓		X	X	X					20934	003B
LOWER JOHNSON AVS	↓	↓	X		100 mL Septa	↓	↓					X				20934	003A
LOWER SLATE METALS, TOC, Grain size	8/16/07	1200	X		500 mL HDPE	↓	↓		X	X	X					20935	004B
LOWER SLATE AVS	↓	↓	X		100 mL Septa	↓	↓					X				20935	004A
All samples subsampled	8/30/07	@ 1600			by Ted Dixon (ENSR) for												

Relinquished by: (Print Name)/(Affiliation) Ted Dixon Signature: T. Dixon	Date: 9/5/07 Time: 1500	Received by: (Print Name)/(Affiliation) Marcee Cameron / MSE Signature: M.C.	Date: 9/6/07 Time: 1140
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:

Analytical Laboratory (Destination):
T = 6.0°C FEDEX
rcvd in sealed cooler, on ice

~~ENSR Toxicology Lab~~ MSE LAB
~~4303 W. Laporte Avenue~~
~~Fort Collins, CO 80521~~
~~(970) 416-0916~~
~~(970) 493-8935 (FAX)~~

Serial No. 43814

FM01008b_902

Page ___ of ___
FCETL QA Form No.131
Revision 0
Effective 10/06

(ENSR)

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

QA: AR 12/10/07

Project No: 8503-128-058

Analytical Balance ID: AND

TARE: Date/time: 8/30/07 @ 1600 Analyst: TD

DRY GROSS: Date/time: 9/5/07 @ 1445 Analyst: TD

ASHED GROSS: Date/time: 9/6/07 @ 1005 Analyst: TD

Dried in Oven # 2 from Date: 8/30/07 Time: 1715 to Date: 9/5/07 Time: 1125
Oven °C: 101

Ashed in Furnace from Date: 9/5/07 Time: 1455 to Date: 9/5/07 Time: 1700
Furnace °C: 550

Dish No.	Treatment	Rep	Tare Weight of Dish (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Ashed Gross Weight (dish + sample)(g) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)
1A	Johnson		12.4274	37.7118	30.7628	72.5	30.6165	0.798
2A	Mid. Shor		12.3630	37.3072	30.6529	73.3	30.2284	2.32
3A	Low. Shor.		10.4975	35.5889	29.1588	74.4	28.7871	1.99
4A	Slate		10.7727	35.8363	27.4472	66.5	26.5929	5.12
5A	Mid Shor (Dup)		12.0062	37.6376	30.6056	72.6	~~26.5929~~ 30.0942	2.75
Blank			12.1409		12.1409		12.1409	

[1] Add in weight loss of blank boat, if appropriate.

① TD 9/6/07 WP

Appendix 2: Benthic invertebrate data 2007 – Number of each genus in each sample.

			Sherman Creek Reach 1					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	15	10	21	66	48	47
	Heptageniidae	Epeorus	4	1	1	1	1	0
		Cinygmula	7	1	1	8	11	5
		Rithrogena	10	5	0	11	2	6
	Ephemerellidae	Caudatella	2	9	9	9	8	3
		Drunella	1	2	2	5	1	0
		Attenella	0	0	0	2	0	0
	Leptophlebiidae	Paraleptophlebia	0	0	0	5	0	0
	Ameletidae	Ameletus	0	0	0	1	0	0
Plecoptera	Chloroperlidae	Alaskaperla	0	0	0	0	2	1
		Haploperla	0	0	1	2	1	0
		Suwallia	0	0	1	0	0	0
		Kathroperla	0	0	0	1	0	0
		Plumiperla	18	9	30	8	11	13
		Paraperla	0	0	0	0	1	0
	Capniidae	Allocapnia	1	0	4	0	1	0
		Paracapnia	1	0	0	0	0	0
		Eucapnopsis	1	1	0	0	0	2
	Leuctricidae	Perlomyia	0	3	0	0	0	0
	Nemouridae	Zapada	0	0	0	2	0	4
	Perlodidae	Megarcys	0	0	1	0	0	0
Trichoptera	Brachycentridae	Micrasema	0	0	0	1	0	0
	Hydropsychidae	Parapsyche	0	0	0	1	0	0
		Arctopsyche						
	Glossosomatidae	Glossoma	1	1	0	0	0	0
		Agapetus						
	Polycentropidae	Neureclipses	0	0	0	1	0	0
		Paranyctiophylax						
	Rhyacophilidae	Rhyacophila	1	0	0	1	1	2
		Himalopsyche	0	1	0	1	0	0
	Limnephilidae	Apatania	0	1	0	0	1	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	0	2	2	2	3	1
	Tanytarsini	Tanytarsus	0	0	0	0	1	0
		Tipula	0	3	0	0	1	0
	Syrphidae	unknown	0	0	0	0	1	0
	Dryomyziidae	unknown	0	1	0	0	0	0
Simuliidae	Simuliidae	Prosimulium	0	0	1	0	0	0
	Oligochaetae		0	0	0	0	1	0
		Total	**62**	**50**	**74**	**128**	**96**	**84**

Appendix 2: cont.

			Sherman Creek Reach 2					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	12	16	103	41	52	20
		Diphetor						
	Heptageniidae	Epeorus	1	0	10	2	9	1
		Cinygmula	6	5	7	7	7	3
		Rithrogena	6	3	5	3	2	4
	Ephemerellidae	Attenella	0	0	5	1	4	0
		Drunella	2	3	2	3	2	1
		Caudatella	12	7	9	8	2	1
	Leptophlebiidae	Paraleptophlebia						
Plecoptera	Chloroperlidae	Triznaka						
		Haploperla	3	1	1	0	1	5
		Plumiperla	13	9	11	14	10	13
	Capniidae	Paracapnia	1	1	1	0	0	0
	Leuctridae	Perlomyia	0	3	0	2	2	1
		Leuctra	0	0	0	0	1	0
	Nemouridae	Zapada	5	0	0	1	0	0
		Shipsa	0	0	0	1	0	0
	Perlodidae	Megarcys	1	2	0	1	0	0
Trichoptera	Brachycentridae	Micrasema						
	Glossosomatidae	Glossoma	0	2	0	0	1	0
	Polycentropidae	Neureclipses	1	0	0	0	0	2
	Rhyacophilidae	Rhyacophila	1	1	2	3	1	3
		Himalopsyche	0	2	0	1	1	1
	Limnephilidae	Apatania	5	0	1	4	0	1
		Moselyana	0	0	0	2	0	0
		Allomyia	0	0	0	1	0	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	0	0	3	6	0	2
	Tanytarsini	Tanytarsus	0	0	1	1	0	0
Nematocera	Tipulidae	Dicranota						
		Tipula	1	0	0	1	0	1
Brachycera	Syrphidae	unknown	0	0	0	0	0	1
	Simuliidae	Prosimulium	0	0	1	1	0	0

Appendix 2: cont.

			Sweeny Reach 1 Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	13	8	12	6	6	9
	Heptageniidae	Epeorus	0	0	0	2	2	0
		Cinygmula	1	0	1	0	0	0
		Rithrogena	0	0	1	2	0	0
	Ephemerellidae	Attenella						
		Drunella	1	0	3	0	2	0
	Leptophlebiidae	Paraleptophlebia						
Plecoptera	Chloroperlidae	Triznaka						
		Haploperla	0	0	9	0	5	0
		Suwallia						
		Kathroperla						
		Plumiperla	9	6	15	10	15	4
	Capniidae	Paracapnia	0	0	1	0	1	0
	Leuctridae	Despaxia	0	0	0	1	0	0
		Perlomyia	0	0	8	0	0	0
	Nemouridae	Zapada						
		Nemoura	1	0	0	0	0	0
		Shipsa	0	0	0	0	0	1
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche	0	0	0	0	1	0
	Glossosomatidae	Glossoma	0	1	0	0	0	0
	Polycentropidae	Neureclipses	0	0	1	0	0	0
	Rhyacophilidae	Rhyacophila	0	0	0	1	0	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	1	0	4	2	0	0
		Tvetania	0	0	0	3	0	0
	Tanytarsini	Tanytarsus	0	0	2	0	0	0
	Tipulidae	Dicranota	0	0	6	0	0	0
		Hesperoconopa	0	0	1	0	0	0
		Tipula	0	0	0	1	0	0
		Prionocera	0	0	0	0	0	1
		Total	**26**	**15**	**64**	**28**	**32**	**15**

Appendix 2: cont.

			Sweeny Reach 2 Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	32	34	21	38	11	11
	Heptageniidae	Epeorus	0	2	2	1	4	1
		Cinygmula	2	3	0	0	1	1
		Rithrogena	1	0	0	4	5	3
	Ephemerellidae	Attenella						
		Drunella	3	2	2	1	0	0
Plecoptera	Chloroperlidae	Triznaka						
		Haploperla	1	2	4	6	0	0
		Suwallia	0	0	0	0	1	0
		Kathroperla	0	0	0	0	0	1
		Plumiperla	2	3	1	3	1	3
		Neaviperla	0	0	0	1	0	0
		Sweltsia	0	0	0	1	0	0
	Capniidae	Paracapnia	0	0	1	0	0	1
	Leuctridae	Despaxia						
		Perlomyia	0	1	2	7	1	0
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche	0	0	0	1	1	0
	Polycentropidae	Neureclipses	0	1	0	0	0	0
		Paranyctiophylax						
	Rhyacophilidae	Rhyacophila	0	0	0	0	1	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	2	13	2	11	0	0
	Tanytarsini	Tanytarsus	0	0	0	1	0	0
		Constempellina	0	1	0	5	0	5
	Podonominae	Boreochlini	0	0	5	0	0	0
Nematocera	Tipulidae	Dicranota						
		Tipula	0	0	0	0	1	0
		Antocha	9	1	1	1	0	0
Brachycera	Ceratopogonidae	Probezzia						
		Culicoides	0	0	0	0	1	0
	Empididae	Chelifera	0	0	1	0	0	0
	Muscidae		0	0	0	1	0	0
	Simuliidae	Prosimulium						
Collembola		Folsomina	0	1	0	0	0	0
Oligochaetae			0	2	0	1	0	0
		Total	**52**	**66**	**42**	**83**	**28**	**26**

Appendix 2: cont.

			Johnson Creek Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	116	76	55	206	310	180
		Procleon	0	0	0	0	1	0
	Heptageniidae	Epeorus	3	1	6	6	1	0
		Cinygmula	33	22	7	24	32	68
		Rithrogena	7	1	5	1	7	10
	Ephemerellidae	Attenella	4	0	0	1	4	0
		Drunella	50	20	20	40	28	20
		Caudatella	45	12	23	16	15	0
	Leptophlebiidae	Paraleptophlebia	2	0	0	0	0	0
Plecoptera	Chloroperlidae	Triznaka	1	0	0	0	0	0
		Haploperla	2	2	0	1	3	8
		Suwallia	0	0	0	0	1	0
		Kathroperla	1	0	0	0	0	0
		Alaskaperla	0	0	0	1	0	0
		Neaviperla	0	0	1	1	2	0
		Sweltsia	0	0	1	0	0	0
	Leuctridae	Despaxia	0	0	0	0	0	2
		Perlomyia	12	6	0	1	3	0
	Nemouridae	Zapada	8	2	0	20	8	5
		Nemoura	0	1	0	0	0	0
		Shipsa	0	0	1	1	2	0
	Capniidae	Paracapnia	1	0	0	0	0	0
		Allocapnia	1	0	0	0	0	0
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche	3	0	0	0	1	0
		Arctopsyche	2	0	1	2	4	0
	Glossosomatidae	Glossoma	0	1	0	0	0	0
		Anagapetus	7	2	0	6	4	0
	Polycentropidae	Neureclipses	8	3	1	6	2	0
	Rhyacophilidae	Rhyacophila	11	4	1	3	6	5
	Psychomiidae	Lype	0	0	0	1	0	0
	Limnephilidae	Pedomeocus	0	0	0	0	1	0
	Brachycentridae	Amniocentrus	2	0	0	0	0	0
Diptera	Chironomidae							
sub-family	Orthocladiinae	Eukiefferiella	4	3	0	1	4	4
		Tvetania	5	1	0	4	8	0
Brachycera	Ceratopogonidae	Probezzia						
	Sciomyzidae	Hedria	0	1	0	0	0	0
	Simuliidae	Prosimulium	3	0	0	4	0	0
		Total	**331**	**158**	**122**	**346**	**447**	**302**

Appendix 2: cont.

			Slate Creek Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	9	2	12	13	12	19
	Heptageniidae	Epeorus	0	1	8	8	26	19
		Cinygmula	2	3	6	9	15	14
		Rithrogena						
	Ephemerellidae	Attenella	0	0	0	0	0	2
		Drunella	0	0	0	0	0	9
		Caudatella	0	0	1	0	1	0
	Leptophlebiidae	Paraleptophlebia	1	6	9	56	65	124
Plecoptera	Chloroperlidae	Alaskaperla						
		Haploperla	7	8	4	9	10	47
		Neaviperla	0	0	0	0	0	0
	Nemouridae	Nemoura	2	2	9	13	9	10
		Zapada	1	0	3	3	0	2
	Perlidae	Hesperoperla						
		Agnetina	0	0	1	2	6	14
Trichoptera	Brachycentridae	Micrasema						
		Anagapetus	0	0	0	0	0	1
	Polycentropidae	Neureclipses	0	0	0	0	2	8
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	5	8	23	14	8	96
		Tvetenia	12	1	1	1		1
		Parachaetocladius	1	2	2	0	0	0
	Diamesinae	Pagastia	0	1	1	1		22
	Tanytarsini	Tanytarsus	23	35	55	85	139	787
		Stempellinella	1	2	2	3	9	15
		Corynoneura	0	0	1	2	1	0
Nematocera	Tipulidae	Dicranota						
		Tipula	0	1	0	1	2	15
		Antocha	0	0	0	0	0	3
Brachycera	Ceratopogonidae	Probezzia	0	1	0	1	2	19
Collembola		Folsomina	0	0	0	0	0	2
Oligochaetae			0	0	0	0	2	0
Simuliidae	Simuliidae	Prosimulium	30	2	15	25	19	147
Sphaeriidae	Psidiinae	Psidium (pea clam)	54	45	13	42	39	395
		Total	**148**	**120**	**166**	**288**	**367**	**1771**

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

Permit No. SF2007-153

Expires: 9/30/2007

Report Due 10/30/2007

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes **Liz Flory** *(whose signature is required on page 2 for permit validation)*
person

of Alaska Employment Group **at 4546 River Road, Juneau, Alaska 99802**
agency or organization — address

to conduct the following activities **from** July 1, 2007 **to** September 30, 2007 in accordance with AS 16.05.930:

Purpose: To estimate fish populations by species, habitat type and strata as well as measure fish condition factor as required by the Environmental Protection Agency's NPDES permit.

Location: Sherman/Slate/Johnson Creeks in the Berner's Bay area

Species Collected: Dolly Varden, cutthroat trout

Method of Capture: minnow trap and a single pass with a backpack electrofisher

Final Disposition: ≤180 Dolly Varden and ≤45 cutthroat trout may be captured, measured and released alive at the capture site.

-Continued on Back-

REPORT DUE October 30, 2007. The report shall include species, numbers, dates, and locations of collection (datum/GPS coordinates in the decimal degrees format (dd.ddddd)) and disposition, and if applicable, sex, age, and breeding condition, and lengths and weights of fish. A completion report (abstract/background/methods/data/analysis), if not submitted with the collection report described above, must be submitted to the department within six months of the expiration of the permit. Data from such reports are considered public information. The report shall also include other information as may be required under the permit stipulations section.

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.
2. No specimens taken under authority hereof may be sold or bartered. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.
3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until the department has received detailed reports, as specified above.
5. UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

Bob Piorkowski
Fish Resource Permit Coordinator
Division of Sport Fish

Robert Bentz
for Director
Division of Sport Fish

6-25-07
Date

Authorized Personnel: The following persons may perform collecting activities under terms of this permit:

Brian Flory, Liz Flory, Chris Frank, Brian Maupin, Ray Pohl, Kate Savage

Employees and volunteers under the direct supervision of, and in the presence of, one of the authorized personnel listed above may participate in collecting activities under terms of this permit.

Permit Stipulations:

1) The local Area Management Biologist, **Brian Glynn** (465-4318; brian_glynn@fishgame.state.ak.us) Juneau, must be notified **prior** to you engaging in any collecting activities. These Area Management Biologists have the right to specify methods for collecting, as well as limiting the collections of any species by number, time and location
2) All unattended sampling gear; 1) labeled with the permittee's name, telephone number, and permit number, 2) securely tied to substrate, 3) be placed in a location where they will not be easily noticed (e.g. under cut banks, in pools away from roads or trails), 4) soak no more than twenty-four hours at a time, 5) be located with GPS coordinates, and 6) must be accounted for/ removed at the conclusion of sampling.
3) Salmon eggs used as bait in traps must either be; sterilized commercial eggs or, if raw, be disinfected prior to use. A 10 minute soak in 1/100 Betadyne solution or some other iodophor disinfectant is adequate.
4) Gloves (cotton, etc.), boots, and collecting gear should be disinfected between streams to reduce the potential of pathogen transmission. A wash/rinse in 1/100 Betadyne solution should be adequate.
5) If anadromous fish are found in permitted streams and rivers, the permit holder will work closely with ADF&G to see that information is included in the database for the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes*. Anadromous fish include *Oncorhynchus spp.*, Arctic char, Dolly Varden, sheefish, smelts, lamprey, whitefish, and sturgeon. Please direct questions to J. Johnson, 267-2337 or j_johnson@fishgame.state.ak.us
6) Electroshocking is currently discouraged, but not prohibited by the department. Electroshockers **may not** be used in anadromous waters in the presence of adult salmonids, adult trout or adult char. In areas where other means of capture are not feasible, only one pass is allowed. Operators of electroshockers must have formal training.
7) **Atlantic salmon** and other **non-native invasive aquatic species** that you encounter during your sampling should be killed. In such an event please contact the nearest ADF&G office (see # 1 above) ASAP with species identification or description, capture location or location of sighting if capture is not possible, number captured, size, and sex. Preserve and turn in the whole specimen to the nearest ADF&G office.
8) *A copy of this permit, including any amendments, must be made available at all field collection sites and project sites for inspection upon request by a representative of the department or a law enforcement officer.*
9) Issuance of this permit does not absolve the permittee from compliance in full with any and all other applicable federal, state, or local laws, regulations, or ordinances.
10) A **report of collecting activities**, referenced to this fish resource permit number, must be submitted to the Alaska Department of Fish and Game, Division of Sport Fish HQ, P.O. Box 115525, Juneau, AK 99811-5525, Attention: Bob Piorkowski (465-6109; Bob_Piorkowski@fishgame.state.ak.us), within 30 days after the expiration of this permit. This report must summarize the number of fish captured by date, by location (provide GPS coordinates and datum or a map), and by species, and the fate of those fish. Fish length, weight, sex, and age data should be included if collected. A completion report (abstract/background/methods/data/analysis), if not submitted with the collection report described above, must be submitted to the department within six months of the expiration of the permit. Data from such reports are considered public information. A report is required whether or not collecting activities were undertaken. A report should also be sent to the Biologist(s) listed under stipulation 1 in the Permit Stipulations section.

PERMIT VALIDATION requires permittee's signature agreeing to abide by permit conditions before beginning collecting activities:

Signature of Permittee

cc: Brian Glynn, Division of Sport Fish, Juneau
Kevin Monagle, Division of Commercial Fisheries, Juneau
Jackie Timothy, ADNR, Office of Habitat Management and Permitting, Juneau
Fish and Wildlife Protection, Juneau

Appendix 3b: Dimensions of each habitat unit.

2007 Resident Fish Habitat Dimensions

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Sherman	Number of Units	21	30	1	0	52
	Total Length (m)	260.1	142.9	5.9	0.0	
	Mean Length (m)	12.4	4.8	5.9		
	Mean Width (m)	6.5	3.4	7.5	0.0	
	Mean Area (m^2)	85.1	27.8	44.2	0.0	
	Total Area (m^2)	**1786.6**	**832.9**	**44.2**	**0.0**	**2663.7**
	% of Total Area	67.1	31.3	1.7	0.0	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Sherman	Number of Units	27	49	1	1	78
	Total Length (m)	301.4	97.4	12.0	3.9	
	Mean Length (m)	11.2	2.0	12.0	3.9	
	Mean Width (m)	6.0	2.3	5.0	5.0	
	Mean Area (m^2)	72.5	5.6	60.0	9.8	
	Total Area (m^2)	**1956.5**	**274.4**	**60.0**	**9.8**	**2300.6**
	% of Total Area	85.0	11.9	2.6	0.4	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Sherman	Number of Units	19	70	3	11	103
	Total Length (m)	190.9	134.3	14.6	77.1	416.9
	Mean Length (m)	10.0	1.9	4.9	7.0	
	Mean Width (m)	2.6	1.6	2.7	2.6	
	Mean Area (m^2)	26.3	4.0	12.6	21.7	
	Total Area (m^2)	**500.1**	**278**	**37.7**	**238.9**	**1054.1**
	% of Total Area	47.4	26.3	3.6	22.7	100.0
Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Johnson	Number of Units	17	29	10	0	56
	Total Length (m)	261.8	106.2	80.3	0.0	
	Mean Length (m)	15.4	3.7	8.0	0.0	
	Mean Width (m)	8.8	3.5	6.0	0.0	
	Mean Area (m^2)	102.7	16.8	46.0	0.0	
	Total Area (m^2)	**1745.55**	**486.5**	**460.3**	**0.0**	**2692.3**
	% of Total Area	64.8	18.1	17.1	0.0	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Johnson	Number of Units	12	39	4	3	58
	Total Length (m)	216.1	159.7	48.4	13.7	
	Mean Length (m)	18.0	4.1	12.1	4.6	
	Mean Width (m)	6.6	2.8	5.4	5.0	
	Mean Area (m^2)	119.5	18.6	64.0	28.6	
	Total Area (m^2)	**1433.7**	**723.8**	**256.1**	**85.7**	**2499.1**
	% of Total Area	57.4	29.0	10.2	3.4	100.0

Appendix 3b cont.

	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Johnson	Number of Units	16	31	9	2	58
	Total Length (m)	232.8	132.2	47.5	3.3	
	Mean Length (m)	14.6	4.3	5.3	1.6	
	Mean Width (m)	3.3	2.3	2.9	3.3	
	Mean Area (m^2)	51.9	12.1	16.4	4.8	
	Total Area (m^2)	**830.9**	**374.3**	**147.6**	**9.6**	**1362.3**
	% of Total Area	61.0	27.5	10.8	0.7	100.0
Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Slate	Number of Units	27	32	10	0	69
	Total Length (m)	291.7	82.4	59.1	0.0	
	Mean Length (m)	10.8	2.6	5.9	0.0	
	Mean Width (m)	3.8	2.5	4.5	0.0	
	Mean Area (m^2)	43.9	8.9	27.4	0.0	
	Total Area (m^2)	**1186.1**	**285.2**	**274.2**	**0.0**	**1745.4**
	% of Total Area	68.0	16.3	15.7	0.0	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Slate	Number of Units	23	24	13	4	64
	Total Length (m)	186.5	68.3	101.0	20.7	
	Mean Length (m)	8.1	2.8	7.8	5.2	
	Mean Width (m)	3.9	2.7	3.7	3.3	
	Mean Area (m^2)	32.1	10.1	29.6	17.4	
	Total Area (m^2)	**739.2**	**241.4**	**384.8**	**69.6**	**1434.9**
	% of Total Area	51.5	16.8	26.8	4.8	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Upper Slate	Number of Units	26	28	11	0	65
	Total Length (m)	250.9	75.2	53.9	0.0	
	Mean Length (m)	9.7	2.7	4.9	0.0	
	Mean Width (m)	1.9	1.7	2.2	0.0	
	Mean Area (m^2)	19.1	5.1	10.9	0.0	
	Total Area (m^2)	**495.5**	**144.0**	**120.4**	**0.0**	**759.9**
	% of Total Area	65.2	18.9	15.8	0.0	100.0

Appendix 3c: Resident fish survey data – fish counts per habitat unit.

Lower Sherman					Snorkel		Electro Fish	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Ct	Dv	Ct	Dv
Riffle	0.0	29.9	12.0	358.8	1	0		
SDP		1.0	1.0	1.0	1	1	1	1
Riffle	29.9	11.2	7.0	78.4	NS	NS		
Pool	41.1	24.4	6.5	158.6	3	1	3	1
Riffle	65.5	4.3	5.5	23.7	NS	NS		
Riffle	69.8	15.1	6.0	90.6	0	0		
SDP		1.0	1.0	1.0	1	0	2	0
Riffle	84.9	13.1	6.5	85.2	NS	NS		
Riffle	98.0	4.1	6.0	24.6	1	0	1	0
SDP		2.0	2.0	4.0	0	1	0	1
Riffle	102.1	4.2	6.5	27.3	NS	NS		
Riffle	106.3	15.1	6.0	90.6	0	0		
SDP		1.0	1.0	1.0	1	0	1	0
SDP		1.0	1.0	1.0	NS	NS		
Riffle	121.4	8.0	7.0	56.0	NS	NS		
Pool	129.4	10.1	6.5	65.7	1	0	1	0
Pool	139.5	27.7	6.0	166.2	0	0		
Riffle	167.2	6.5	6.0	39.0	1	1	1	1
SDP		1.0	1.0	1.0	NS	NS		
SDP		1.0	1.0	1.0	1	0	1	1
Riffle	173.7	10.0	6.5	65.0	NS	NS		
Riffle	183.7	9.1	7.0	63.7	1	0	1	0
Glide	192.8	5.9	7.5	44.2	0	0		
SDP		1.0	2.0	2.0	NS	NS		
SDP		1.0	2.0	2.0	0	0		
Pool	198.7	8.4	6.5	54.6	0	1	0	2
Riffle	207.1	12.3	6.0	73.8	0	0	0	0
SDP		2.0	2.0	4.0	0	0		
SDP		2.0	2.0	4.0	NS	NS		
Riffle	219.4	5.7	7.0	39.9	0	0		
SDP		2.0	3.0	6.0	0	0	0	0
Pool	225.1	5.3	6.5	34.5	1	0	1	0
SR		5.3	3.0	15.9	NS	NS		
Riffle	230.4	21.2	6.0	127.2	NS	NS		
SDP		1.0	2.0	2.0	1	0	1	1
SDP		2.0	2.0	4.0	NS	NS		
Pool	251.6	4.1	6.0	24.6	1	0		
Riffle	255.7	11.6	7.0	81.2	NS	NS		
Riffle	267.3	13.6	7.0	95.2	1	1		
Pool	280.9	4.7	5.0	23.5	NS	NS		
Riffle	285.6	8.1	4.0	32.4	NS	NS		
SDP		1.0	1.0	1.0	NS	NS		
Pool	293.7	2.9	5.5	16.0	NS	NS		
Riffle	296.6	17.0	5.5	93.5	NS	NS		
SDP		1.0	2.0	2.0	0	0		
SDP		1.0	1.0	1.0	NS	NS		
Pool	313.6	3.1	4.5	13.9	NS	NS		
Riffle	316.7	13.7	7.0	95.9	NS	NS		
SDP		4.0	2.0	8.0	1	0		
Pool	330.4	10.2	7.0	71.4	1	0		
Riffle	340.6	26.3	5.5	144.7	NS	NS		
SDP		2.0	2.0	4.0	0	1		
Pool	366.9	14.0	11.0	154.0	0	1		

Appendix 3c cont.

Middle Sherman				Rectangle	**Snorkel**	**Captured**	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Electro	Trap
Riffle	0.0	8.0	11.0	88.0	NS		
SDP	1.0	1.5	3.0	4.5	0		
SDP	5.1	1.0	1.0	1.0	NS		
Pool	8.0	4.0	4.0	16.0	2	1	
SR	8.0	4.0	1.0	4.0	NS		
Pool	12.0	1.0	3.0	3.0	2	1	
SDP	12.8	1.0	1.5	1.5	NS		
Riffle	13.0	3.4	2.0	6.8	0		
Riffle	16.4	3.8	4.5	17.1	NS		
SDP	17.1	1.5	1.5	2.3	1	1	
Riffle	20.2	9.0	15.0	135.0	NS		
SDP	20.2	3.0	3.0	9.0	2	2	
SDP	23.9	1.0	1.0	1.0	NS		
Riffle	29.2	20.0	6.0	120.0	1		
SDP	29.2	1.0	1.5	1.5	1		
SDP	40.1	1.0	2.0	2.0	NS		
Riffle	49.2	41.7	9.0	375.3	NS		
SDP	53.2	1.0	1.0	1.0	1		
SDP	54.1	1.0	2.0	2.0	NS		
SDP	58.5	3.0	3.0	9.0	1	2	
SDP	61.9	3.0	2.0	6.0	NS		
SDP	75.9	1.0	2.0	2.0	NS		
SDP	78.0	1.0	1.0	1.0	NS		
SDP	81.4	1.0	1.0	1.0	1	1	
SDP	87.0	1.0	2.0	2.0	NS		
Riffle	90.9	6.7	12.0	80.4	1	3	
SDP	91.2	1.0	3.0	3.0	1	1	
Riffle	97.6	7.3	11.5	84.0	NS		
Riffle	104.9	7.0	8.0	56.0	1	0	
Pool	111.9	3.3	6.0	19.8	2	3	
SR	111.9	3.3	2.0	6.6	NS		
Riffle	115.2	13.9	6.0	83.4	0	0	
SDP	117.7	2.0	1.0	2.0	1		
SDP	120.7	3.0	2.0	6.0	1		
SDP	124.5	1.0	2.0	2.0	NS		
SDP	128.3	1.0	1.0	1.0	1		

Appendix 3c cont.

Middle Sherman				Rectangle	**Snorkel**	**ctro Fisher**	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Caught	Dv
Pool	129.1	2.5	5.0	12.5	2	2	
Riffle	131.6	19.3	9.0	173.7	0	0	
SDP	143.2	1.0	2.0	2.0	1		
SDP	150.7	4.0	5.0	20.0	7		2
Riffle	150.9	7.8	4.0	31.2	NS		
Pool	158.7	2.6	4.0	10.4	0		
Riffle	161.3	18.2	3.5	63.7	NS		
SDP	174.5	1.0	3.0	3.0	NS		
Riffle	179.5	7.1	5.0	35.5	0		
Pool	186.6	3.5	5.5	19.3	0		
Riffle	190.1	5.8	2.5	14.5	NS		
Pool	195.9	1.3	3.0	3.9	0		
Riffle	197.2	14.1	6.0	84.6	0		
SDP	207.3	1.0	1.0	1.0	NS		
SDP	210.1	1.0	1.5	1.5	1		
Riffle	211.3	6.5	6.0	39.0	NS		
Riffle	217.8	11.7	5.5	64.3	1		
SDP	218.2	4.0	1.5	6.0	1		
SDP	228.3	1.0	1.0	1.0	1		
Riffle	229.5	17.9	6.0	107.4	NS		
SDP	237.4	1.0	2.0	2.0	2		
Glide	247.4	12.0	5.0	60.0	NS		
Pool	259.4	5.3	3.5	18.6	1		
SDP	261.2	1.0	2.0	2.0	NS		
Riffle	264.7	5.3	4.0	21.2	NS		
Pool	270.0	2.3	3.0	6.9	NS		
Riffle	272.3	3.4	2.5	8.5	NS		
Pool	275.7	2.8	5.0	14.0	4		
Riffle	278.5	6.2	4.0	24.8	NS		
SDP	279.5	1.5	1.0	1.5	NS		
Riffle	284.7	7.6	4.0	30.4	0		
SDP	287.3	1.0	1.0	1.0	NS		
Riffle	292.3	39.0	4.5	175.5	NS		
SDP	303.7	1.0	2.0	2.0	1		
SDP	316.9	1.0	1.0	1.0	1		
SDP	319.8	1.0	1.0	1.0	1		
SDP	323.2	1.0	1.0	1.0	1		
Pool	331.3	9.4	3.5	32.9	2		
Riffle	340.7	5.5	3.5	19.3	NS		
Cascade	346.2	3.9	2.5	9.8	NS		
Riffle	350.1	2.5	3.0	7.5	NS		
Pool	352.6	3.5	2.0	7.0	2		
SG	352.6	3.5	1.0	3.5	NS		
SR	352.6	3.5	1.0	3.5	NS		
Riffle	356.1	2.7	3.5	9.4	2		
SDP	358.8	3.4	1.0	3.4	1		

Appendix 3c cont.

Upper Sherman				Rectangle	**Snorkel**	**Electro**
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv
Riffle	0.0	11.7	3.5	40.95	NS	
SDP	0.0	3.0	2.0	6.00	NS	
SDP	4.7	3.0	1.0	3.00	1	
Pool	11.7	2.8	2.5	7.00	1	1
Riffle	14.5	2.6	2.0	5.20	NS	
Pool	17.1	3.5	3.5	12.25	2	
Riffle	20.6	11.9	3.0	35.70	0	0
Pool	32.5	2.2	2.0	4.40	0	0
Riffle	34.7	2.5	2.0	5.00	0	0
Pool	37.2	1.8	1.5	2.70	NS	
Cascade	39.0	2.2	2.5	5.50	NS	
Riffle	41.2	14.6	3.5	51.10	1	1
SDP	45.5	2.0	1.0	2.00	0	0
SDP	51.9	1.0	1.0	1.00	0	0
Pool	55.8	3.4	3.5	11.90	1	1
Riffle	59.2	6.9	2.0	13.80	NS	
Pool	66.1	3.6	1.5	5.40	1	
Riffle	69.7	4.2	2.5	10.50	NS	
SDP	70.3	1.5	1.0	1.50	NS	
Pool	73.9	1.6	1.5	2.40	2	
Riffle	75.5	7.3	2.0	14.60	NS	
Riffle	82.8	2.0	1.5	3.00	1	
Pool	84.8	2.1	3.0	6.30	2	
Pool	86.9	2.5	2.5	6.25	1	1
Riffle	89.4	2.7	3.5	9.45	NS	
Pool	92.1	2.4	1.5	3.60	1	1
Riffle	94.5	19.7	2.0	39.40	0	
SDP	101.9	1.0	1.0	1.00	0	1
SDP	107.2	1.5	1.0	1.50	0	1
SDP	110.4	1.5	1.0	1.50	NS	
Pool	114.2	4.0	2.0	8.00	2	3
Riffle	118.2	24.3	2.0	48.60	NS	
SDP	120.2	1.0	1.0	1.00	1	1
SDP	124.3	1.0	0.5	0.50	0	
SDP	126.1	0.5	5.0	2.50	NS	
SDP	128.0	1.0	1.5	1.50	0	1
SDP	135.1	0.5	1.0	0.50	NS	
SDP	138.7	1.0	0.5	0.50	0	1
Pool	142.5	1.9	1.5	2.85	0	2
Cascade	144.4	1.7	2.0	3.40	NS	
Riffle	146.1	4.1	2.5	10.25	NS	
SDP	146.1	1.0	1.0	1.00	1	1
SDP	148.3	0.5	0.5	0.25	NS	
Glide	150.2	4.1	3.5	14.35	0	0

Appendix 3c cont.

Upper Sherman				Rectangle	**Snorkel**	**Electro**
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv
Pool	154.3	5.3	3.0	15.90	1	2
Cascade	159.6	2.3	2.5	5.75	NS	
Riffle	161.9	19.0	3.5	66.50	NS	
SDP	163.7	1.0	1.0	1.00	NS	1
SDP	165.9	2.0	1.5	3.00	1	1
SDP	169.0	1.0	1.0	1.00	NS	
SDP	171.2	1.5	1.0	1.50	1	1
SDP	178.0	0.5	0.5	0.25	0	
Pool	180.9	2.2	2.5	5.50	1	1
Riffle	183.1	10.9	2.5	27.25	NS	
SDP	185.0	0.5	0.5	0.25	1	1
SDP	188.1	0.5	0.5	0.25	NS	
SDP	190.3	1.0	1.0	1.00	2	2
Pool	194.0	3.1	1.5	4.65	1	1
Pool	197.1	1.9	1.5	2.85	1	
Riffle	199.0	6.0	2.0	12.00	NS	
SDP	200.4	1.5	5.0	7.50	1	1
SDP	203.5	1.0	1.0	1.00	1	1
Pool	205.0	3.2	2.0	6.40	1	
Riffle	208.2	18.2	2.5	45.50	NS	
SDP	208.9	1.0	1.0	1.00	1	
SDP	210.7	1.0	1.0	1.00	1	
SDP	214.6	1.0	0.5	0.50	NS	
SDP	219.0	4.0	1.5	6.00	1	
SDP	223.0	0.5	0.5	0.25	1	
Pool	226.4	4.3	5.0	21.50	15	
Cascade	230.7	20.9	4.0	83.60	NS	
SDP	242.0	1.0	1.0	1.00	0	
SDP	246.7	0.5	1.0	0.50	1	
Riffle	251.6	16.8	2.5	42.00	1	
SDP	252.5	1.0	0.5	0.50	NS	
SDP	258.3	0.5	1.0	0.50	0	
SDP	262.6	0.5	0.5	0.25	NS	
SDP	264.7	1.5	1.0	1.50	0	
SDP	265.4	0.5	1.0	0.50	NS	
Riffle	268.4	5.5	3.5	19.25	NS	
SDP	270.0	0.5	0.5	0.25	0	
SDP	271.9	0.5	0.5	0.25	NS	
Glide	273.9	5.8	2.0	11.60	3	3
Cascade	279.7	16.1	3.5	56.35	NS	
SDP	286.7	1.0	1.0	1.00	1	
SDP	290.8	1.0	1.0	1.00	NS	
Pool	295.8	3.0	3.0	9.00	3	
Cascade	298.8	4.7	2.5	11.75	NS	
Pool	303.5	3.1	2.5	7.75	2	
Cascade	306.6	1.7	1.5	2.55	NS	
Pool	308.3	2.3	2.0	4.60	1	
Pool	310.6	4.4	2.5	11.00	1	
Cascade	315.0	6.6	2.5	16.50	NS	
Pool	321.6	4.5	5.0	22.50	1	
Cascade	326.1	7.2	3.5	25.20	NS	
SDP	326.3	1.0	1.0	1.00	0	
Glide	333.3	4.7	2.5	11.75	0	
Cascade	338.0	1.7	2.5	4.25	NS	
Pool	339.7	3.8	2.5	9.50	NS	
Cascade	343.5	12.0	2.0	24.00	NS	
SDP	344.6	7.7	2.0	15.40	1	
SDP	352.3	1.5	1.0	1.50	NS	
Pool	355.5	3.7	2.0	7.40	2	

Appendix 3c cont

Lower Johnson				Rectangle	Snorkel		Electro	Trap	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Ct	Dv	Dv	Trap	Dv
Riffle	0.0	12.5	3.0	37.5	NS	NS			
Riffle	0.0	12.5	5.0	62.5	0	0			
SDP		1.0	2.0	2.0	NS	NS			
Riffle	12.5	10.0	7.5	75.0	0	1	1		
SDP		2.0	2.0	4.0	0	0	0		
SDP		2.5	2.5	6.3	NS	NS			
Glide	22.5	6.4	4.5	28.8	0	0			
Riffle	28.9	7.8	4.0	31.2	0	1	1		
Riffle	36.7	7.3	5.0	36.5	NS	NS			
SDP		4.0	2.0	8.0	0	0	0		
Riffle	44.0	7.4	8.0	59.2	0	0	0		
Pool	51.4	4.2	7.0	29.4	0	0		T1	2
Riffle	55.6	19.3	6.5	125.5	0	0	0		
SDP		2.0	1.0	2.0	0	0	0		
Glide	74.9	3.7	7.0	25.9	0	0			
Pool	78.6	4.8	5.0	24.0	0	1	1	T2	0
Riffle	83.4	5.5	5.0	27.5	NS	NS			
SDP		1.0	1.0	1.0	NS	NS			
Riffle	88.9	12.0	4.5	54.0	0	1			
Glide	78.6	22.3	4.0	89.2	NS	NS			
SDP		2.0	2.0	4.0	NS	NS			
Glide	100.9	5.2	8.0	41.6	0	0			
Pool	106.1	3.6	7.0	25.2	0	0			
Riffle	109.7	10.8	8.0	86.4	NS	NS			
SDP		5.0	3.0	15.0	NS	NS			
Pool	120.5	4.2	7.5	31.5	0	1	1	T3	0
Glide	124.7	19.0	6.5	123.5	0	0			
SDP		3.0	2.0	6.0	0	0			
SDP		3.0	2.0	6.0	NS	NS			
Pool	143.7	5.9	4.5	26.6	0	0			
Riffle	149.6	6.0	3.0	18.0	NS	NS			
Pool	155.6	5.3	5.0	26.5	0	0			
Glide	160.9	5.2	4.5	23.4	0	0			
Glide	166.1	4.4	5.5	24.2	NS	NS			
SDP		3.0	1.0	3.0	NS	NS			
Glide	170.5	2.1	3.5	7.3	NS	NS			
Pool	172.6	6.0	5.0	30.0	0	0			
Glide	178.6	7.8	7.5	58.5	NS	NS			
Riffle	186.4	6.8	9.0	61.2	NS	NS			
SDP		6.0	6.0	36.0	0	3	3		
Glide	193.2	4.2	9.0	37.8	NS	NS			
Pool	197.4	11.2	9.0	100.8	0	2			
Riffle	208.6	12.8	6.0	76.8	0	0			
SDP		4.0	1.5	6.0	0	0			
Riffle	221.4	54.5	7.0	381.5	NS	NS			
SDP		2.0	1.0	2.0	0	0			
SDP		2.0	1.0	2.0	NS	NS			
SDP		1.0	7.0	7.0	0	0			
SDP		3.0	3.0	9.0	0	0			
SDP		1.0	1.0	1.0	NS	NS			
SDP		1.0	1.0	1.0	1	0			
Riffle	275.9	10.6	8.0	84.8	0	0			
Pool	286.5	7.5	7.5	56.3	0	4		T4	0
Riffle	294.0	38.0	8.0	304.0	NS	NS			
SDP		5.0	3.0	15.0	0	0			
Riffle	332.0	28.0	8.0	224.0	0	1			
	360.0			0.0					

Appendix 3c cont

Middle Johnson				Rectangle	Snorkel	Electro	Trap	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv	Trap	Dv
Riffle	0.0	10.5	8.0	84.0	0			
SG	0.0	10.5	3.0	31.5	0			
Riffle	10.5	12.9	4.5	58.1	0			
Glide	10.5	12.9	3.0	38.7	NS			
Riffle	23.4	11.6	6.0	69.6	0			
SDP	15.5	1.0	1.0	1.0	0			
SDP	33.7	1.0	2.0	2.0	0			
Riffle	35.0	13.5	5.0	67.5	NS			
SDP	40.0	1.0	1.0	1.0	0			
SDP	45.5	1.0	2.0	2.0	NS			
SDP	46.3	1.0	2.0	2.0	0			
Glide	48.5	17.5	6.0	105.0	0	0		
SDP	64.1	2.0	2.0	4.0	NS			
Pool	66.0	5.8	6.5	37.7	0			
Riffle	71.8	11.0	7.0	77.0	0			
SDP	79.3	2.0	3.0	6.0	NS			
Pool	82.8	32.1	5.0	160.5	0			
SR	82.8	4.7	3.0	14.1	0	0		
SDP	87.5	2.0	3.0	6.0	0			
SDP	92.7	1.0	2.0	2.0	NS			
SDP	99.3	1.0	1.0	1.0	0			
SDP	107.4	1.0	2.0	2.0	NS			
Pool	114.9	22.3	7.5	167.3	0		T1	4
Cascade	137.2	2.0	5.5	11.0	NS			
Riffle	139.2	12.2	5.0	61.0	NS			
SDP	141.4	3.0	2.0	6.0	0	1		
SDP	145.8	2.0	1.0	2.0	0	1		
Riffle	151.4	20.3	8.0	162.4	1	0		
SDP	168.2	2.0	3.0	6.0	0	1		
SDP	169.1	3.0	1.0	3.0	NS			
Pool	171.7	9.1	7.0	63.7	2			
SDG	171.7	9.1	1.5	13.7	NS			
Cascade	180.8	0.4	3.0	1.2	NS			
Pool	181.2	6.0	4.0	24.0	1			
Riffle	187.2	18.6	5.5	102.3	0	0		
SDP	198.7	1.0	1.5	1.5	NS			
SDP	198.9	1.0	1.0	1.0	0			
Pool	205.8	10.2	7.5	76.5	3		T2	4
Riffle	216.0	55.7	6.0	334.2	0	0		
SDP	218.2	1.5	2.0	3.0	0			
SDP	221.8	2.0	2.0	4.0	NS			
SDP	227.9	3.0	1.5	4.5	0			
SDP	229.6	4.0	3.0	12.0	1			
SDP	234.8	2.0	1.0	2.0	0			
SDP	239.5	2.0	3.0	6.0	NS			
SDP	246.7	4.0	2.0	8.0	0			
SDP	258.4	4.0	3.0	12.0	0			
SDP	262.5	3.0	2.0	6.0	NS			
SDP	269.2	3.0	2.0	6.0	1			
Pool	271.7	4.5	6.5	29.3	2			
Riffle	276.2	23.3	7.0	163.1	0			
Glide	299.5	8.7	6.5	56.5	1	1		
Riffle	308.2	3.5	7.0	24.5	NS			
SDP	308.2	3.0	2.0	6.0	NS			
Cascade	311.7	11.3	6.5	73.5	NS			
Riffle	323.0	23.0	10.0	230.0	NS			
SDP	331.4	3.5	4.0	14.0	1		T3	1
SDP	331.7	3.0	2.0	6.0	1		T4	2
SDP	341.8	1.0	1.0	1.0	NS			
Glide	346.0	9.3	6.0	55.8	1	0		
Pool	355.3	4.7	5.5	25.8	3		T5	6

Appendix 3c cont

Upper Johnson				Rectangle	**Snorkel**	**E-fishing**	**Trap**	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv	Trap	Dv
Glide	0.0	2.9	2.5	7.3	0			
Pool	2.9	5.5	3.0	16.5	0			
Glide	8.4	2.6	3.0	7.8	1			
Pool	11.0	19.5	3.5	68.3	2			
Riffle	30.5	4.5	2.5	11.3	NS			
SDP	32.3	2.0	1.5	3.0	0			
Pool	35.0	2.6	3.5	9.1	2			
Riffle	37.6	12.4	3.0	37.2	0			
SDP	38.1	1.0	1.0	1.0	0			
SDP	40.7	2.0	1.5	3.0	2			
Pool	50.0	9.1	3.0	27.3	NS			
Pool	59.1	2.7	3.0	8.1	0			
Glide	61.8	1.5	2.5	3.8	NS			
Pool	63.3	10.5	3.5	36.8	8		T1	2
Riffle	73.8	7.3	2.5	18.3	1			
Pool	81.1	16.3	3.0	48.9	NS		T2	2
SDP	58.5	5.0	1.0	5.0	0			
SDP	94.4	2.0	1.0	2.0	NS			
SDP	95.1	2.0	3.0	6.0	0			
SDP	95.1	1.0	4.0	4.0	NS			
Pool	97.4	8.8	4.0	35.2	5		T3	2
Riffle	106.2	4.8	5.0	24.0	0			
SDP	107.4	2.5	5.2	13.0	0			
Riffle	111.0	10.2	2.0	20.4	0	0		
SDP	114.3	2.0	1.0	2.0	NS			
Riffle	111.0	10.2	3.0	30.6	NS			
Glide	114.5	6.7	2.5	16.8	NS			
Glide	121.2	1.9	2.5	4.7	1	1		
SDP	124.6	1.5	1.5	2.3	1			
Riffle	123.1	13.6	4.5	61.2	NS			
Glide	136.7	4.4	3.5	15.4	1			
Pool	141.1	2.9	2.5	7.3	4		T4	2
Glide	144.0	4.4	2.5	11.0	0	1		
Riffle	148.4	33.0	3.0	99.0	3	3		
SDP	170.5	1.0	1.0	1.0	NS	3		
Riffle	181.4	11.7	3.5	41.0	NS			
SDP	184.0	1.5	1.0	1.5	0			
SDP	187.0	1.0	1.0	1.0	NS			
Riffle	193.1	35.7	4.5	160.7	1	2		
SDP	203.9	1.0	1.0	1.0	0			
Cascade	228.8	0.9	4.0	3.6	NS			
Riffle	229.7	34.1	4.0	136.4	NS			
SDP	230.5	1.0	2.0	2.0	0	1		
SDP	241.7	5.0	2.0	10.0	NS			
SDP	256.9	1.5	3.0	4.5	0			
SDP	258.9	3.0	1.0	3.0	NS			
Pool	263.8	7.1	3.5	24.8	2			
Pool	270.9	3.6	3.0	10.8	0			
Riffle	274.5	14.7	3.5	51.5	0			
Glide	289.2	12.4	3.5	43.4	1			
Riffle	301.6	6.6	3.5	23.1	NS			
Glide	308.2	10.7	3.5	37.5	NS			
SDP	317.2	2.0	1.0	2.0	1			
Riffle	318.9	18.2	4.0	72.8	0			
Pool	337.1	5.6	2.5	14.0	0			
Riffle	342.7	3.8	2.0	7.6	NS			
Cascade	346.5	2.4	2.5	6.0	NS			
Riffle	348.9	12.0	3.0	36.0	NS			

Appendix 3c cont.

Lower Slate				Rectangle	Snorkel		Electro
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Ct	Dv	Ct
Riffle	0.0	7.7	7.0	53.9	NS	NS	
Glide	7.7	3.4	4.5	15.3	0	0	
Pool	11.1	3.6	4.0	14.4	1	5	
Glide	14.7	6.3	5.0	31.5	1	0	1
Pool	21.0	5.1	5.5	28.1	6	2	6
Riffle	26.1	9.6	4.0	38.4	NS	NS	
SDP		1.0	1.0	1.0	NS	NS	
Riffle	35.7	7.6	5.5	41.8	1	0	1
Glide	43.3	10.1	5.0	50.5	4	0	
Riffle	53.4	8.9	5.0	44.5	NS	NS	
Glide	62.3	5.7	5.5	31.4	NS	NS	
SDP		1.5	1.5	2.3	1	0	2
Riffle	68.0	10.9	4.5	49.1	0	0	0
Glide	78.9	7.1	5.0	35.5	1	0	3
Pool	86.0	5.4	4.0	21.6	4	0	4
Riffle	91.4	20.9	4.5	94.1	2	0	2
Riffle	112.3	36.9	7.0	258.3	NS	NS	
SDP		1.0	1.0	1.0	1	0	0
SDP		2.0	1.0	2.0	2	0	1
SDP		1.5	1.5	2.3	NS	NS	
Pool	149.2	8.4	7.0	58.8	4	1	4
Riffle	157.6	5.4	4.0	21.6	1	0	1
Riffle	163.0	13.0	4.0	52.0	NS	NS	
SDP		1.0	1.0	1.0	0	0	0
SDP		1.0	1.0	1.0	NS	NS	
Glide	176.0	7.2	4.5	32.4	3	1	
Riffle	183.2	9.1	5.0	45.5	NS	NS	
SDP		1.5	1.0	1.5	0	0	
Glide	192.3	3.4	5.5	18.7	0	0	0
Pool	195.7	2.7	4.5	12.2	1	0	1
Pool	198.4	3.7	2.5	9.2	0	0	
Riffle	202.1	2.7	2.0	5.4	NS	NS	
Riffle	204.8	5.1	4.5	23.0	NS	NS	
SDP		1.0	1.0	1.0	3	0	

Appendix 3c cont.

Lower Slate				Rectangle	Snorkel		Electro
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Ct	Dv	Ct
Riffle	209.9	12.2	3.0	36.6	1	0	
SDP		1.0	1.0	1.0	1	0	
SDP		1.0	1.0	1.0	NS	NS	
SDP		1.0	1.0	1.0	2	0	
Riffle	222.1	13.2	4.5	59.4	NS	NS	
Pool	235.3	3.7	5.0	18.5	4	0	
Riffle	239.0	22.9	2.0	45.8	NS	NS	
SDP		1.0	1.0	1.0	NS	NS	
Riffle	239.0	22.9	2.0	45.8	NS	NS	
SDP		4.0	4.0	16.0	NS	NS	
Pool	253.8	4.2	6.0	25.2	0	0	
Riffle	258.0	3.9	2.0	7.8	NS	NS	
Glide	261.9	5.2	4.5	23.4	0	0	
SDP		3.0	1.0	3.0	2	0	
Riffle	267.1	6.7	3.0	20.1	1	0	
Glide	273.8	9.4	3.5	32.9	3	0	
Riffle	283.2	3.9	3.0	11.7	NS	NS	
Riffle	287.1	11.5	4.0	46.0	0	0	
SDP		1.0	1.0	1.0	2	0	
SDP		2.0	2.0	4.0	0	1	
Riffle	298.6	17.8	3.5	62.3	NS	NS	
SDP		2.0	2.0	4.0	NS	NS	
SDP		3.0	2.0	6.0	0	0	
Riffle	316.4	9.7	3.5	34.0	NS	NS	
Riffle	316.4	9.7	3.0	29.1	NS	NS	
SDP		2.0	1.0	2.0	NS	NS	
Pool	326.1	4.3	3.5	15.0	1	1	
Riffle	330.4	4.9	4.0	19.6	NS	NS	
Pool	335.3	3.3	4.0	13.2	0	1	
Pool	338.6	2.2	2.0	4.4	0	0	
Riffle	340.8	4.6	2.5	11.5	NS	NS	
Pool	345.4	3.3	3.5	11.6	1	0	
Riffle	348.7	6.0	2.5	15.0	NS	NS	
Riffle	354.7	4.0	3.5	14.0	0	0	
Glide	358.7	1.3	2.0	2.6	NS	NS	

Appendix 3c cont.

Middle Slate				Rectangle	**Snorkel**	**Electro**	**Trap**	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Caught	Trap	Dv
Riffle	0.0	5.5	5.0	27.5	NS			
SDP	2.4	1.5	2.0	3.0	0			
SDP	3.9	1.0	1.0	1.0	NS			
Cascade	5.5	7.6	4.0	30.4	NS			
SDP	6.0	1.0	1.5	1.5	0			
Riffle	13.1	6.4	4.0	25.6	NS			
SDP	14.0	2.0	3.0	6.0	0			
Glide	19.5	8.0	4.0	32.0	NS			
Pool	27.5	5.5	3.0	16.5	0			
Cascade	33.0	6.4	3.0	19.2	NS			
SDP	37.1	2.0	3.0	6.0	0			
Cascade	39.4	3.3	4.5	14.9	NS			
Glide	42.7	3.3	3.5	11.6	0			
Riffle	46.0	15.3	3.5	53.6	0			
SDP	52.3	1.0	1.0	1.0	NS			
SDP	55.1	1.5	1.5	2.3	0			
Glide	61.3	5.3	2.5	13.3	NS			
Pool	66.6	1.6	3.5	5.6	NS			
Riffle	68.2	5.0	3.0	15.0	0	0		
Pool	73.2	6.9	4.0	27.6	0			
Riffle	80.1	9.0	5.5	49.5	NS			
Glide	89.1	8.6	5.0	43.0	0			
Riffle	97.7	7.6	4.0	30.4	NS			
SDP	97.9	1.0	1.0	1.0	NS			
Riffle	105.3	4.5	4.0	18.0	0	0		
Riffle	109.8	14.9	3.0	44.7	NS			
Pool	124.7	3.7	4.0	14.8	1		T1	0
Riffle	128.4	3.2	4.5	14.4	NS			
SDP	128.7	2.0	1.5	3.0	0			
Pool	131.6	2.0	3.0	6.0	0			
Riffle	133.6	2.8	4.0	11.2	NS			
Pool	136.4	2.4	4.0	9.6	0	0		
Riffle	138.8	3.4	2.5	8.5	NS			
Glide	142.2	3.7	3.0	11.1	0	0		
Riffle	145.9	2.8	2.0	5.6	0	0		
Glide	148.7	3.2	3.0	9.6	NS			
Pool	151.9	3.2	2.5	8.0	0	0		
Cascade	155.1	3.4	1.5	5.1	NS			
Riffle	158.5	6.4	4.5	28.8	NS			
SDP	163.9	1.0	1.0	1.0	0	1		

Appendix 3c cont.

Middle Slate				Rectangle	Snorkel	Electro	Trap	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Caught	Trap	Dv
Riffle	164.9	9.6	4.0	38.4	0	0		
SDP	169.8	3.0	3.0	9.0	0	0		
Glide	174.5	8.3	3.5	29.1	0			
Riffle	182.8	18.5	5.0	92.5	NS			
SDP	198.4	1.0	1.0	1.0	1	1		
Pool	201.3	4.0	4.5	18.0	NS			
Pool	205.3	12.6	5.0	63.0	0	0		
Riffle	217.9	22.7	4.0	90.8	1	1		
Pool	240.6	4.4	5.0	22.0	0		T2	0
Riffle	245.0	13.2	4.0	52.8	NS			
Glide	258.2	17.2	4.0	68.8	NS			
Riffle	275.4	1.9	4.5	8.6	NS			
SDP	276.9	1.0	1.0	1.0	NS			
Glide	277.3	8.1	3.5	28.3	NS			
Glide	285.4	10.7	4.0	42.8	0			
Riffle	296.1	6.7	3.5	23.5	1	1		
Glide	302.8	9.6	3.5	33.6	1	1		
Riffle	312.4	1.8	3.0	5.4	NS			
Glide	314.2	5.8	3.5	20.3	0	1		
Riffle	320.0	10.5	3.5	36.8	NS			
Riffle	330.5	10.8	3.5	37.8	0			
Glide	341.3	9.2	4.5	41.4	1	1		
Riffle	350.5	4.0	5.0	20.0	NS			
Pool	354.5	3.0	4.5	13.5	0			

Appendix 3c cont.

Upper Slate				Rectangle	Snorkel	Electro	Trap	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv	Trap	Dv
Riffle	0.0	7.4	1.5	11.1	NS			
Riffle	7.4	3.6	2.0	7.2	0			
Riffle	11.0	8.6	1.5	12.9	1	1		
Glide	19.6	11.8	2.5	29.5	0			
SDP	27.5	3.0	1.0	3.0	2	1		
Riffle	31.4	5.3	2.5	13.3	0	0		
Riffle	36.7	10.8	1.0	10.8	NS			
SDP	44.5	1.0	0.5	0.5	NS			
Glide	47.5	2.9	3.0	8.7	0			
Pool	50.4	4.0	1.5	6.0	0	1		
Riffle	54.4	5.9	2.0	11.8	0	0		
Pool	60.3	2.6	2.0	5.2	1	2		
Riffle	62.9	7.4	2.5	18.5	NS			
Glide	70.3	5.5	2.5	13.8	0	0		
Riffle	75.8	3.3	1.5	5.0	NS			
Glide	79.1	2.9	2.0	5.8	0	0		
Pool	82.0	3.1	2.0	6.2	1	1		

Appendix 3c cont.

Upper Slate				Rectangle	**Snorkel**	**Electro**	**Trap**	
Habitat Type	Distance (m)	Length (m)	Width (m)	Ai (m2)	Dv	Dv	Trap	Dv
Riffle	85.1	4.0	1.0	4.0	NS			
Glide	89.1	6.9	2.5	17.3	NS			
Riffle	96.0	8.3	2.0	16.6	0	0		
Glide	104.3	5.3	2.5	13.3	1	1		
Pool	109.6	2.5	1.0	2.5	0		T1	2
Riffle	112.1	4.6	2.0	9.2	NS			
Glide	116.7	3.7	2.0	7.4	0			
Pool	120.4	4.5	1.5	6.8	1	2	T2	1
Riffle	124.9	10.5	1.5	15.8	NS			
SDP	131.2	1.0	1.0	1.0	NS			
Pool	135.4	2.8	3.0	8.4	0	1		
Glide	138.2	2.4	2.5	6.0	NS			
Pool	140.6	4.6	3.5	16.1	2	1		
Riffle	145.2	4.0	1.5	6.0	NS			
Glide	149.2	4.6	1.5	6.9	1	1		
Riffle	153.8	7.3	2.0	14.6	0	0		
Riffle	161.1	8.3	2.5	20.8	2	2		
Pool	169.4	3.3	3.0	9.9	0	2	T3	3
Riffle	172.7	2.3	2.0	4.6	NS			
Pool	175.0	3.9	1.5	5.9	0	1	T4	4
Riffle	178.9	10.9	2.5	27.3	NS			
Pool	189.8	2.8	3.5	9.8	1	1		
Riffle	192.6	7.8	2.0	15.6	NS			
SDP	192.6	3.0	2.0	6.0	0	2		
Pool	200.4	2.4	2.5	6.0	0	1		
Riffle	202.8	7.7	1.5	11.6	NS			
SDP	205.8	4.0	1.0	4.0	0	2		
Pool	210.5	3.8	3.5	13.3	1			
Riffle	214.3	9.4	1.5	14.1	0	1		
Pool	223.7	4.8	2.0	9.6	1	3		
Riffle	228.5	9.5	2.0	19.0	NS			
Pool	238.0	2.1	1.5	3.1	0	1		
Glide	240.1	3.5	1.5	5.3	NS			
Riffle	243.6	31.6	2.0	63.2	0			
SDP	268.9	2.0	1.0	2.0	NS			
Pool	275.2	3.0	2.0	6.0	0			
Riffle	278.2	42.5	2.5	106.3	0			
SDP	293.9	1.0	1.0	1.0	NS			
SDP	304.1	2.0	1.0	2.0	0			
Pool	320.7	3.4	1.5	5.1	1			
Riffle	324.1	7.1	2.0	14.2	NS			
Pool	331.2	1.6	1.0	1.6	0			
Riffle	332.8	16.3	2.0	32.6	NS			
SDP	340.9	1.0	1.0	1.0	0			
SDP	345.4	1.0	1.0	1.0	NS			
Glide	349.1	4.4	1.5	6.6	0			
Riffle	353.5	6.5	1.5	9.8	NS			
SDP	356.4	1.0	1.0	1.0	NS			

Appendix 3d: Total length, weight and condition factor (K) for resident fish in 2007.

Dolly Varden	Length (mm)	Weight (g)	k	Statistics	
Lower Sherman	61	2.1	0.925	Mean	0.861
	113	13.7	0.949	Standard deviation	0.133
	137	18.2	0.708	n	3
				95% Confidence	0.151
Middle Sherman	109	12.4	0.958	Mean	0.882
	133	24.1	1.024	Standard deviation	0.075
	180	51.2	0.878	n	16
	123	17.5	0.940	95% Confidence	0.037
	140	23.6	0.860		
	161	33.9	0.812		
	166	45.1	0.986		
	145	23.6	0.774		
	128	17.6	0.839		
	126	17.5	0.875		
	138	24.0	0.913		
	122	14.7	0.810		
	128	17.4	0.830		
	171	44.9	0.898		
	175	50.8	0.948		
	135	19.0	0.772		
	123	16.6	0.892		
	126	16	0.800		

Dolly Varden	Length (mm)	Weight (g)	k	Statistics	
Upper Sherman	182	56.3	0.934	Mean	0.874
	149	31.4	0.949	Standard deviation	0.075
	160	38.8	0.947	n	24
	159	36.0	0.896	95% Confidence	0.030
	167	42.8	0.919		
	166	43.3	0.947		
	182	54.8	0.909		
	108	12.4	0.984		
	149	24.8	0.750		
	155	31.6	0.849		
	123	13.6	0.731		
	133	21.2	0.901		
	155	25.8	0.693		
	134	22.8	0.948		
	127	16.9	0.825		
	143	24.3	0.831		
	138	21.2	0.807		
	160	38.4	0.938		
	154	29.5	0.808		
	75	3.8	0.901		
	109	11.6	0.896		
	120	15.1	0.874		
	148	29.0	0.895		
	144	25.3	0.847		

Appendix 3d cont.

Dolly Varden	Length (mm)	Weight (g)	k	Statistics	
Lower Johnson	80	4.1	0.801	Mean	0.762
	66	2.3	0.800	Standard deviation	0.084
	72	3.2	0.857	n	8
	80	3.6	0.703	95% Confidence	0.058
	143	21.3	0.728		
	140	17.7	0.645		
	77	4.0	0.876		
	172	34.9	0.686		
Middle Johnson	154	32.2	0.882	Mean	0.907
	163	38.9	0.898	Standard deviation	0.059
	160	32.8	0.801	n	20
	173	49.7	0.960	95% Confidence	0.026
	130	23.5	1.070		
	118	15.4	0.937		
	152	33.3	0.948		
	154	32.6	0.893		
	166	41.8	0.914		
	150	29.4	0.871		
	207	77.7	0.876		
	146	26.8	0.861		
	157	34.5	0.891		
	122	15.2	0.837		
	147	30.3	0.954		
	177	46.3	0.835		
	185	61.3	0.968		
	128	18.9	0.901		
	119	15.7	0.932		
	136	22.9	0.910		

Dolly Varden	Length (mm)	Weight (g)	k	Statistics	
Upper Johnson	158	30.4	0.771	Mean	0.879
	138	26.1	0.993	Standard deviation	0.085
	95	8.7	1.015	n	19
	147	31.5	0.992	95% Confidence	0.038
	201	72.0	0.887		
	103	8.5	0.778		
	90	5.3	0.727		
	188	61.0	0.918		
	100	8.9	0.890		
	106	12.3	1.033		
	108	10.9	0.865		
	91	6.7	0.889		
	89	5.8	0.823		
	94	7.4	0.891		
	137	22.5	0.875		
	98	7.9	0.839		
	97	7.4	0.811		
	99	7.9	0.814		
	200	71.3	0.891		

Appendix 3d cont.

Dolly Varden	Length (mm)	Weight (g)	k	Statistics	
Middle Slate	157	33.8	0.873	Mean	0.838
	139	20.7	0.771	Standard deviation	0.060
	140	23.1	0.842	n	6
	131	18.8	0.836	95% Confidence	0.048
	138	20.4	0.776		
	169	44.9	0.930		
Upper Slate	173	42.5	0.821	Mean	0.862
	63	2.4	0.960	Standard deviation	0.078
	61	2.5	1.101	n	38
	58	1.7	0.871	95% Confidence	0.025
	61	1.8	0.793		
	65	2.5	0.910		
	94	6.5	0.783		
	104	10.2	0.907		
	75	4.2	0.996		
	96	7.1	0.802		
	96	8.3	0.938		
	81	4.7	0.884		
	123	16.7	0.897		
	63	2.0	0.800		
	80	4.7	0.918		
	72	2.9	0.777		
	127	15.7	0.766		
	140	24.5	0.893		
	112	13.9	0.989		
	105	9.3	0.803		
	97	7.8	0.855		
	96	6.9	0.780		
	89	5.7	0.809		
	68	3.0	0.954		
	92	7.3	0.937		
	89	6.4	0.908		
	74	3.0	0.740		
	70	2.7	0.787		
	88	5.5	0.807		
	85	5.0	0.814		
	92	6.4	0.822		
	74	3.5	0.864		
	67	2.4	0.798		
	65	2.3	0.838		
	97	8.4	0.920		
	94	6.9	0.831		
	107	10.7	0.873		
	72	3.0	0.804		

Appendix 3d cont.

Cutthroat Trout	Length (mm)	Weight (g)	k	Statistics	
Lower Sherman	140	29.3	1.068	Mean	1.051
	113	15.6	1.081	Standard deviation	0.057
	114	14.3	0.965	n	4
	120	18.8	1.088	95% Confidence	0.056
Lower Slate	94	6.9	0.831	Mean	0.865
	87	4.7	0.714	Standard deviation	0.124
	90	6.9	0.947	n	18
	73	3.8	0.977	95% Confidence	0.057
	88	5.8	0.851		
	69	3.1	0.944		
	75	3.4	0.806		
	76	3.4	0.775		
	71	3.3	0.922		
	83	6.4	1.119		
	69	3.3	1.005		
	99	8.8	0.907		
	90	5.9	0.809		
	89	3.9	0.553		
	89	6.0	0.851		
	97	7.1	0.778		
	65	2.5	0.910		
	66	2.5	0.870		

Appendix 5: Weekly salmon counts for Sherman, Johnson and Slate in 2007.

Sherman Pink Salmon Counts **Totals**

Reach	7/26/07	8/2/07	8/9/07	8/16/07	8/23/07	8/29/07	9/5/07	9/13/07	9/20/07	
Intertidal	0	0	16	200	100	6	60	0	0	
0-50	0	0	4	12	20	20	50	24	2	
50-100	0	0	0	0	0	0	4	3	0	
100-150	0	0	4	5	4	4	20	10	4	
150-200	0	0	0	4	10	12	18	22	8	
200-250	0	0	0	2	2	2	10	10	2	
250-300	0	0	4	0	10	10	6	6	2	
300-350	0	0	0	2	14	6	8	6	0	
Falls Pool	0	0	3	1	12	10	4	3	0	
Total	**0**	**0**	**31**	**226**	**172**	**70**	**180**	**84**	**18**	**781**

Johnson Pink Salmon Counts

Reach	7/26/07	8/2/07	8/10/07	8/17/06	8/23/07	8/30/07	9/6/07	9/13/07	9/20/07	
Lace Trib	240	100	650	150	0	0	0	0	0	
Trap Corner	150	50	70	250	300	120	2	24	0	
Marker 4	270	400	400	400	250	210	20	4	0	
Marker 7	50	125	400	600	150	10	0	0	0	
Marker 8	20	0	50	0	0	0	0	4	0	
Marker 10	20	20	400	150	50	10	10		0	
Powerhouse	10	0	50	20	10	10	10		0	
Log Falls	2	0	20	10	10	8	4		0	
Marker 15	0	0	10	6	2	2	0	2	0	
Falls Barrier	2	0	0	0	0	0	0			
Total	**764**	**695**	**2050**	**1586**	**772**	**370**	**46**	**34**	**0**	**6317**

Slate Pink Salmon Counts

Reach	7/26/07	8/2/07	8/10/07	8/16/07	8/23/07	8/30/07	9/6/06	9/13/06	9/20/07	
Intertidal	0	0	0	0	0	0	0	0	0	
0-100	0	0	0	150	0	1	1	0	0	
100-200	0	0	11	0	3	0	1	0	0	
200-300	2	0	0	0	2	0	0	0	0	
300-400	0	0	1	0	0	0	0	0	0	
400-500		0	0	0	0	0	0	0	0	
500-600		0	0		0	0	0	0	0	
600-700		0	0		0	0	0	0	0	
700-800			0		0			0	0	
800-900					0			0		
900-1000					0					
Total	**2**	**0**	**12**	**150**	**5**	**1**	**7**	**0**	**0**	**177**