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1.0 Introduction

This report describes 2009 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 out-migrating 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 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 prevent fish passage on both East and West forks approximately 1000m from the stream mouth. The East Fork of Slate Creek is unique among the streams in containing two lakes upstream. 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. Fish species present in anadromous reaches, downstream of falls barriers include pink salmon (*Onchorhynchus gorbuscha*), coho salmon (*Onchorhynchus kisutch*), Cutthroat trout, Dolly Varden etc.

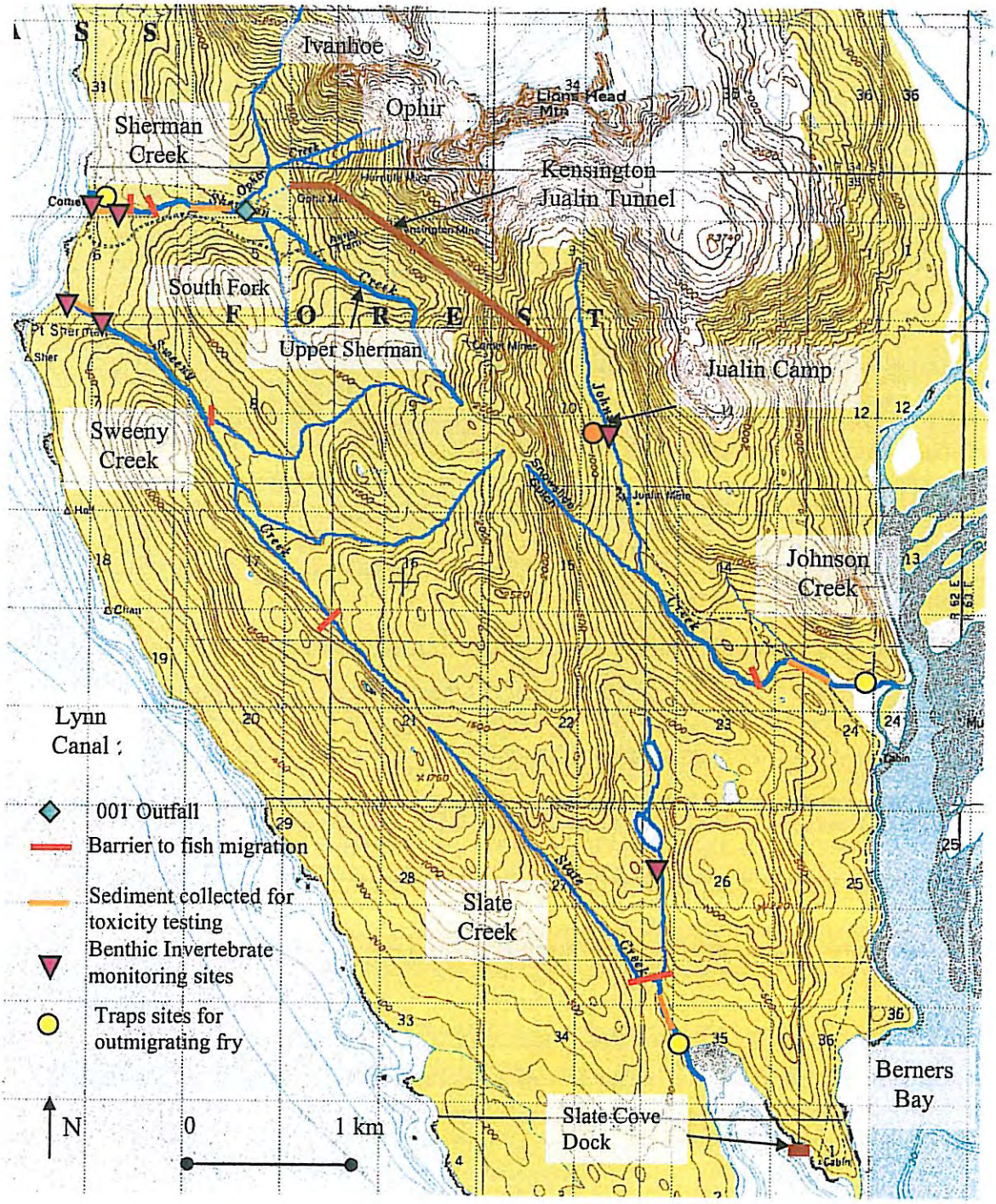


Figure 1: Location of streams near Kensington Mine included in 2009 Aquatic Resource Monitoring. Sediment toxicity testing, benthic invertebrate surveys, resident and anadromous fish surveys, analysis of spawning gravel and aquatic vegetations surveys were conducted in Sherman, Johnson and Slate Creeks. Benthic invertebrates were also collected from two reaches of Sweeny Creek.

Sediment Monitoring

3.1 Introduction

Stream sediment samples were collected at the end of August and beginning of September 2009 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 dilutus* (formerly known as *Chrinomus 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 Lower and Middle reaches of Sherman Creek, Lower Slate Creek and Lower Johnson Creek (Figure 1). Metals tend to adhere to fine clay particles, but there a very few areas of fine sediment deposition in any of the streams. Samples were collected from fine deposits of mud trapped behind boulders on the stream margins.

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 remove course material. 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 decanted off the top and the finest sediment left in the bottom of the cone was 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 (AECOM, formerly ENSR, Fort Collins, Colorado). These samples were analyzed to determine the physical composition of the sediment including metal concentration, grain size, total organic carbon content, 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 wiping with 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: Physical Composition of Sediment Samples.

Particle Size %	Lower Sherman	Middle Sherman	Lower Johnson	Lower Slate
Sand	79	80	50	82
Silt	13	16	41	10
Clay	8	4	9	8
Coarse material (>2mm)	ND	ND	ND	ND
Texture	Loamy sand	Loamy sand	Loam	Loamy sand
Total Solids %	62.18	73.24	65.82	56
Total Volatile solids %	4.16	2.97	2.16	6.66
Total Sulfide (umoles/g)	1.37	1.19	ND	ND
Total Organic Carbon %	5.05	2.53	2.02	6.58

ND = not detected

Samples from the four sites were similar in their size composition, ranging from 82% sand at Slate Creek to 50% sand at Lower Johnson (Table 1). Clay content was lowest at Middle Sherman (4%). Total Solids, Total Volatile Solids and Total Sulfide were analyzed using Standard Methods 2540B, 2540E. Total Organic Carbon was determined using the Organic Matter-Walkley Black Method. Concentrations of total organic carbon ranged from 2% in Johnson Creek sediment to 6.6% in Slate Creek sediment. Total volatile solids ranged from 2.2% in Lower Johnson sediment to 6.7% in Slate Creek samples. Sulfide was only detected at low level in Lower and Middle Sherman sediment. The laboratory reports are included as Appendix 1a and b.

3.3 Sediment Metal Concentration

Total metals (aluminum, chromium, zinc) were determined using EPA method 6010B, inductivity-coupled plasma-atomic emission spectrometry (ICP-AES). Solid sample analysis of the metals arsenic, cadmium, copper, nickel, silver, lead and selenium was carried out using method 6020, inductivity-coupled plasma-mass spectrometry (ICP-MS) and mercury was determined by method 7471B, manual cold-vapor technique. Table 2 summarizes metal concentrations in the sediment collected from each stream.

Table 2: Concentrations of metals in stream sediment, (mg/kg)

Analyte	Lower Sherman	Middle Sherman	Lower Johnson	Slate Creek
Aluminum	14,600	10,500	13,000	10,400
Arsenic	46.4	29.4	8.91	22.8
Cadmium	0.466	0.283	0.24	0.717
Chromium	42.1	23.3	33.2	17.5
Copper	105	65.1	66.6	44.3
Lead	12.6	7.88	7.64	13.4
Mercury	0.0786	0.0579	0.054	0.0822
Nickel	33.8	21.8	48.4	27.4
Selenium	1.8	1.09	0.405	1.24
Zinc	126	101	93.5	155
Silver	0.319	0.252	0.369	0.18

Five out of the eleven metals appeared to be of highest concentration in Lower Sherman (aluminum, arsenic, chromium, copper and selenium) while four were highest in Lower Slate (cadmium, lead, mercury and zinc). Six metals showed lowest concentrations in Johnson Creek, while four metals had lowest concentrations at Slate Creek. All four sites had high concentrations of aluminum (over 10,000 mg/kg). Zinc and copper were the next most abundant metals after aluminum (Figure 2). Zinc made up 55% of the metal content (excluding aluminum) in the Lower Slate sample. Zinc and copper each made up 35% of the sample at Lower Johnson; zinc comprised around 35%

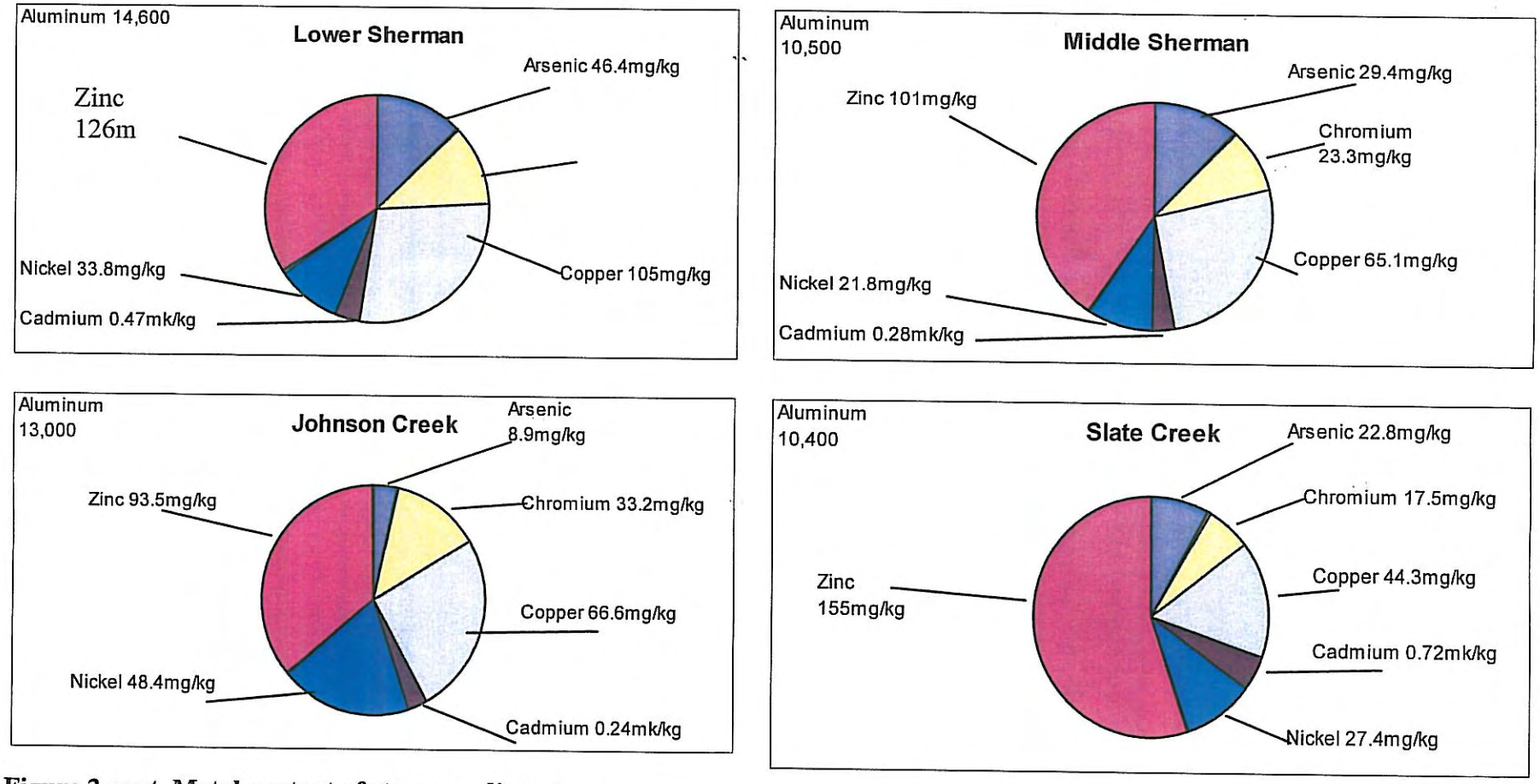


Figure 2 cont. Metal content of stream sediment.

3.4 Sediment Toxicity Testing

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

Short term chronic screening toxicity tests were conducted on both organisms from September 15 to 25, 2009 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). For each test the sand and formulated sediment were compared using a t-test. If there was no significant difference between the two, the controls were pooled and comparisons made against the pooled data. If there was a significant difference, all statistical comparisons were made against the formulated sediment since the organic matter content of this control was more reflective of that of the test sediments. Survival of *Hyalella azteca* and *Chironomus dilutus* was high in sediment from all sites (most over 90%) and not significantly different from control sediment (Table 3).

Table 3: Survival of organisms after 10-day exposure to sediment.

Biological Data			
Collection Date and Time	**Sample ID**	***Chironomus dilutus* Survival (%)**	***Hyalella azteca* Survival (%)**
9/1/09 12:00	Lower Sherman	**83.75**	**91.25**
9/2/09 11:00	Middle Sherman	**90.00**	**90.00**
8/23/09 12:00	Johnson Creek	**95.00**	**91.25**
8/31/09 12:00	Slate Creek	**91.25**	**91.25**
	Sand - control	**91.25**	**98.75**
	Lab Sediment	**93.75**	**86.25**

Survival of *Chironomus dilutus* was slightly higher in 2009 than previous years at all sites (Figure 3). The survival of *Hyalella azteca* in 2009 was similar to 2008 test results at all sites. Middle Sherman sediment had almost 98% survival in 2008 and was 90% in 2009, which was still higher than the control sediments. 2007 was the first year sediment was collected from Middle Sherman.

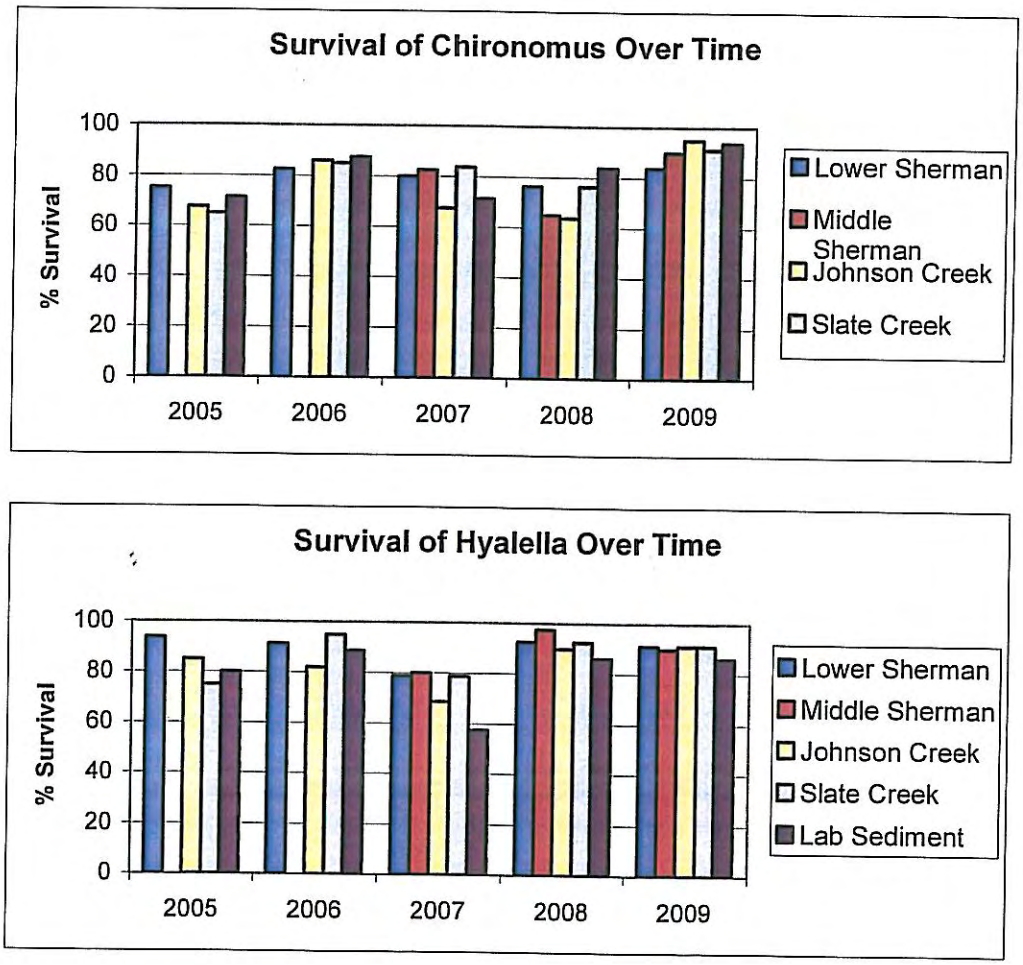


Figure 3: Comparison of toxicity tests with previous years

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. *Hyalella azteca* showed a significant reduction in growth in sediment from Slate and Johnson Creeks compared to laboratory formulated sediment.

Chironomus dilutus showed significant reductions in growth in sediment from all sites compared to laboratory formulated control sediment, but not compared to the sand control (Table 4). In 2007 and 2006, the lowest survival and growth among the test sediments were found in Lower Johnson sediment. In 2008, Johnson and Middle Sherman showed low survival and growth, but only for *Chironomus*, not *Hyalella*.

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

	Chironomus dilutus		***Hyalella azteca***	
	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	1.5461c	1.9603c	0.060	0.066
Middle Sherman	1.5964c	1.8127c	0.055	0.060
Johnson Creek	1.5496c	1.6463c	0.030	0.033c
Slate Creek	1.3729c	1.5459c	0.029c	0.032c
Sand - control	1.2597	1.4721	0.069	0.070
Lab Sediment	2.1998	2.3508	0.043	0.048

Growth in the two controls was significantly different.

All statistical comparison made against formulated sediment.

c = significantly lower weight compared to formulated sediment

Hyalella azteca and *Chironomus dilutus* performed consistently well in survival in sediment from all sites. Growth of *Chironomus* showed significant effects in sediment from all sites and growth of *Hyalella* was affected at Johnson and Slate Creek sediment. Metal content of the sediments do not appear to explain differences in test results with previous years. The metal concentrations found in 2009 were for the most part lower than 2008 levels, including much reduced levels of zinc at Slate Creek. Total organic carbon levels were more than twice as high at Lower Sherman and Johnson in 2009 than the previous year. TOC can often offset toxicity, but it did not appear to help with the growth of organisms in this case.

4.0 Benthic Invertebrates

4.1 Site Description

Benthic invertebrates were collected from established sampling sites on Slate, Johnson, Sherman and Sweeny Creeks in April and May of 2009 (Figure 1). Samples were collected from Sherman Creek on May 11 and 12 and from Sweeny Creek on April 27 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. Samples were collected from Slate Creek on April 21 and from Johnson Creek on April 15. At Slate Creek, the sampling site is 400m downstream from Lower Slate Lake, while at Johnson Creek samples are collected at the JS-1 flow monitoring site, upstream of the upper bridge crossing.

4.1 Sample Collection

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 4), placed in labeled whirlpak bags and preserved with 70% ethyl alcohol.

4.2 Invertebrate identification

Sorting and identification of invertebrates was conducted by personnel from Aquatic Science Inc. Juneau, Alaska, with quality control performed by Elizabeth Flory PhD. who has 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 of stream bed enclosed by the Surber sampling frame 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:

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

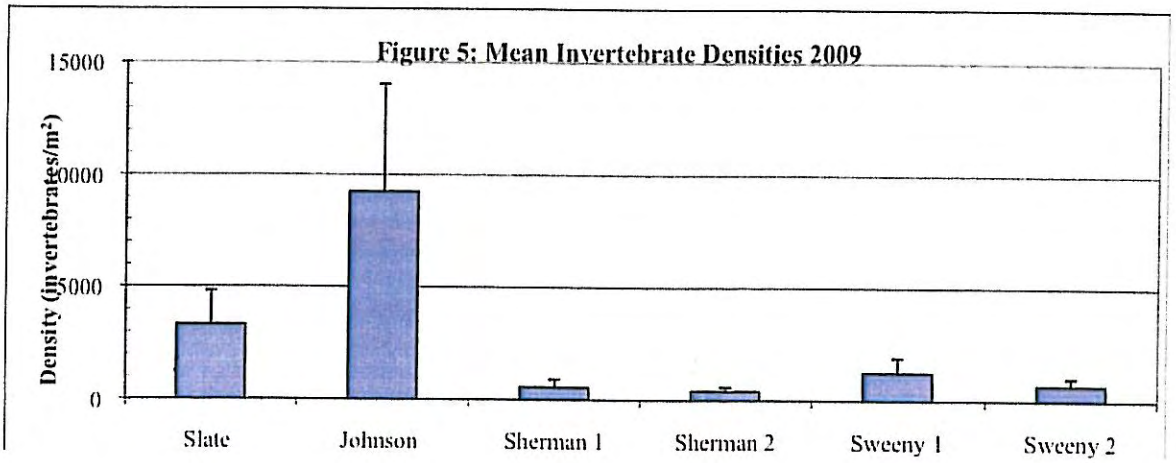
$$E = H/\log10 (S)$$

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 4: A caddis larvae encased its housing made from rock fragments.

4.4 Densities and Taxa Present

Densities of invertebrates in Slate Creek samples varied widely, ranging from 1,086 invertebrates per m^2 to 6,548/m^2 with a mean of 3,301/m^2 (Figure 5, Table 5). Johnson Creek densities were significantly higher than Sherman or Sweeny Creeks ($p < 0.05$) and with the exception of one sample, ranged from 7,656 to 13,850/m^2 with a mean of 9,238/m^2. Sherman Creek densities ranged from 226 to 1,204/m^2 over both reaches with a mean density of 556/m^2 in Reach 1 and 409/m^2 in Reach 2. Sweeny Creek densities ranged from 215 to 2462/m^2 over both reaches with mean density of 1,251/m^2 for Reach 1 and 685/m^2 for Reach 2.



Site	Density (inverts/m^2)	Mean # Taxa	Mean # EPT	Mean Ratio
Slate	3301.1	18.7	11.5	0.67
Johnson	9238.4	20.5	15.2	0.77
Sherman 1	555.6	15.5	9.2	0.59
Sherman 2	408.6	11.8	9.0	0.77
Sweeny 1	1250.9	9.7	8.3	0.86
Sweeny 2	684.6	12.2	9.8	0.83

Table 5: Invertebrate Densities and Mean Number of Taxa.

The mean number of taxa was significantly higher in Johnson Creek and Slate Creek samples (20.5 and 18.7 respectively) than other sites (15 or less). There was no significant difference between mean numbers of taxa at other sites. Johnson and Slate Creek samples also had the highest mean number of Ephemeroptera, Plecoptera and Trichoptera (EPT taxa).

Overall, Slate Creek samples contained a total of 1,841 invertebrates from 29 genera, including 20 EPT taxa (Table 6). The overall ratio of EPT to non-EPT taxa was 0.67. Non-EPT taxa included three Chironomidae genera (non-biting midges), the common pea clam *Psidium*, one Tipulidae (crane fly) genus, two Collembola (springtails) genera, a Simulidae, a water mite (*Eylais*) and an Oligochaetae. Johnson Creek samples contained 5,155 invertebrates from 28 genera composed of 20 EPT taxa, five Chironomidae taxa, one Tipulidae, one Simulidae and one Oligochaetae, giving a ratio of EPT to non-EPT of 0.71.

Sherman Creek samples contained 310 individuals at Reach 1 and 228 individuals at Reach 2. Reach 1 samples contained 31 genera with 17 EPT taxa while Reach 2 samples contained 25 genera including 14 EPT taxa giving EPT ratios of 0.55 and 0.56 respectively. Non-EPT taxa included five Chironomidae taxa, three Tipulidae, one Empididae, one other Diptera (Ceratopogonidae), two Collembolas, a Coleoptera (beetle larvae), a Lepidoptera larvae and one oligochaetae. Sweeny Creek samples contained 698 individuals at Reach 1 and 381 individuals at Reach 2. Sweeny Creek samples from Reach 1 contained 17 genera, with 14 of these EPT taxa, while Reach 2 samples contained 24 genera, with 16 of these EPT taxa (identical to 2008). Sherman Creek Reach 1 had the highest number of genera overall (31) with both Johnson and Slate Creek sharing the highest number of EPT taxa (20). Sherman Creek Reach 1 samples also contained the highest number of non-EPT taxa (14), exceeding that of Slate Creek, which typically has the highest number owing to the presence of lakes upstream (Table 6).

Table 6: Total number of genera in each taxanomic group

	# Ephem.	# Plecop	# Trichop	# EPT	# non-EPT	# Total taxa	EPT ratio
Slate	4	8	3	15	10	25	0.60
Johnson	9	12	9	30	8	38	0.79
Sherman 1	6	5	3	14	6	20	0.70
Sherman 2	7	5	6	18	9	27	0.67
Sweeny 1	8	6	0	14	6	20	0.70
Sweeny 2	6	8	2	16	8	24	0.67

Table 7: Mean numbers of each taxa present at each site.

Class	Order	Family	Genus	Johnson	Slate	Sherman 1	Sherman 2	Sweeny 1	Sweeny 2
Insecta	Ephemeroptera	Baetidae	Baetis	446.2	12.8	9.7	9.3	89.3	28.2
		Heptageniidae	Epeorus	22.5	8.0	4.2	3.8	2.8	4.3
			Cinygmula	86.7	11.5		0.2	4.0	6.5
			Rithrogena	7.3	0.4	0.2	0.2	2.5	3.4
		Ephemerellidae	Drunella	108.0	1.0	4.8	2.8	0.8	1.0
			Caudatella	36.3		1.3	1.2		0.2
		Leptophlebiidae	Paraleptophlebia	0.5	8.2	0.0			
			Leptophlebia			0.2			
		Ameletidae	Ameletus			1.0			
	Plecoptera	Chloroperlidae	Alaskaperla		2.2	5.3			
			Haploperla						
			Suwallia		5.5	0.5			
			Kathroperla			0.7			0.5
			Plumiperla	4.8	2.2	2.7	6.0	6.5	8.0
			Neaviperla		0.2		0.7	0.5	
		Capniidae	Paracapnia	2.7				4.5	1.5
		Leuctridae	Perlomyia	3.3	0.3			1.5	2.3
			Despaxia		0.2				
		Nemouridae	Zapada	24.7	6.8	2.7	0.2	1.0	2.5
			Nemoura	0.3		0.2			0.3
			Shipsa	1.2	32.5				1.7
			Prostoia						
		Perlodidae	Megarcys	0.7					
			Salmoperla		2.2				
		Perlidae	Claassenia		0.8				
			Hesperoperla		0.3				
	Trichoptera	Hydropsychidae	Parapsyche	5.7		0.2		0.3	
			Arctopsyche	0.5	0.5				
		Glossosomatidae	Glossoma	32.3	0.2			0.5	0.2
		Polycentropidae	Neureclipses		0.2				
		Rhyacophilidae	Rhyacophila	23.0	1.0	2.3	1.8	0.2	0.2
		Limnephilidae	Moselyana			0.2			0.2
			Rossiana					0.2	
			Grensia			1.3	0.2		

Class	Order	Family	Genus	Johnson	Slate	Sherman 1	Sherman 2	Sweeny 1	Sweeny 2
Insecta	Diptera	Chironomidae							
	sub-family	Orthocladiinae	Eukiefferiella	28.2	4.0	6.2	2.8	1.8	1.0
			Tvetenia	4.3		1.5	1.0		0.5
			Parachaetocladius			0.2			
			Corynoneura			1.0			
		Diamesinae	Pagasta	0.3	3.7				
			Diamesa			0.3			
		Tanytarsini	Tanytarsus	4.5	25.3				0.3
		Tanypodinae	Telmatopelopia	0.3		0.7			
		Podonominae	Paraboreochlus						
	Nematocera	Tipulidae	Dicranota	2.0		1.2	1.3	0.2	0.7
			Prionocera			0.2			
			Hexatoma			0.8			
			Tipula		1.5				
		Empididae	Clinocera			0.2	0.2		
			Chelifera						0.3
	Brachycera	Ceratopogonidae	Dasyhelea			0.2			0.2
		Simuliidae	Prosimulium	10.3	65.0				
	Collembola	Entomobryidae	Tomocerus		1.8				
			Semicerura		0.4				
		Onychiuridae	Lophognathella			0.5	0.2		0.2
		Sminthuridae	Dicyrtoma		65.0	0.2			
	Coleoptera	Haliplidae	Haliplus			0.3			
	Lepidoptera	Pyralidae	Crambus			0.2			
Arachnida	Mites			0.7	0.2				
Annelida	Oligochaetae			0.5	1.3	3.2	2.0	0.2	0.2
Bivalva	Sphaerlidae	Psidiinae	Psidium (pea clam)		110.8				

Table 7 continued.

The most abundant genera in Slate Creek were the mayflies *Baetis*, *Cinygmula*, *Paraleptophlebia*, Epeorus, the stoneflies, *Shipsa and Zapada*, *Suwallia*, the pea clam *Psidium*, the blackfly larvae *Prosimulium* and the midge *Tanytarsus* (Table 7). In Johnson Creek, the mayflies *Baetis*, *Cinygmula*, *Caudatella* and *Drunella*, the stonefly *Zapada* and the caddis flies *Glossoma* and *Rhyacophila* were the most numerous. In Sherman Creek the most abundant taxa were the mayflies *Baetis, Drunella*, and *Epeorus,* and the stonefly *Plumiperla*. Sweeny Creek abundant fauna included the mayflies *Baetis,* and *Cinygmula,* and stoneflies *Plumiperla and Paracapnia* and midge *Eukiefferiella.* Most of these genera were also found to be numerous at the same sites in 2007 and 2008.

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. Table 8 compares mean diversity and evenness indices between sites.

Diversity and evenness were highest at Sherman Creek and lowest at Reach 1 of Sweeny Creek in 2009 (Table 8). Slate and Johnson Creeks had similar diversity and evenness. Diversity was low in one sample from Slate Creek due to large numbers of pea clams and blackflies and low diversity in one Johnson samples was due to relatively large numbers of one mayfly species. Johnson had a high number of genera overall, but also large numbers of a few mayflies, particularly *Baetis*, which reduced the evenness index markedly. Reach 1 of Sweeny Creek also had lower evenness due to high numbers of *Baetis* mayflies. Sherman Creek diversity was high due to similar numbers of a large number of taxa producing an even distribution of species.

	Shannon-Weaver			Shannon-Weaver	
	Diversity	Evenness		Diversity	Evenness
Slate			**Johnson**		
1	0.890	0.645	1	0.805	0.569
2	0.905	0.647	2	0.800	0.588
3	0.603	0.471	3	0.715	0.533
4	0.869	0.739	4	0.644	0.495
5	0.546	0.506	5	0.489	0.541
6	0.799	0.649	6	0.787	0.570
Mean	**0.768**	**0.609**	**Mean**	**0.707**	**0.549**
Sherman 1			**Sherman 2**		
1	1.062	0.927	1	1.035	0.903
2	1.091	0.906	2	0.843	0.934
3	0.985	0.946	3	0.903	0.811
4	1.103	0.937	4	0.980	0.941
5	1.120	0.892	5	0.815	0.732
6	1.054	0.825	6	0.914	0.847
Mean	**1.069**	**0.905**	**Mean**	**0.915**	**0.861**
Sweeny 1			**Sweeny 2**		
1	0.366	0.384	1	0.818	0.679
2	0.429	0.429	2	0.792	0.734
3	0.552	0.579	3	0.694	0.727
4	0.527	0.623	4	0.832	0.799
5	0.617	0.525	5	0.715	0.624
6	0.231	0.256	6	0.917	0.881
Mean	**0.454**	**0.466**	**Mean**	**0.621**	**0.878**

Table 8: Shannon Indices of Diversity and Evenness.

4.5 Comparison with Previous Years

Densities at Johnson Creek were much higher in 2009 than previous years, with five out of six samples containing having a density of over 7,000 invertebrates per m^2 (Figure 6). Invertebrate densities in Reach 2 of Sherman were lower than 2007 and 2008, while densities at Reach 1 of Sweeny Creek were significantly higher in 2009 than in 2006 and 2007 ($p < 0.05$). Changes in density over time may be due to the timing of sampling with high flow events, which may scour invertebrates off rocks and reduce numbers. The number of taxa was slightly higher at Slate Creek with more EPT taxa (pollution–sensitive) and fewer non-EPT taxa (pollution-tolerant) in 2009. Johnson Creek had fewer EPT taxa in 2009. Sherman and Sweeny Creeks has similar numbers of taxa in 2009 to previous years, though Reach 1 of Sherman has more non-EPT taxa and Reach 1 of Sweeny had few non-EPT taxa in 2009 (Table 9). Slate Creek appears to have gained EPT taxa while non-EPT taxa have declined since 2007. Johnson Creek has fewer EPT taxa, but those present were in high abundance, suggesting competition between species might be influencing the community composition.

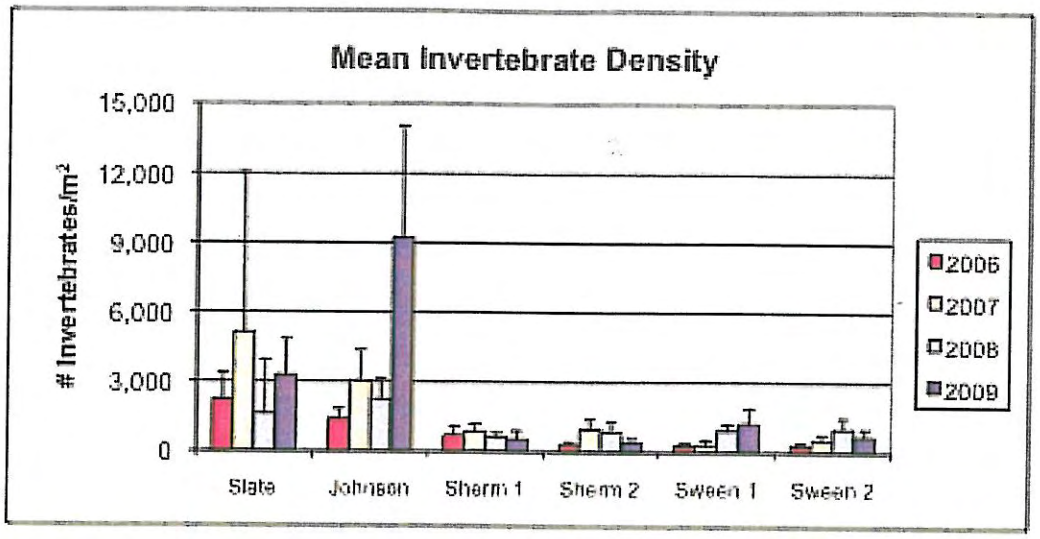
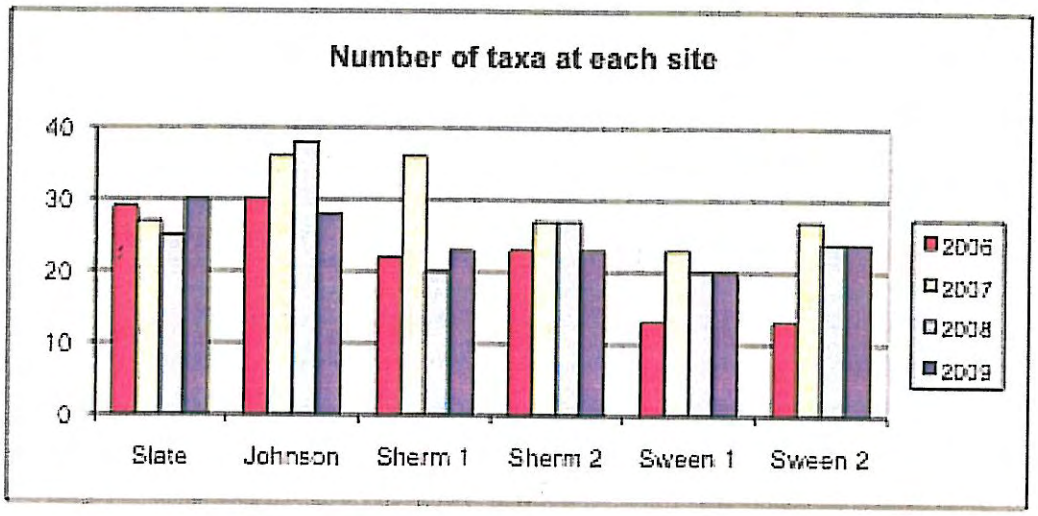


Figure 6: Invertebrate densities and number of taxa compared between years.



	# EPT			# non EPT		
	2007	**2008**	**2009**	**2007**	**2008**	**2009**
Slate	15	15	20	14	10	9
Johnson	30	30	20	4	8	9
Sherman 1	14	14	17	8	6	14
Sherman 2	18	18	14	5	9	11
Sweeny 1	14	14	14	7	6	3
Sweeny 2	16	16	16	11	8	8

Table 9: Comparison of 2007 and 2008 Taxanomic Groups.

5.0 Resident Fish Population

5.1 Stream Reaches

Resident fish surveys were conducted on the three main stream systems around the mine site, Sherman Creek that flows into Lynn Canal and Johnson and Slate Creeks that flow into Berners Bay (Figures 6, 7). Population surveys of resident fish were conducted in 2009 in lower, middle and upper reaches of each stream. Each reach is 360m in length. Sherman and Sweeny Creek reaches were designated during aquatic resource surveys in 1998 (Aquatic Science Inc. 1998) while Johnson and Slate reaches were delineated in 2005. All middle and upper reaches are located above barrier falls and are thereby inaccessible to sea-run fish. Dolly Varden char (*Salvelinus malma*), pink salmon (*Onchorhynchus gorbuscha*), chum salmon (*O. keta*), cutthroat trout (*O. clarki*) and coastrange sculpin (*Cottus aleuticus*) inhabit reaches below falls barriers. Dolly Varden are the only fish present above barrier falls and likely first arrived there when sea levels were higher.

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. Permanent markers are located at the start of strata if no permanent natural features occurred there (e.g. falls, stream confluence).

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 10.

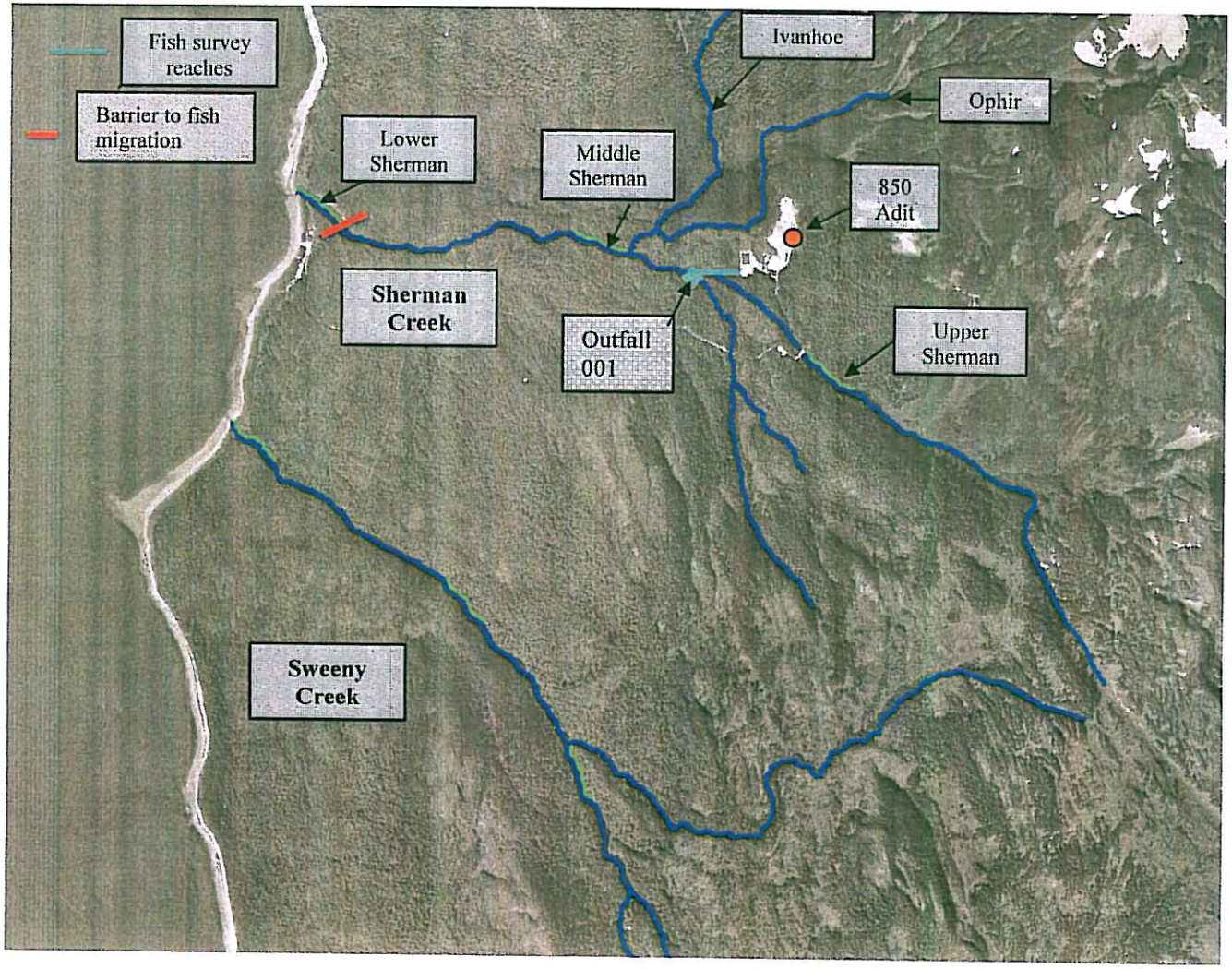


Figure 7A: Sherman Creek reaches used in 2009 Resident Fish Surveys.

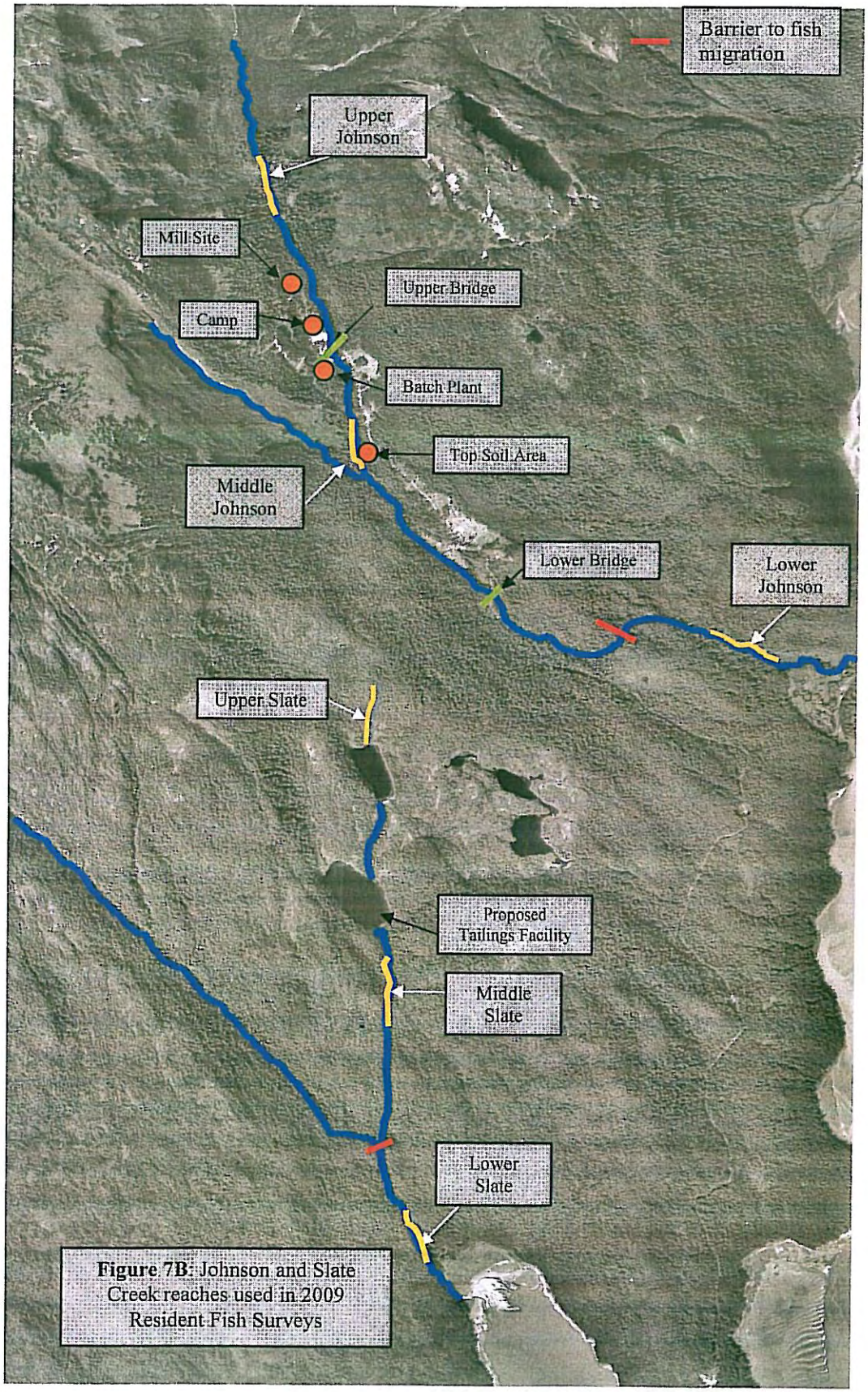


Figure 7B: Johnson and Slate Creek reaches used in 2009 Resident Fish Surveys

Table 10: GPS Coordinates (NAD 27) for resident fish strata.

	Stream Reach	Date Surveyed	Latitude	Longitude
1	Lower Sherman	7/15/2009	58.86908	-135.14005
2	Middle Sherman	8/4/2009	58.86774	-135.11430
3	Upper Sherman	8/11/2009	58.86342	-135.10025
4	Lower Johnson	7/13/2009	58.82383	-134.99936
5	Middle Johnson	8/5/2009	58.83113	-135.03711
6	Upper Johnson	8/12/2009	58.85147	-135.04892
7	Lower Slate	7/20/2009	58.79628	-135.03716
8	Middle Slate	7/28/2009	58.80370	-135.03706
9	Upper Slate	7/29/2009	58.81412	-135.04030

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 previous surveys (Aquatic Science 1998-2008). Resident fish surveys were conducted between July 13 and August 12, 2009. 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. A fisheries biologist, equipped with dry suit and snorkel, quietly entered the water at the downstream end of a selected unit and proceeded upstream observing fish underwater. Two field technicians, 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 snorkeling. 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 habitat units within a reach to give a total population estimate. Standard deviations and 95% confidence intervals for the population estimates were determined using equations (5) through (11) in Dolloff, Hankin & Reeves (1993). 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:

y_i = true number of fish in each unit; i = 1,2,…..,N,

Y = total number of fish in all units, d_i = 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 $y_i = d_i R$ (for i not in n') where R is the ratio of actual numbers present to diver counts, estimated by $R = \Sigma y / \Sigma d$ (for i in n') or the total electro-fishing counts to diver counts. The estimate is then extrapolated over all units using: $Y = N/n (\Sigma y_i)$.

An estimation of error is then made using the equation:

$$V(yd,r) = \frac{S^2y - 2RSxy + R^2S^2x}{n'} + \frac{2RSxy - R^2S^2x}{n} - \frac{S^2y}{N}$$

where $S^2y = \Sigma(yi - y')^2 / n'-1$,

$S^2x = \Sigma(xi - x')^2 / n'-1$, and

$Sxy = \Sigma(xi - x')(yi - y') / n'-1$

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). The minimum detectable difference (δ) in mean numbers of fish in each habitat unit or reach was calculated using the previously calculated estimation of error with the equation:

$$\delta = \sqrt{\frac{V(yd,r)}{n}} \qquad (t\ \alpha(2), v + t\ \beta(1), v)$$

Where $v = n-1$

A significance level (α) of 0.05, and a statistical power β of 0.01 were specified for the analysis, to determine the smallest difference in mean numbers of fish that are detectable 90% of the time with a 95% significance level. The t values were read from tables depending on sample size.

5.4 Population estimates

Numbers of fish counted by snorkeling and captured by electro-fishing and minnow trapping are summarized in Table 11. Population estimates by habitat type and by reach are presented in Table 12 and illustrated in Figures 8A and B. Dolly Varden were found in all stream reaches, while cutthroat trout were only present in the lower stream reaches. Dolly Varden numbers were highest in Lower and Middle Johnson and Upper Sherman Creek and Upper Slate Creek, particularly in pools. Cutthroat numbers were highest in Lower Slate.

Table 11: Numbers of resident fish observed snorkeling and captured fishing.

			Snorkeling			Electrofishing/Trapping		
				Numbers Observed			Numbers Captured	
Stream Reach	Habitat Type	Total Units (N) in stratum	Number of Units (n) snorkeled	Dolly	Cutthroat	Number of Units (n') fished	Dolly	Cutthroat
Lower Sherman	Pool	46	38	10	11	21	7	7
	Riffle	17	14	1	2	6	1	2
	Glide	3	3	1	0	2	1	0
	All Units	**66**	**55**	**12**	**13**	**29**	**9**	**9**
Middle Sherman	Pool	84	76	54	0	14	10	0
	Riffle	24	15	3	0	4	1	0
	Glide	0	0	0	0	0	0	0
	All Units	**108**	**91**	**57**	**0**	**18**	**11**	**0**
Upper Sherman	Pool	64	57	84	0	23	41	0
	Riffle	9	8	9	0	3	4	0
	Glide	2	2	4	0	1	2	0
	All Units	**75**	**67**	**97**	**0**	**27**	**46**	**0**
Lower Johnson	Pool	29	22	66	1	13	36	1
	Riffle	31	18	35	0	7	6	0
	Glide	3	3	5	2	2	2	2
	All Units	**63**	**43**	**106**	**3**	**22**	**44**	**3**
Middle Johnson	Pool	66	50	165	0	19	70	0
	Riffle	20	9	2	0	4	1	0
	Glide	0	0	0	0	0	0	0
	All Units	**86**	**59**	**167**	**0**	**23**	**71**	**0**
Upper Johnson	Pool	41	36	25	0	18	15	0
	Riffle	17	11	3	0	8	3	0
	Glide	4	3	1	0	2	1	0
	All Units	**62**	**50**	**29**	**0**	**28**	**19**	**0**
Lower Slate	Pool	37	26	1	62	8	0	20
	Riffle	24	16	0	20	6	0	5
	Glide	17	14	1	24	5	1	9
	All Units	**78**	**56**	**2**	**106**	**19**	**1**	**34**
Middle Slate	Pool	34	31	9	0	25	10	0
	Riffle	21	16	3	0	11	3	0
	Glide	15	14	23	0	6	10	0
	All Units	**70**	**61**	**35**	**0**	**42**	**18**	**0**
Upper Slate	Pool	55	27	36	0	15	22	0
	Riffle	57	39	58	0	8	12	0
	Glide	6	3	9	0	2	2	0
	All Units	**118**	**69**	**103**	**0**	**25**	**36**	**0**

Table 12: Resident Fish Population Estimates, 95% Confidence and Precision of Estimate.

Sherman Creek Dolly Varden					Johnson Creek Dolly Varden				
	Habitat	Population	Confid.	Precision		Habitat	Population	Confid.	Precision
Reach	Type	Estimate	Interval	%	Reach	Type	Estimate	Interval	%
Lower	Riffles	1.2	1.12	92.3	Lower	Riffles	72.3	2.85	3.9
	Pools	72.6	6.69	9.2		Pools	93.1	19.50	21.0
	Glides	2.0	2.87	143.4		Glides	5.0	0.00	0.0
	All Units	**69.1**	**7.05**	**10.2**		**All Units**	**167.7**	**16.01**	**9.5**
Middle	Riffles	6.4	2.59	40.5	Middle	Riffles	4.4	2.74	61.8
	Pools	78.5	9.48	12.1		Pools	221.3	32.71	14.8
	Glides	-	-	-		Glides	-	-	-
	All Units	**92.6**	**14.54**	**15.7**		**All Units**	**247.2**	**32.72**	**13.2**
Upper	Riffles	10.1	3.00	29.6	Upper	Riffles	7.7	0.08	1.1
	Pools	107.1	14.88	13.9		Pools	38.0	6.17	16.3
	Glides	4.0	0.00	0.0		Glides	1.0	1.30	129.9
	All Units	**145.5**	**18.45**	**12.7**		**All Units**	**48.2**	**6.89**	**14.3**

Slate Creek Dolly Varden					Cutthroat Trout				
	Habitat	Population	Confid.	Precision		Habitat	Population	Confid.	Precision
Reach	Type	Estimate	Interval	%	Creek	Type	Estimate	Interval	%
Lower	Riffles	0.0	0.0	-	Sherman	Riffles	2.4	0.89	36.8
	Pools	1.4	1.96	137.7	Lower	Pools	18.4	3.75	20.4
	Glides	1.2	0.70	57.4		Glides	0.0	-	-
	All Units	**2.8**	**0.89**	**32.1**		**All Units**	**20.3**	**4.53**	**22.4**
Middle	Riffles	3.9	1.93	49.1	Johnson	Riffles	0.0	0.00	-
	Pools	11.0	2.60	23.7	Lower	Pools	1.3	0.82	62.4
	Glides	24.6	1.74	7.1		Glides	2.0	0.00	-
	All Units	**42.0**	**4.39**	**10.5**		**All Units**	**4.4**	**4.01**	**91.2**
Upper	Riffles	80.2	4.05	5.0	Slate	Riffles	31.5	3.75	11.9
	Pools	73.3	7.94	10.8	Lower	Pools	103.8	9.79	9.4
	Glides	18.0	7.35	40.8		Glides	31.9	2.81	8.8
	All Units	**176.6**	**5.39**	**3.1**		**All Units**	**168.9**	**7.52**	**4.5**

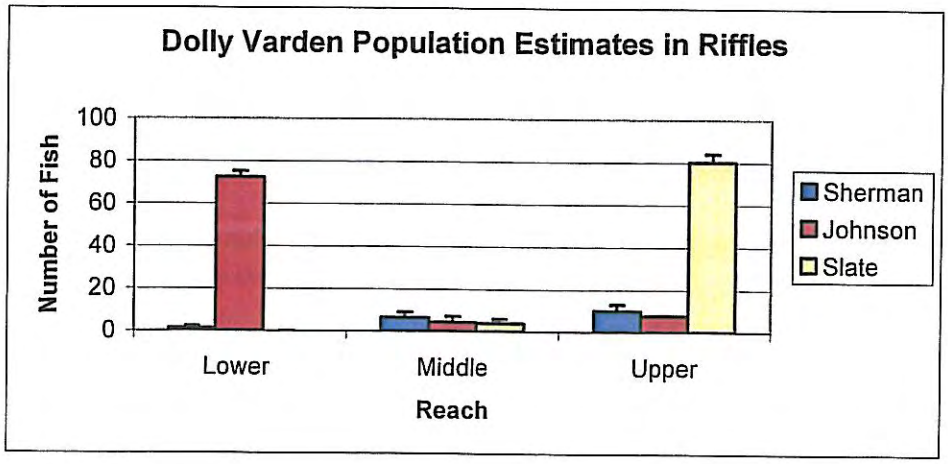
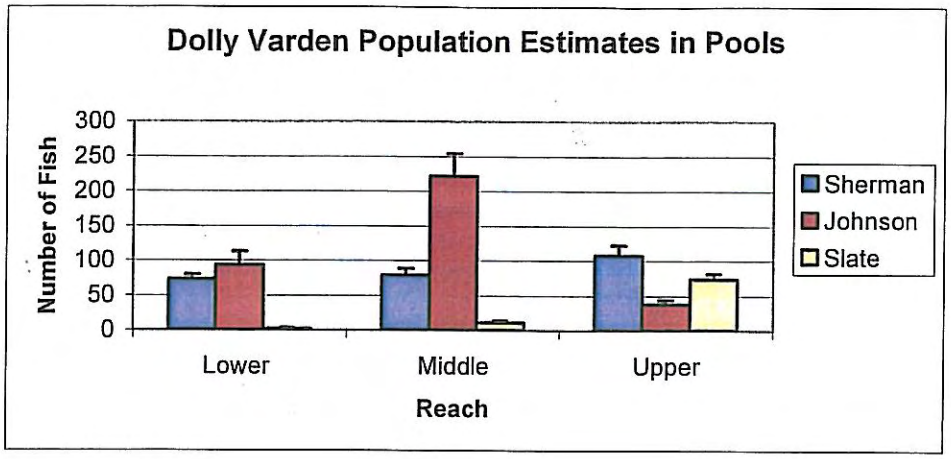
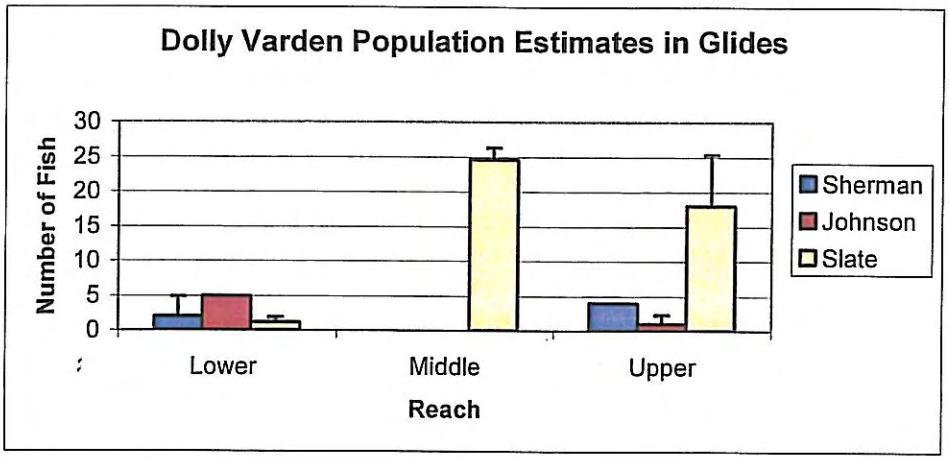


Figure 8A: Dolly Varden Population Estimates by Habitat Type.





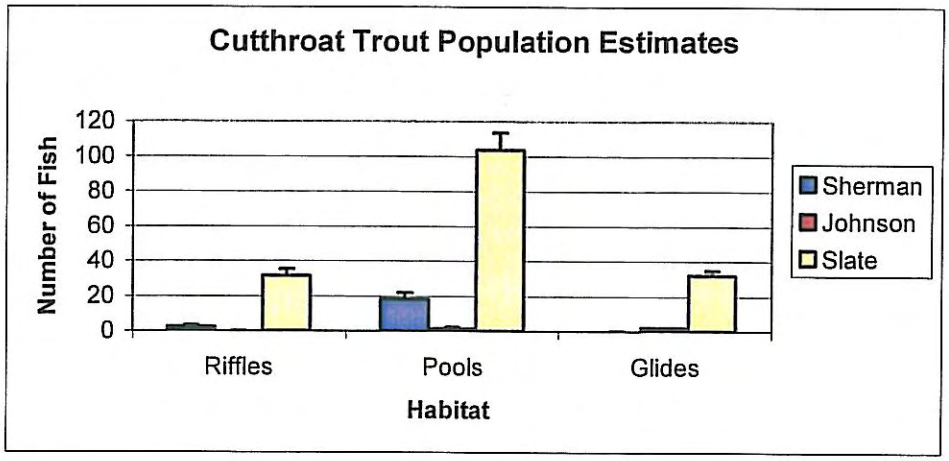


Figure 8B: Cutthroat Estimates and Resident Fish in Sweeny Creek.

Comparison of Dolly Varden numbers over time (Figures 9A, B) showed that numbers appeared to be slightly higher in 2009 in Upper Sherman Creek and in Lower and Middle Johnson than previous years. A large number of fish were observed in one large pool in Middle Johnson so there may be some over-estimate of the total reach due to this. Numbers of Dolly Varden were also higher in Middle and Upper Slate Creek in 2009. The number of cutthroats was higher in Slate Creek in 2009 than previous years though perhaps slightly lower in Sherman Creek. The number of total fish (Dolly Varden and cutthroat trout together) was higher in Johnson and Slate than previous years and similar to previous numbers in Sherman Creek. Fish are able to move in and out of 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 number of larger anadromous Dolly Varden were observed in Lower Johnson in 2009, partly explaining the increase there. A large flood event in November 2005 followed by severe winter of 2006 may also have affected numbers in lower reaches. Numbers may still be recovering from this natural event. There is also natural variability in the population from year to year as well as differences in the numbers detected by snorkeling and electro-fishing, which in turn may be affected by differences in stream flow and temperature at the time of sampling. Stream flows during 2009 surveys were relatively low allowing more fish to be detected.

The 66 Dolly Varden captured by electro-fishing and minnow trapping in the three reaches of Sherman Creek represented 21.5% of the total estimated Dolly Varden population of the three Sherman Creek reaches surveyed. The 9 cutthroat trout captured in Lower Sherman represented 45% of the estimated Sherman Creek cutthroat population. The 134 Dolly Varden captured in Johnson Creek represented 28.9% of the estimated population of Johnson Creek. Only 3 cutthroat trout was captured in Lower Johnson, representing 75% of the total estimate. The 55 Dolly Varden captured in Slate Creek comprised 24.9% of the Slate Creek population estimate and the 34 cutthroats captured represented 20.1% of the Lower Slate population. Counts of fish observed by snorkeling and captured by electro-fishing and minnow trapping in each habitat unit are presented in Appendix 3c.

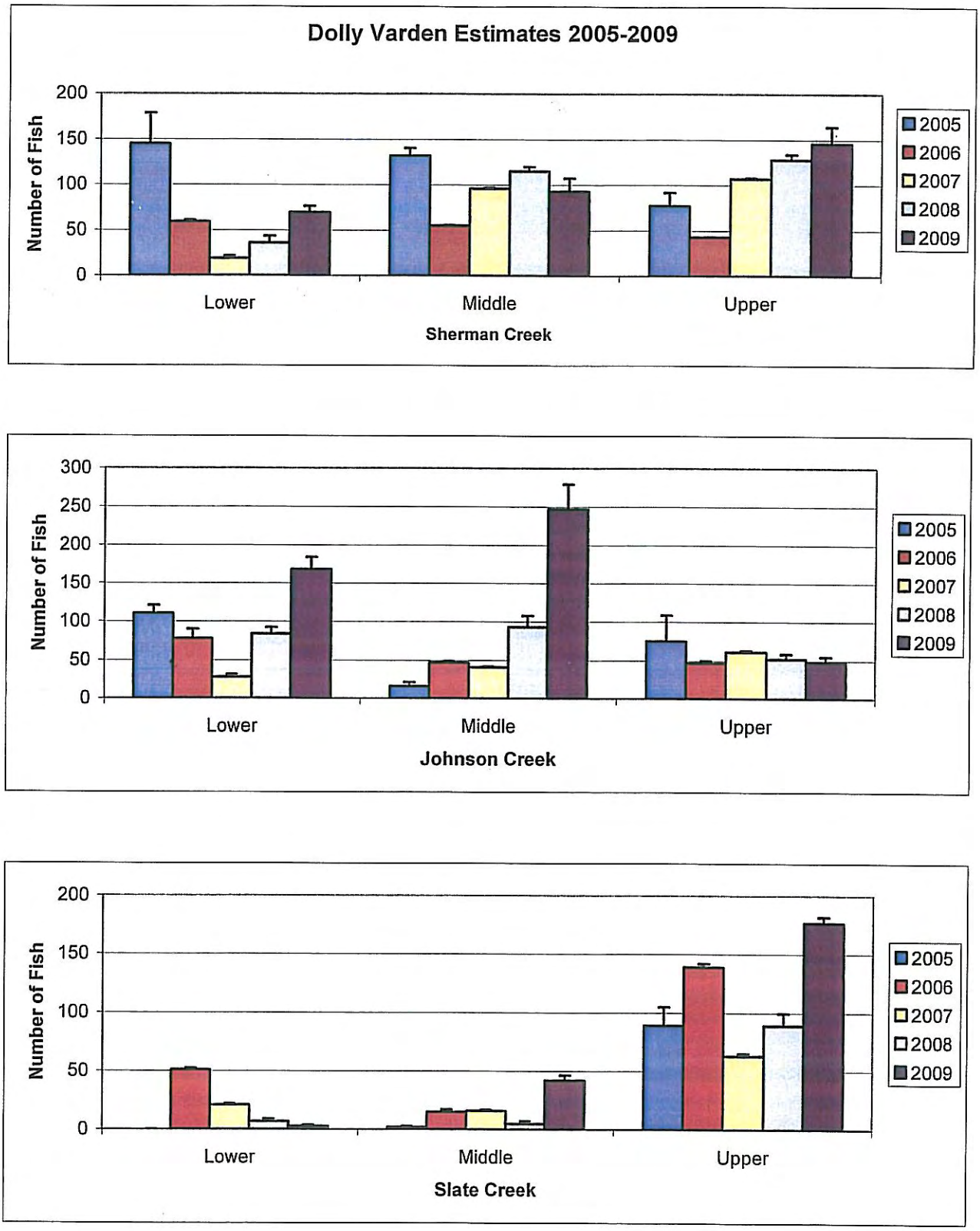
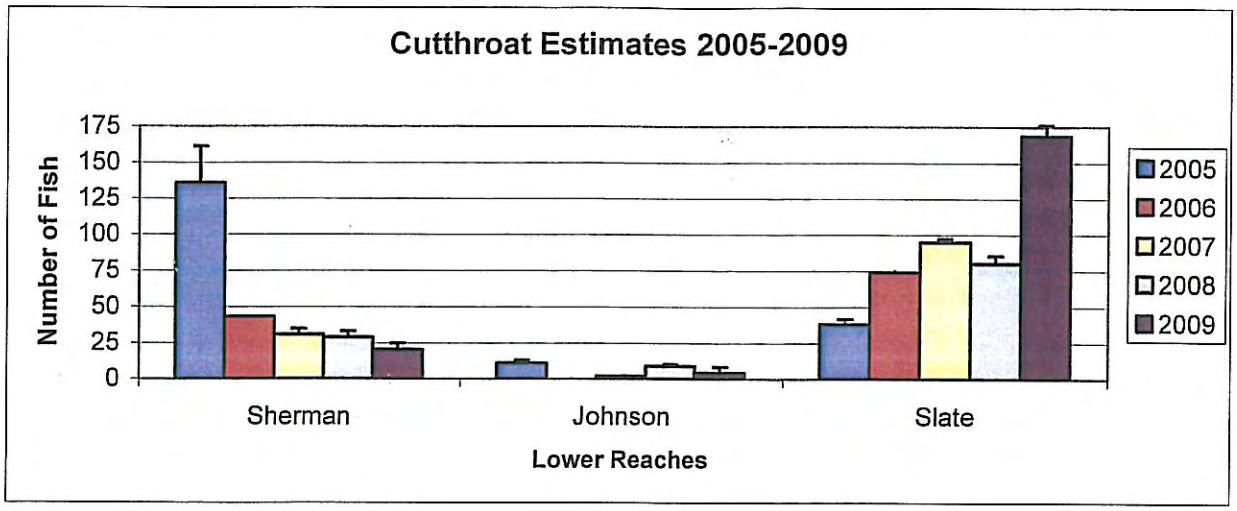


Figure 9A: Comparison of Dolly Varden numbers over time, 2005 to 2009.



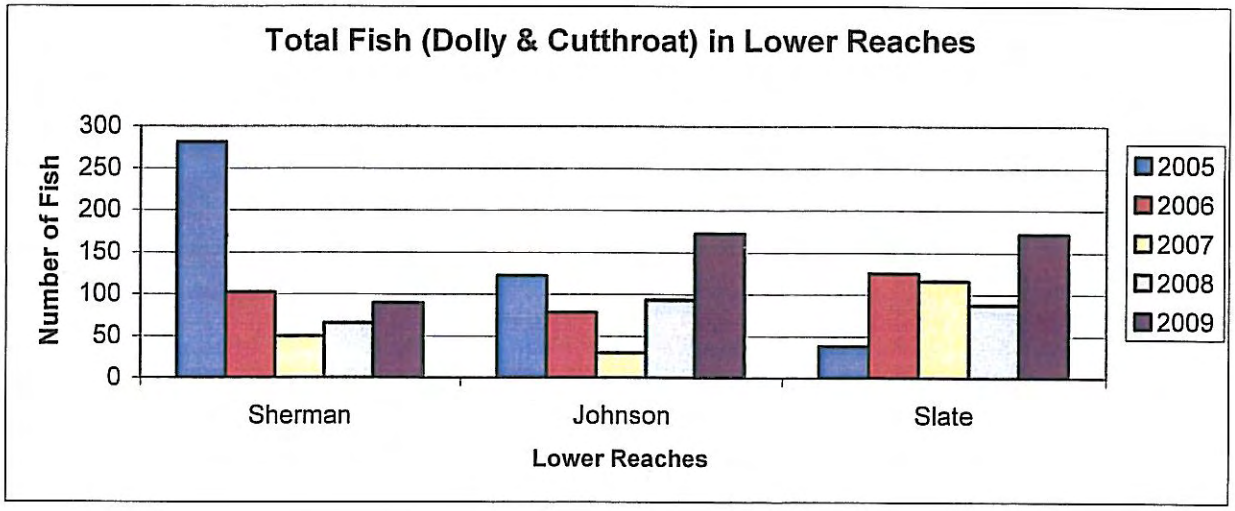


Figure 9B: Comparison of cutthroat trout and total fish numbers over time.

5.5 Minimum detectable differences in mean numbers of fish.

Mean numbers of fish in each habitat unit were used to compute hypothetical minimum detectable differences that could be detected for each mean. Table 13 gives the mean number of fish in each habitat type and the minimum detectable difference (MDD) resulting from comparing habitat types in each stream reach. A difference in means of 1 to 3 fish per habitat unit was detectable for Dolly Varden in most habitat types with the exception of Upper Sherman glides (MDD = 9 fish), Upper Slate glides (MDD = 4 fish), Lower and Middle Johnson pools and glides (MDD = 7 fish). In these reaches, a difference in mean number of fish per unit of seven or more fish would be required before the change could be detected in the data. Results were similar for cutthroat trout with Lower Johnson glides requiring a MDD of 7 fish for detection of change.

Some habitat types showed greater variability in numbers of fish with, for example, one Middle Johnson pool contained 46 fish, but other pools nearby had none. 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.

Figure 10: Cutthroat trout captured in Lower Slate Creek, July 2009.

Table 13: Mean number of fish per habitat unit and minimum detectable differences (MDD).

Sherman Creek Dolly Varden			
Reach	**Habitat Unit**	**Mean # Fish**	**MDD**
Lower	Riffles	0.071	0.720
	Pools	1.579	1.771
	Glides	0.667	2.382
	All Units	**1.047**	1.561
Middle	Riffles	0.267	1.013
	Pools	0.934	1.767
	Glides	-	-
	All Units	**0.857**	4.072
Upper	Riffles	1.125	1.526
	Pools	1.673	3.227
	Glides	2.000	8.750
	All Units	**1.582**	3.460

Slate Creek Dolly Varden			
Reach	**Habitat Unit**	**Mean # Fish**	**MDD**
Lower	Riffles	0.000	-
	Pools	0.038	0.642
	Glides	0.071	0.289
	All Units	**0.036**	0.195
Middle	Riffles	0.188	0.781
	Pools	0.323	0.764
	Glides	1.643	0.731
	All Units	**0.600**	0.926
Upper	Riffles	1.407	1.036
	Pools	1.333	2.363
	Glides	3.000	4.425
	All Units	**1.497**	1.035

Cutthroat Trout			
Creek	**Habitat Unit**	**Mean # Fish**	**MDD**
Sherman	Riffles	0.143	0.376
Lower	Pools	0.399	0.996
	Glides	-	-
	All Units	**0.318**	0.948
Johnson	Riffles	0.000	-
Lower	Pools	0.045	0.285
	Glides	0.667	7.000
	All Units	**0.070**	1.000
Slate	Riffles	1.313	1.476
Lower	Pools	2.805	3.069
	Glides	1.875	1.165
	All Units	**2.165**	1.640

Johnson Creek Dolly Varden			
Reach	**Habitat Unit**	**Mean # Fish**	**MDD**
Lower	Riffles	2.33	1.067
	Pools	3.21	6.746
	Glides	1.67	7.000
	All Units	**2.66**	3.993
Middle	Riffles	0.22	1.589
	Pools	3.35	7.555
	Glides	0	-
	All Units	**2.87**	6.973
Upper	Riffles	0.45	0.040
	Pools	0.93	1.678
	Glides	0.25	2.300
	All Units	**0.78**	6.973

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 comparisons between reaches and habitat types. Dolly Varden density was highest in upper reaches where there is less habitat area available so fish are more concentrated (Table 14). Upper Slate Creek had the highest fish densities, due to this being a nursery stream for Dolly Varden fry (Figure 11). Densities were similar for lower and middle reaches of all three creeks. The highest density of cutthroat trout was found at Lower Slate, where one Dolly Varden was observed. 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 e.g. Dollys) when both are present (Hinder et al 1988, Hastings 2005).

Table 14: Densities of fish by species, reach 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	0.001	0.146	0.013	**0.046**	0.003	0.037	0.000	**0.014**
	Middle	0.013	0.190	0.000	**0.104**				
	Upper	0.094	0.199	0.874	**0.224**				
Johnson	Lower	0.061	0.252	0.136	**0.106**	0.000	0.014	0.054	**0.003**
	Middle	0.005	0.221	0.000	**0.139**				
	Upper	0.012	0.035	0.012	**0.026**				
Slate	Lower	0.000	0.003	0.002	**0.002**	0.016	0.211	0.032	**0.110**
	Middle	0.021	0.135	0.161	**0.100**				
	Upper	0.327	0.433	0.638	**0.399**				

Table 15: Densities of Dolly Varden and Cutthroat Combined.

Fish Density (# of fish/m^2)					
		Dolly Varden and Cutthroat			
Creek	**Strata**	**Riffles**	**Pools**	**Glides**	**All Units**
Sherman	Lower	0.004	0.183	0.013	**0.060**
	Middle	0.013	0.190	0.000	**0.104**
	Upper	0.094	0.199	0.874	**0.224**
Johnson	Lower	0.061	0.267	0.191	**0.109**
	Middle	0.005	0.221	0.000	**0.139**
	Upper	0.012	0.035	0.012	**0.026**
Slate	Lower	0.058	0.240	0.059	**0.112**
	Middle	0.021	0.135	0.161	**0.100**
	Upper	0.327	0.433	0.638	**0.399**

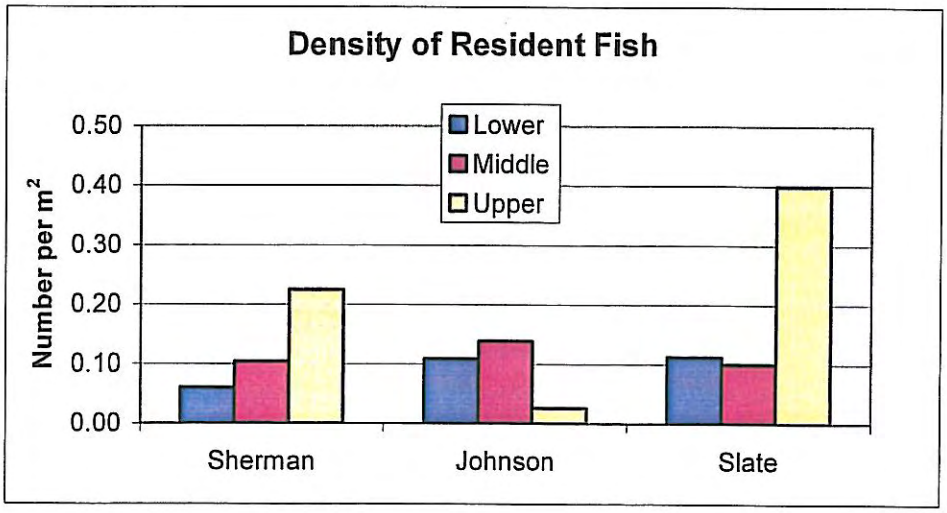


Figure 11: Densities of Resident Fish in Sherman, Johnson and Slate Creeks.

Both Dolly Varden and cutthroat density was much higher in pools and glides compared to riffles (Figure 12). Upper Sherman glides had the highest densities (0.87 fish/m^2) followed by Upper Slate glides (0.64/m^2) and pools (0.43/m^2). Densities of both fish species tended to be highest in pool habitat and increased from downstream to upstream as habitat areas are smaller in upper reaches.

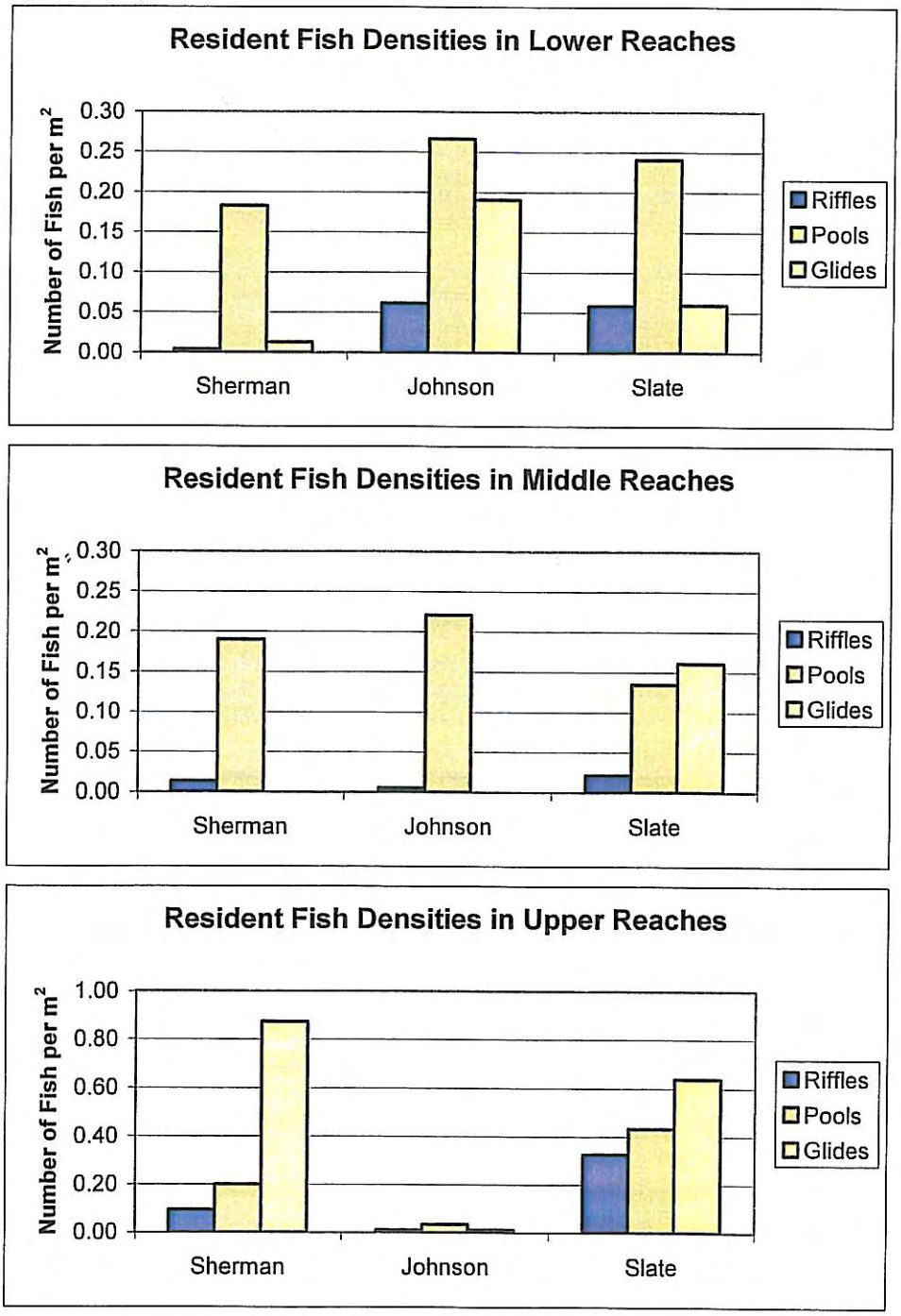


Figure 12: Resident Fish Densities by Habitat Type.

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 and minnow trapping. The histograms in Figure 12 show the size range of fish captured in each creek. The largest Dolly Varden was found in Upper Sweeny Creek and measured 311mm and 264g. The largest Cutthroat was found in Middle Sweeny and was 185mm and 63.2g. 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 stream reach are presented in Table 16 and Figure 13. Condition of Dolly Varden appeared slightly higher in Lower and Upper Sherman and Upper Johnson than other reaches, but the differences are not significant (95% level). Cutthroats had significantly greater condition in Lower Sweeny than Lower Johnson (only one captured) and Lower Slate perhaps due to the lack of competing Dolly Varden in Lower Sweeny. Both cutthroat and Dolly Varden showed fairly high condition in Lower Sherman, but density of both species was relatively low perhaps reducing competition for food there.

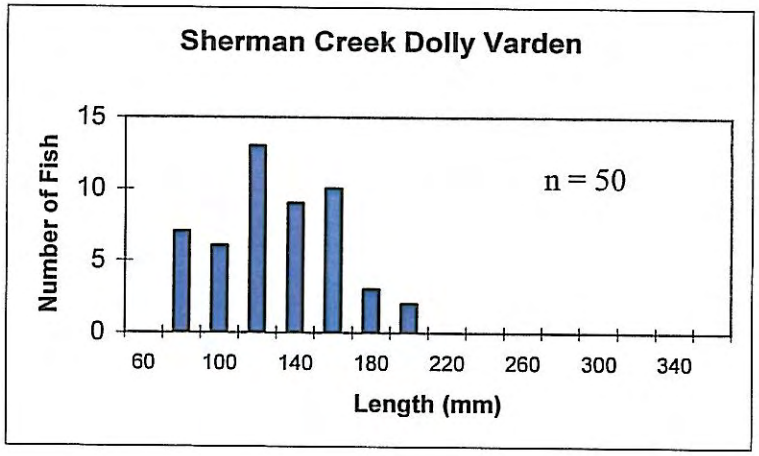
Table 16: Mean condition factor of Dolly Varden and cutthroats by reach.

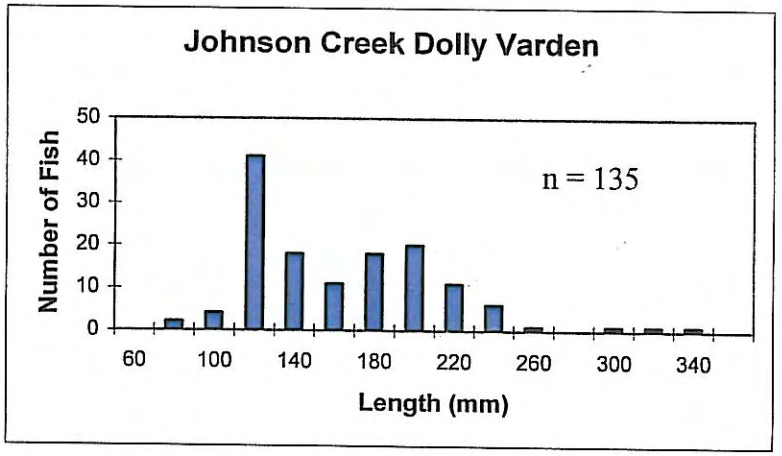
		Sherman		Sweeny	
Species	**Reach**	**Mean K**	**95% C.I.**	**Mean K**	**95% C.I.**
Dolly Varden	**Lower**	0.902	0.063	na	na
	Middle	0.852	0.048	0.834	0.038
	Upper	0.916	0.025	0.881	0.059
Cutthroat	**Lower**	0.899	0.103	0.912	0.035
	Middle	na	na	0.875	0.045
	Upper	na	na	0.868	0.031

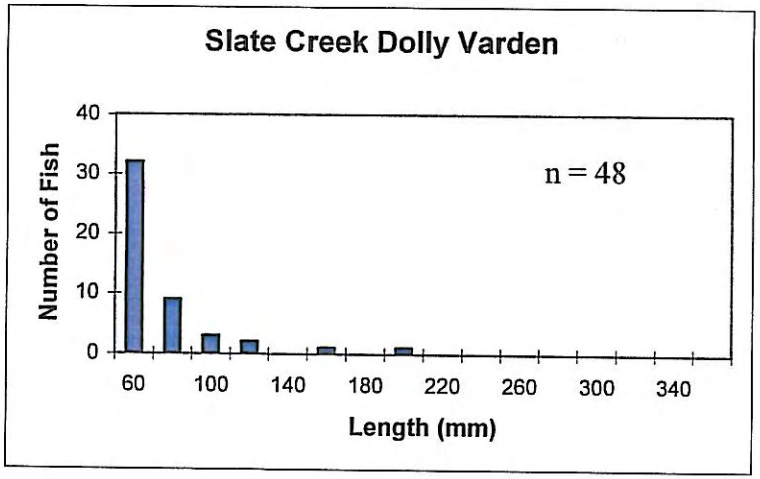
		Johnson		Slate	
Species	**Reach**	**Mean K**	**95% C.I.**	**Mean K**	**95% C.I.**
Dolly Varden	**Lower**	0.865	0.125	0.764	0.077
	Middle	0.849	0.030	0.870	0.019
	Upper	0.918	0.109	0.852	0.054
Cutthroat	**Lower**	0.744	na[1]	0.806	0.041
	Middle	na	na	na	na
	Upper	na	na	na	na

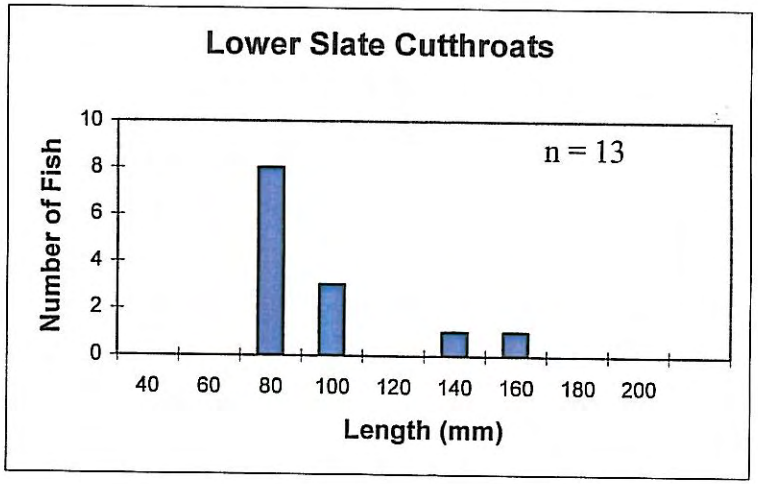
na[1] = only one fish caught

Figure 12: Length-frequency histograms for Dolly Varden and cutthroat trout captured in Sherman, Johnson and Slate Creeks in 2009.









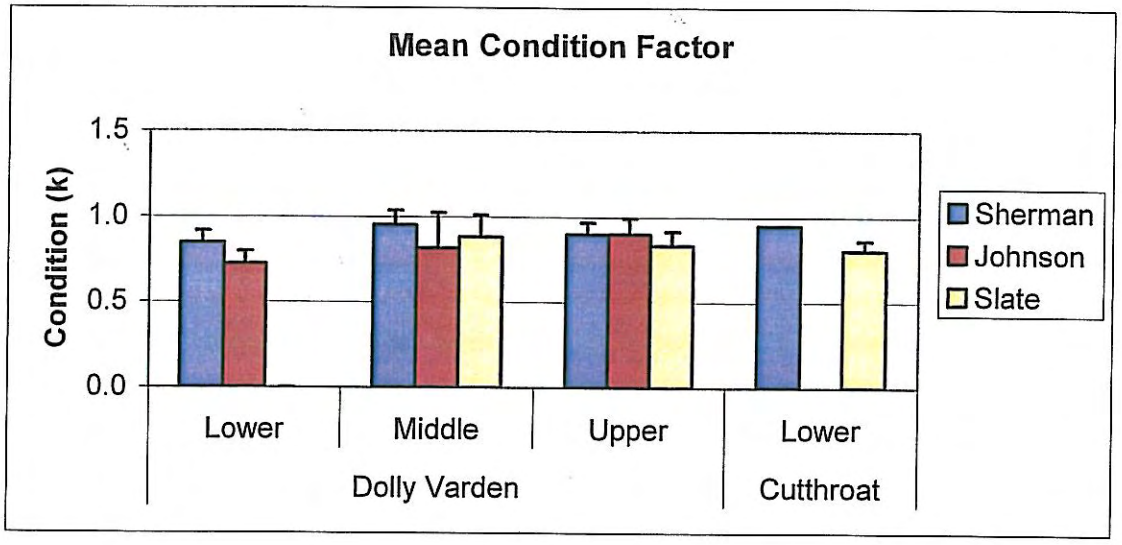


Figure 13: Mean Condition Factor of fish captured in 2009.

Comparison with previous years did not reveal any significant changes in mean condition factor (Figure 14). Dolly Varden condition appeared higher in Middle Sherman in 2009, but was not significantly different in other reaches. Cutthroat condition was not significantly different from previous years among the lower reaches.

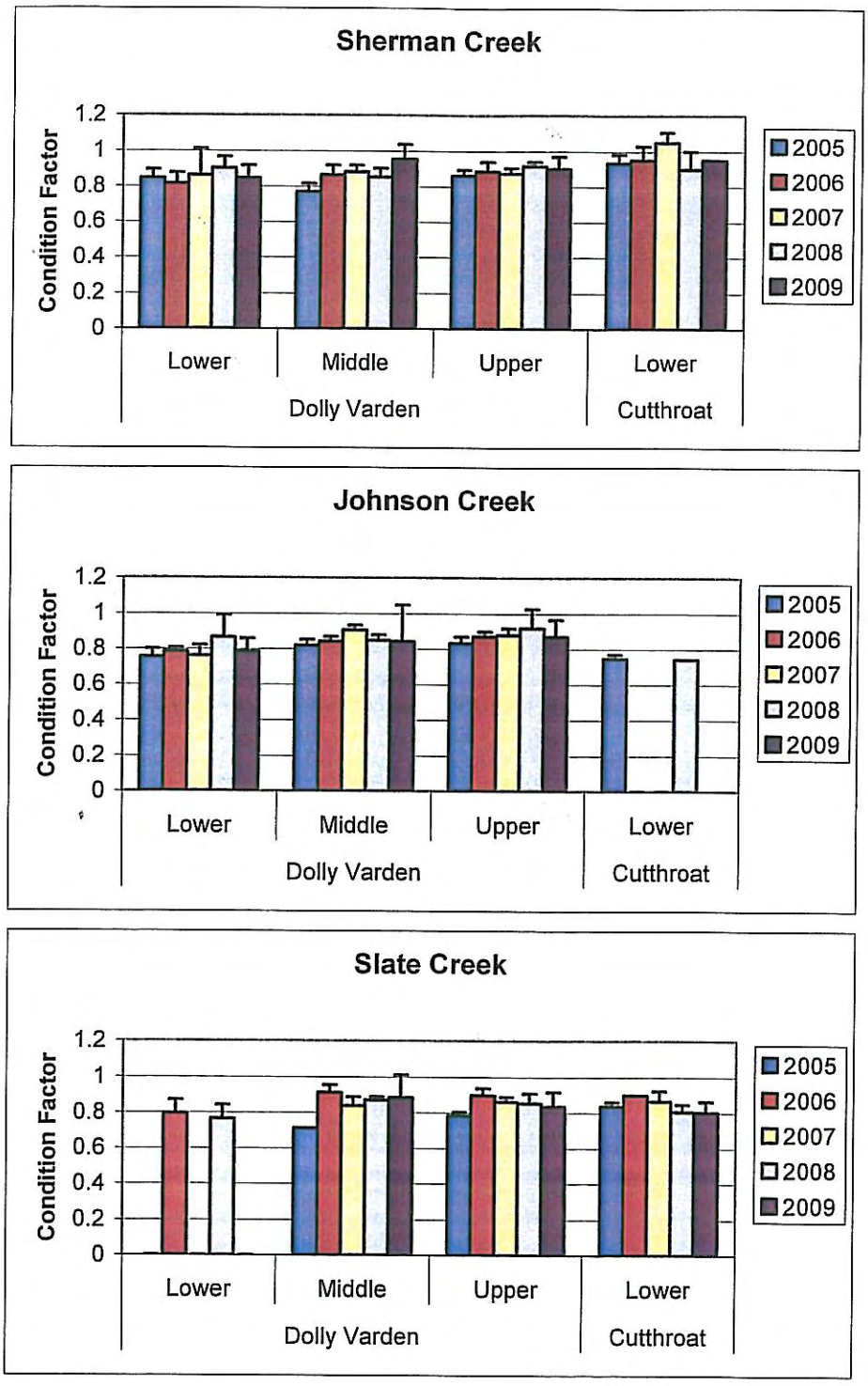


Figure 14: Comparison of mean condition factor from 2005 to 2009.

6.0 Anadromous Fish Monitoring

6.1 Pink Salmon Ecology

All pink salmon migrate to sea, are 2 years old at maturity and all die after spawning. This has resulted in two separate populations that do not interbreed using the same spawning habitat in alternate years (Quinn 2005). Around Southeast Alaska, even-year populations of returning adult salmon 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 in the southern part of their range, perhaps being better adapted to warmer water. The out-migrating fry population for 2009 was expected to be larger than the previous year, following the spawning of the even-year larger population.

Adult pink salmon migrate into Southeast Alaska 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 2005-2007). 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 have been 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 much reduced.

Due to the distance between streams and the necessity of checking traps daily, two teams of field personnel were used to conduct the study. In 2009, Sherman Creek was accessed by one team traveling through the mine tunnel from Jualin Camp, approximately 5 miles away, 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 out-migrating 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. Debris traps were also set in front of the nets in the form of 1 inch chicken wire set in a v-shape with rebar to reduce debris loading inside the nets (Figure 15A).

One net was set in Johnson Creek on April 1, 2009 approximately 100m from the confluence with the Lace River. A net was set in Slate Creek on April 8 approximately 25m above mean high water. The Sherman Creek net was set on April 9 approximately 50m upstream of the creek mouth at mean high water. The GPS co-ordinates of each trap are given in Table 17. 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 perforated aluminum and had adjustable legs that could be raised or lowered with stream flow so that moderate flow could be maintained inside the box.

Each net was visited at least once a day to identify, count and release fish from the trap using small hand nets. Every 3-4 days, a sample of 150 fish (if available) was stained with Bismarck Brown dye and released upstream of the trap to determine trap efficiency. All other fish were released downstream of the trap after identification. The total population of fry migrating from each creek was estimated using the average ratio of marked to unmarked fish from successive marking events.

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 debris trap at Johnson Creek.

Figure 15B: Salmon fry inside the holding box.

Stream	GPS Co-ordinates (NAD27 Alaska)
Sherman	N 58.86908 W 135.14005
Johnson	N 58.82383 W 134.99936
Slate	N 58.79628 W 135.03716

Table 17: GPS Co-ordinates of the trap sites at each stream.

6.4 Fish Data Collection

Prior to the beginning of field operations, a Fish Resource Permit was obtained from the Alaska Department of Fish and Game (Appendix 4a) which authorized sampling fish in each creek. 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 Creek on April 2, Slate Creek on April 9 and Sherman Creek on April 10 and continued until negligible numbers of fish were being captured. Daily sampling continued until June 1 at Sherman Creek and June 4 at Slate and Johnson Creeks. Before conducting the fish counts, a general assessment of the flow, debris accumulation, and number of dead fish in the traps was performed. 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 fish species trapped 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 out-migrating fry 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. Fish were immersed for 10 minutes in 1.5 gallons of water in which 0.6g 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. Fifteen mark-recapture trials were conducted at Sherman Creek, sixteen at Slate Creek and eighteen at Johnson Creek with 100 to 150 fish marked (if available) on each occasion (Table 14). 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 13, 150 marked fish were released and 21 were recaptured (26% of total released). A catch of 232 fish on April 13 divided by 0.26 gives a total estimate of 892 fish for that day. Mean capture rates were calculated for the period between two successive recapture trials and these rates used to calculate a daily estimate (Table 18).

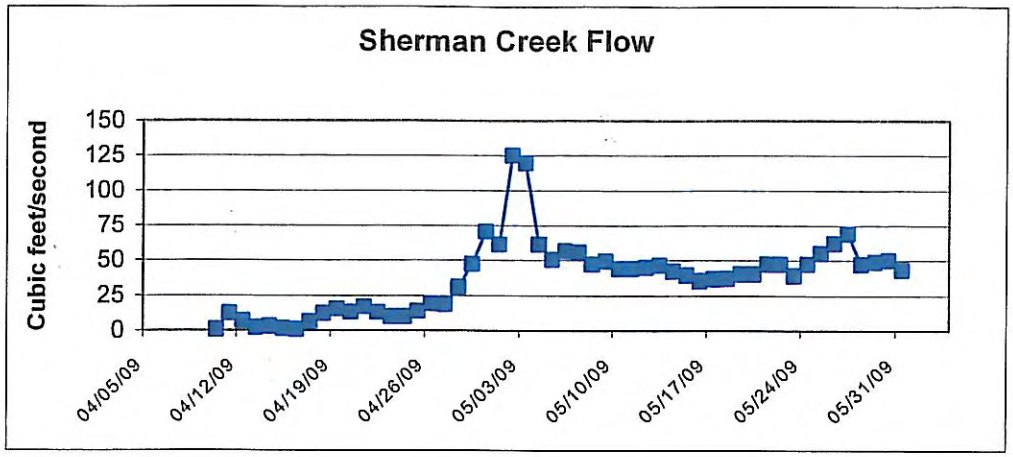
The total population estimate for the survey period for Sherman Creek is 109,957 pink fry. The estimated total catch was calculated in this way for each day and then a final total summed for the entire survey period. The actual recapture rates for the first and last trials were used to estimate fish numbers at the beginning and end of the study respectively.

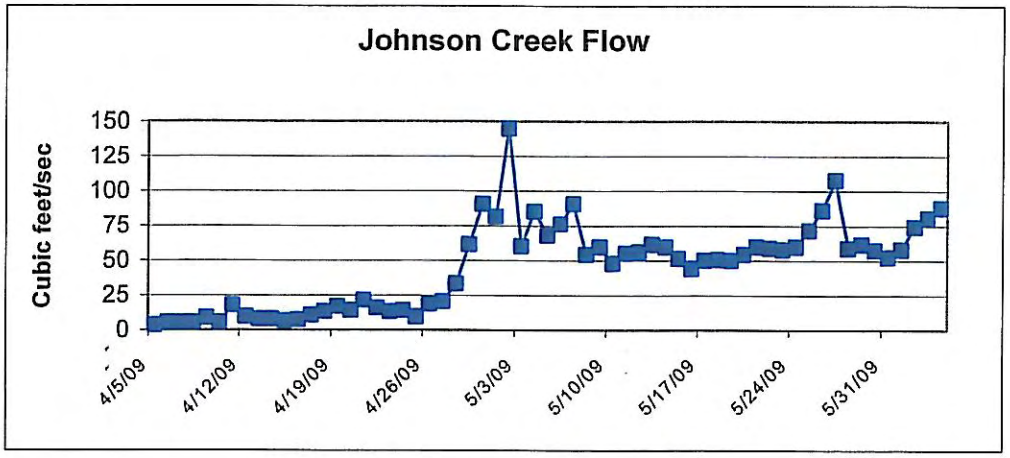
6.7 Physical Data

Water temperature data was unavailable at the time of writing this report. Flow data was used to develop stage-discharge relationships for each stream based on manual discharge measurements and staff gage readings near the fyke nets. These relationships were then used to calculate discharge for each day of the fry study (Figure 19). The flow at each creek was low at the beginning of the April, with Sherman Creek mostly less than 7cfs and Johnson and Slate Creeks less than 10cfs. Flows increased gradually with warming temperatures to around 50cfs or less at Sherman Creek, 60cfs or more at Johnson Creek and mostly less than 30cfs at Slate Creek. Peaks in flow occurred on May 2 reaching 125cfs at Sherman, 145 at Johnson and 56 at Slate. There was a later peak in flow on May 27 at Sherman and Johnson reaching 69 and 107cfs respectively. A peak was not observed at Slate Creek on this date presumably because the lakes, now thawed, were buffering flow.

The proportion of the flow sampled by the nets varied with discharge and creek, affecting the number of salmon fry captured. At Sherman Creek around 15% to 20% of the flow was sampled during the study, while at Johnson Creek around 15% of the flow was sampled. At Slate Creek 20% to 30% of the flow was sampled. High flow may flush more salmon fry out of the gravel or result in a lower catch because the net had to be moved out of main channel.

Figure 18: Access to Johnson Creek after heavy snowfall.





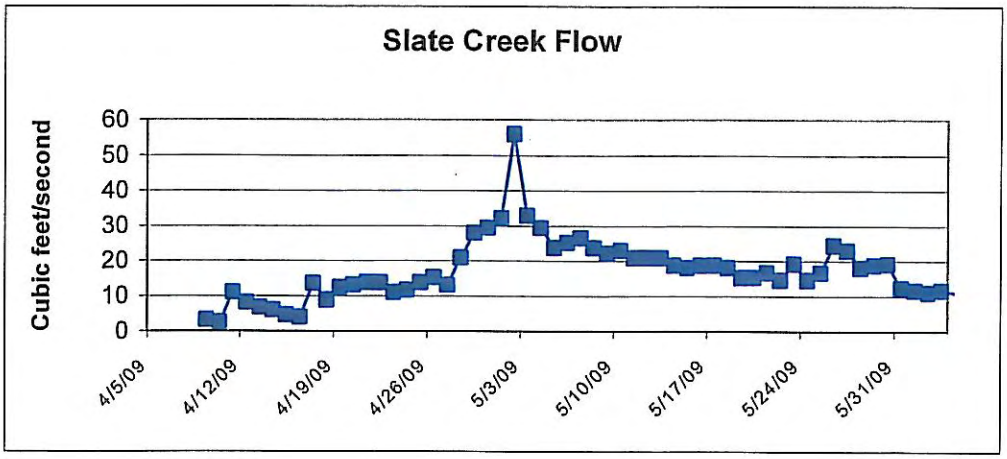
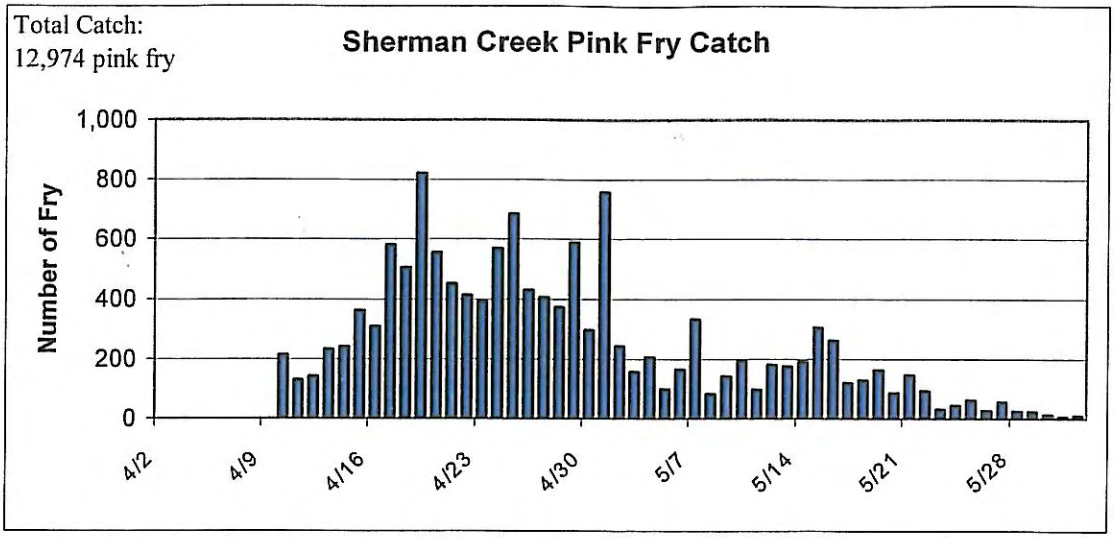
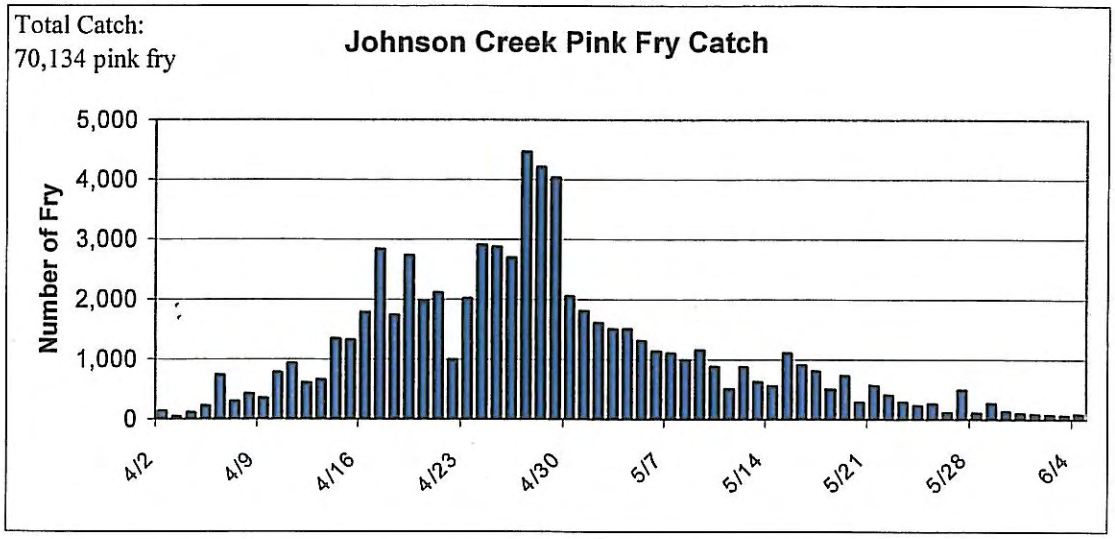


Figure 19: Stream flow based on daily staff gage readings, and manual discharge measurements.





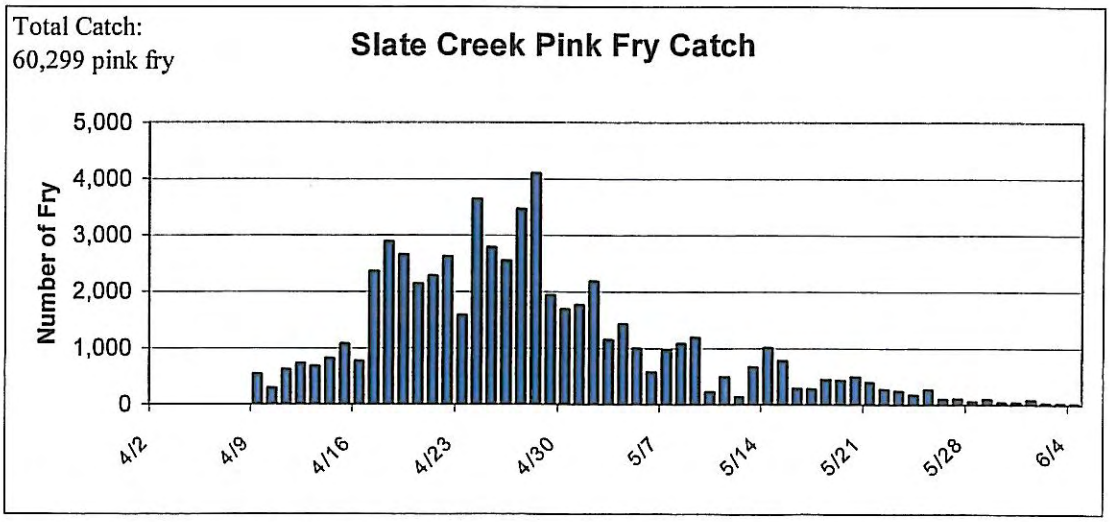
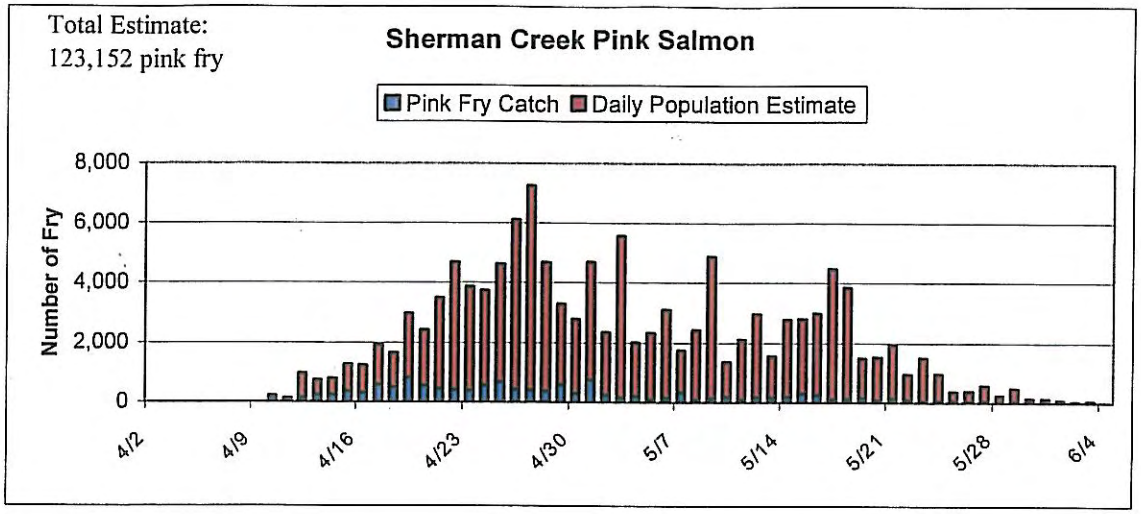
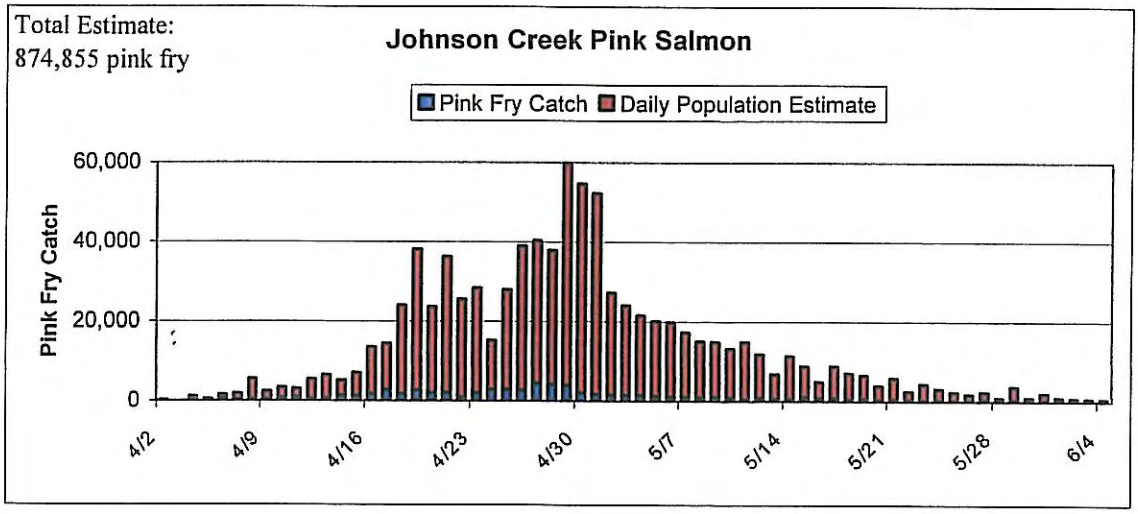


Figure 20: Daily catch of pink salmon fry April-May 2009.





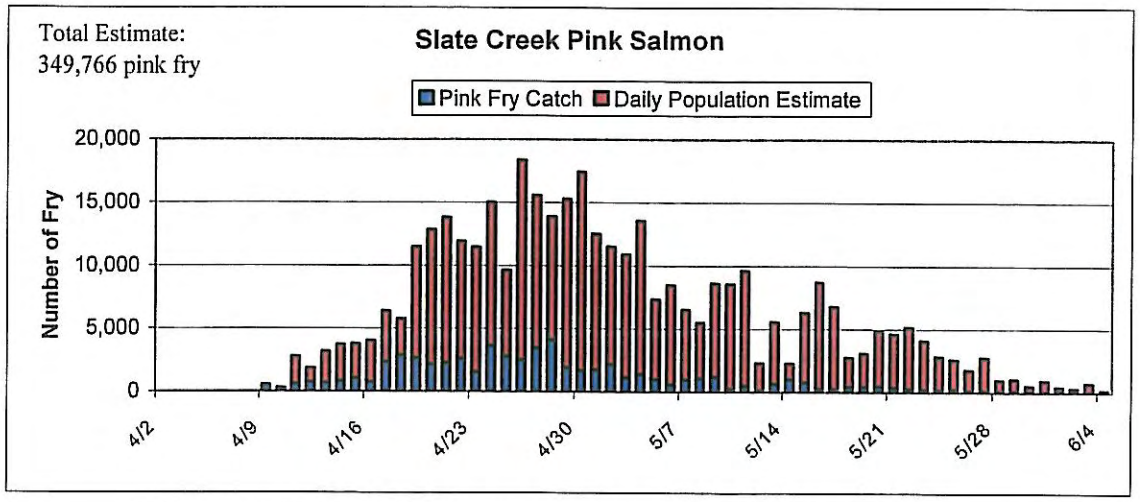


Figure 21: Estimated daily total pink fry migrating downstream.

6.8 Timing of Pink Salmon Outmigration

Numbers of captured fry increased steadily at Johnson Creek from around 100 fish in early April, rising to 4,000 by the end of April, then declining to low numbers by the beginning of June (Figure 20). Numbers were around 200 at Sherman Creek at the beginning of the study and peaked at 750 fish on May 1. Slate Creek numbers began at around 500 fish, peaked around 4,000 fry, at the end of April 23, and declined in early June. High flows on May 2 at Sherman and Slate Creeks appeared to flush more fry downstream. High flow at Johnson Creek around the same time meant the net had to be removed from the stream. High flow during May 1-5 caused nets to be washed out of the stream at Johnson and Sherman Creeks so fry catch had to be estimated from the previous and subsequent day's catch.

6.9 Daily Catch and Mark-Recapture Trials

The estimated population at Johnson Creek was 7 times the magnitude of Sherman Creek and 2.5 times the magnitude at Slate Creek. The total catch from Sherman Creek was 13,271 pink salmon fry between April 10 and June 1 with a maximum daily catch of 757 fry on May 1. Sherman Creek mark-recapture experiments resulted in an average of 7 to 27% recovery of marked fish with recapture rates varying with stream flow. Figure 21 shows the estimated daily total number of pink fry migrating downstream based on mark-recapture trials. The total population estimate for the survey period for Sherman Creek is 109,957 pink fry. Table 18 gives the daily catches of fry and daily population estimates.

Johnson Creek was sampled from April 2 to June 4 with a total catch of 70,134 pink fry and maximum daily catch of 4,462 on April 27. Johnson mark-recapture surveys resulted in 8% to 16% recovery giving a total population estimate of 795,323 pink fry. Slate Creek was sampled from April 9 to June 4 with a total catch of 60,299 pink fry, and maximum daily catch of 4,087 on April 28. Average recapture rates of between 10 and 27% resulted in a total population estimate of 312,291 pink fry.

	Sherman Creek							
	Total PK Caught	Total PK Released	Total PK Recaptured					Total PK Population Estimate
	13,271	1868	231					109,957
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
2-Apr								
3-Apr								
4-Apr								
5-Apr								
6-Apr								
7-Apr								
8-Apr								
9-Apr								
10-Apr	213	147	36	24.49			0.26	819
11-Apr	130	0	3	2.04			0.26	500
12-Apr	141	0	0	0.00	39	26.53	0.26	542
13-Apr	232	150	21	14.00			0.26	892
14-Apr	240	0		0.00	39	26.00	0.26	923
15-Apr	361	0		0.00			0.27	1337
16-Apr	308	150	39	26.00			0.27	1141
17-Apr	580	0	1	0.67	40	26.67	0.27	2148
18-Apr	504	0		0.00			0.27	1867
19-Apr	820	0		0.00		13.40	0.27	3037
20-Apr	554	147	10	6.80	12	8.16	0.13	4262
21-Apr	449	0	2	1.36			0.13	3454
22-Apr	412	0		0.00			0.13	3169
23-Apr	392	145	10	6.90	15	10.34	0.10	3920
24-Apr	568	0	5	3.45			0.10	5680
25-Apr	684	0		0.00			0.10	6840
26-Apr	429	0		0.00			0.10	4290
27-Apr	405	0		0.00		15.17	0.15	2700
28-Apr	372	150	30	20.00	30	20.00	0.15	2480
29-Apr	588	0		0.00			0.15	3920
30-Apr	295	0		0.00		13.85	0.14	2107
1-May	757	130	10	7.69	10	7.69	0.14	5407
2-May	253	0		0.00			0.14	1807
3-May	156	0		0.00		6.20	0.07	2229
4-May	205	150	7	4.67			0.07	2929
5-May	98	0		0.00	7		0.07	1400
6-May	164	0		0.00			0.07	2343
7-May	331	150	8	5.33		7.47	0.07	4729
8-May	81	0		0.00	8	5.33	0.07	1157
9-May	141	0		0.00			0.07	2014
10-May	194	0		0.00			0.07	2771
11-May	96	86	5	5.81		5.81	0.07	1371
12-May	180	0		0.00	5		0.07	2571
13-May	174	0		0.00	0		0.07	2486
14-May	190	150	8	5.33	0		0.07	2714
15-May	304	0	1	0.67		6.00	0.07	4343
16-May	260	0		0.00	9		0.07	3714
17-May	119	0		0.00	0	8.74	0.09	1322
18-May	128	122	14	11.48		11.48	0.09	1422
19-May	161	0		0.00	14		0.09	1789
20-May	84	0		0.00			0.10	840
21-May	146	108	6	5.56		8.52	0.10	1460
22-May	91	0		0.00	6	5.56	0.10	910
23-May	30	0		0.00			0.10	300
24-May	42	0		0.00		11.79	0.12	350
25-May	61	61	11	18.03			0.12	508
26-May	25	0		0.00	11	18.03	0.12	208
27-May	54	0		0.00			0.12	450
28-May	23	22	4	18.18			0.18	128
29-May	22	0		0.00	4	18.18	0.18	122
30-May	12	0		0.00			0.18	67
31-May	4	0		0.00			0.18	22
1-Jun	8	0		0.00			0.18	44

Table 18: Daily Catch and Daily Population Estimates (highlighted cells estimated from previous and subsequent data due to nets being removed from water at high flow).

Johnson Creek								
Total PK Caught	Total PK Released	Total PK Recaptured						Total PK Population Estimate
70,134	**2274**	**173**						**795,323**
Total PK Caught	Total Released per event	Total Recaptured per day	% Recaptured per day	Total Recaptured per event	% Recaptured per event	average rate	Mean Racapture Rate	Daily Population Estimate
131	121	5	4.13	16	13.22		0.13	992
35	0	9	7.44				0.13	265
108	0	2	1.65				0.13	818
216	0	0	0.00			14.28	0.14	1510
734	150	22	14.67	23	15.33		0.14	5133
290	0	1	0.67				0.14	2028
416	0	0	0.00			16.00	0.16	2600
343	150	20	13.33				0.16	2144
774	0	1	0.67				0.16	4838
931	0	0	0.00				0.16	5819
599	0	4	2.67	25	16.67		0.16	3744
655	0	0	0.00			11.39	0.11	5746
1341	147	4	2.72	9	6.12		0.11	11763
1319	0	5	3.40				0.11	11570
1781	0	0	0.00			8.06	0.08	22263
2831	150	4	2.67				0.08	35388
1733	0	3	2.00	7	4.67		0.08	21663
2724	0	0	0.00			8.06	0.08	34050
1965	150	8	5.33	8	5.33		0.08	24563
2103	0	0	0.00				0.08	26288
986	0	0	0.00			7.67	0.08	12325
2007	150	15	10.00	15	10.00		0.08	25088
2900	0	0	0.00				0.08	36250
2867	0	0	0.00				0.08	35838
2691	0	0	0.00				0.08	33638
4462	0	0	0.00			8.00	0.08	55775
4204	150	4	2.67				0.08	52550
4028	0	0	0.00	4	2.67		0.08	50350
2048	0	0	0.00				0.08	25600
1800	0	0	0.00				0.08	22500
1600	100	6	6.00	6	6.00		0.08	20000
1500	0	0	0.00			6.57	0.08	18750
1500	28	2	7.14				0.08	18750
1300	0	0	0.00	2	7.14		0.08	16250
1126	0	0	0.00			7.90	0.08	14075
1097	150	6	4.00				0.08	13713
985	0	0	0.00	6	4.00		0.08	12313
1147	0	0	0.00				0.08	14338
874	0	0	0.00			7.90	0.08	10925
497	150	1	0.67	1	0.67		0.08	6213
868	0	0	0.00				0.08	10850
619	0	0	0.00				0.08	7738
547	150	13	8.67	13	8.67		0.14	3993
1099	0	0	0.00				0.14	8022
898	0	0	0.00				0.14	6555
795	0	0	0.00			8.36	0.14	5803
493	150	6	4.00				0.14	3599
721	0	0	0.00	6	4.00		0.14	5263
284	0	0	0.00				0.14	2073
558	150	3	2.00				0.14	4073
392	0	0	0.00	3	2.00		0.14	2861
279	0	0	0.00				0.14	2036
224	0	0	0.00			13.73	0.14	1635
254	149	28	18.79	28	18.79		0.14	1854
106	0	0	0.00				0.14	774
477	0	0	0.00				0.14	3457
101	79	1	1.27	1	1.27		0.14	732
258	0	0	0.00				0.14	1870
126	0	0	0.00				0.14	913
95	0	0	0.00			13.83	0.14	688
79	79	7	8.86	7	8.86		0.14	572
71	0	0	0.00				0.14	514
61	0	0	0.00				0.14	442
81	0	0	0.00				0.14	587

Table 18 cont.

Slate Creek								
Total PK Caught	Total PK Released	Total PK Recaptured						Total PK Population Estimate
60299	2142	337						310641
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
537	150	37	24.67			0.25		2148
282	0	1	0.67			0.25		1128
619	0	0	0.00			0.25		2476
725	0	0	0.00	38	25.33	0.25		2900
676	150	35	23.33			0.25	25.00	2704
815	0	2	1.33	37	24.67	0.25		3260
1071	0	0	0.00			0.27	25.67	4016
761	150	39	26.00			0.27		2854
2355	0	0	0.00	40	26.67	0.27		8831
2881	0	1	0.67			0.27		10670
2648	0	0	0.00			0.23	24.67	11513
2138	150	34	22.67	34	22.67	0.23		9296
2275	0	0	0.00			0.23		9891
2611	0	0	0.00			0.23	23.00	11352
1570	150	34	22.67	35	23.33	0.23		6826
3639	0	1	0.67			0.23		15822
2776	0	0	0.00			0.23		12070
2541	0	0	0.00			0.26	26.33	9773
3462	150	44	29.33	44	29.33	0.26		13315
4087	0	0	0.00			0.26		15719
1934	0	0	0.00			0.18	18.00	10744
1678	150	10	6.67	10	6.67	0.18		9322
1752	0	0	0.00		18.00	0.18		9733
2179	0	0	0.00			0.18		12106
1135	0	0	0.00			0.18	12.33	6306
1418	150	27	18.00			0.18		7878
996	0	0	0.00	27	18.00	0.18		5533
570	0	0	0.00			0.13	15.67	4385
959	150	20	13.33			0.13		7377
1078	0	0	0.00	20	13.33	0.13		8292
1183	0	0	0.00			0.13		9100
216	0	0	0.00			0.10	9.33	2160
489	150	8	5.33	8	5.33	0.10		4890
125	0	0	0.00		10.22	0.10		1250
659	0	0	0.00			0.12	8.67	5492
1007	150	18	12.00	18	12.00	0.12		8392
777	0	0	0.00			0.12		6475
275	0	0	0.00			0.12		2292
264	0	0	0.00			0.10	10.00	2640
435	150	12	8.00	12	8.00	0.10		4350
423	0	0	0.00			0.10		4230
487	0	0	0.00			0.10	6.96	4870
383	150	4	2.67	4	2.67	0.10		3830
263	0	0	0.00			0.10		2630
231	0	0	0.00			0.10		2310
165	0	0	0.00			0.10		1650
263	152	9	5.92	9	5.92	0.10		2630
92	0	0	0.00			0.10		920
94	0	0	0.00			0.10		940
47	40	1	2.50	1	2.50	0.10		470
88	0	0	0.00			0.10		880
36	0	0	0.00			0.10		360
30	0	0	0.00			0.10		300
71	67	0	0.00	0	0.00	0.10		710
15	0	0	0.00			0.10		150
10	0	0	0.00			0.10		100
3	0	0	0.00			0.10		30

Table 18 cont.

6.10 Total Population Estimates

Numbers of pink fry migrating downstream in the spring of 2009 were estimated from mark-recapture experiments as 109,957, 795,323 and 312,291 in Sherman, Johnson and Slate respectively. These estimates only include fry that hatched upstream of the traps. Sherman Creek has approximately 12% of total spawning habitat located downstream of the trap. If an equivalent number of fry emerged downstream of the trap, then the total out-migrating fry count would include an additional 12% or 13,195 fry bringing the total to 123,152. Johnson Creek has approximately 10% of the total spawning habitat downstream of the trap giving a final total estimate of 874,855 fry. Slate Creek had an additional 12% of potential spawning habitat downstream of the trap giving a total estimate of 349,766 pink fry. Based on these numbers, total mortality caused by monitoring was 0.37% (456 fry), 0.06% (550 fry) and 0.34% (1209 fry) of the total estimated outmigration in Sherman, Johnson and Slate Creeks, respectively.

The number of spawning pink salmon adults estimated in 2008 was 784 in Sherman Creek, 7,953 in Johnson Creek and 1,878 in Slate Creek. Assuming a 1:1 sex ratio, the numbers of adult female salmon present would have been 392 at Sherman, 3976 at Johnson and 939 at Slate. The estimated number of fry produced per adult female is therefore 314 in Sherman Creek, 220 at Johnson Creek and 372 at Slate Creek. Previous estimates for Sherman Creek vary widely from 194 fry per female in 1998 to 792 in 2008. The high estimate was thought to be in error and adjusted accordingly. Average pink salmon fry production over 15 brood years in Auke Creek, SE Alaska, was 25 fry per female (Fukushima 1996). 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 from stream to stream.

Fry estimates produced by mark-recapture can be over-estimated if fry are able to avoid capture either by deliberate movement around the trap or by being eaten by predators. Flow at Sherman Creek is typically swift enough to prevent fry from deliberately avoiding trap, but release site for marked fish is upstream of a deep pool that may shelter predators such as Dolly Varden. Predation could result in fewer marked fish being recaptured and inflated population estimates, although the lowest recapture rates were excluded from estimates. There could also be error in counts of adult salmon that would affect estimates of numbers of fry per adult female.

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 588,000 eggs (392 females x 1500 eggs) and 784,000 eggs (392 females x 2000 eggs). If 123,152 fry emerged in April and May then between 15.7 and 20.9% survived from the egg stage. For Johnson Creek, an estimated 5,964,000 to 7,952,000 eggs produced 874,855 fry or between 11 and 14.7% survived. At Slate Creek, an estimated 1,408,500 to 1,878,000 eggs produced 349,766 fry so the survival rate was between 18.6 and 24.8%. 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. Since the 2009 fry estimates seem to have reasonable egg-to-fry survival rates, no further adjustment of figures was made.

6.11 Other Species Collected

In addition to pink salmon, six other species were caught in the fyke nets (Table 20). Around 7,400 chum salmon fry (*Oncorhynchus keta*) were captured in Johnson Creek during the study, but only 34 were caught at Slate Creek and 34 in Sherman Creek. Most of the chum at Slate Creek were caught during the first 2 weeks of April, but the chum at Sherman were captured slowly up to mid-May. The only other species caught in Sherman Creek were three cutthroat trout, caught May 25 and a coast-range sculpin (*Cottus aleuticus*) captured May 10. A total of 294 coast-range sculpins were caught in Slate Creek and 22 caught in Johnson Creek. 131 juvenile coho salmon were caught in Johnson Creek and 22 caught in Slate Creek. Several Dolly Varden (*Salvelinus malma*) were captured in Johnson and Slate Creeks. 105 eulachon (*Thaleichtys pacificus*) were captured in Slate Creek during early May as they entered the stream to spawn.

	Sherman	Johnson	Slate
Chum salmon	34	7,428	34
Coho	0	131	22
Eulachon	0	0	105
Coast Range Sculpin	1	22	294
Dolly Varden	0	16	6
Cutthroat Trout	3	0	0

Table 20: Other species captured in fyke nets at each creek.

6.12 Discussion and Recommendations

The Johnson Creeks population estimate was of much great magnitude than that of Sherman and Slate Creek, as found in previous years. Johnson Creek has more spawning habitat than the other creeks, with barrier falls located approximately 1.5km 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. Additionally, pink salmon at Slate Creek rarely ascend beyond 600m upstream. The total anadromous area in Sherman Creek was measured as 1,944m^2 in July 2005 (Resident Fish Surveys, Coeur Annual Report 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 giving an area of roughly 12,000m^2. Slate Creek can be estimated by multiplying 900m by 9m giving 8100m^2, with the area in the first 600m approximating 5,400m^2. The difference in numbers of fry between Johnson Creek and Sherman Creek is roughly in proportion to the difference in habitat area present.

Fukushima et al. (1998) found that use of limited spawning areas led to the loss of eggs by displacement by late spawners 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 392 female spawners at Sherman Creek, would allow 4.9 m^2 per female and 3,976 females at Johnson Creek would allow 3m^2 per female. At Slate Creek, the majority of adults were observed in the first 600m of the creek, but even with 5,400m^2, the 939 females at Slate Creek would have had 14.5m^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.

Mortality due to sampling in 2009 was less than 0.4% of the total estimated population for Sherman and Slate Creek and less than 0.1% for Johnson Creek. Mortality can occur when high flow causes fry to become impinged against the net wall or large amounts of debris trap fry against the walls of the holding box. The height-adjustable legs of the holding boxes made it easy to accommodate a wide range of stream flows from day to day, helping reduce mortality rates. In 2009, debris traps set upstream of the fyke nets, greatly reduced the amount of debris in the traps and the amount of mortality. Low flows also helped keep mortality rates down.

7.0 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 14 to September 28, 2009. Prior to the first survey, markers were placed along one bank of each creek at 50m intervals (Sherman and Sweeny Creeks) 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.

Data gathered during weekly 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. Chum and coho were only observed for one week so the total number observed was used as the escapement for these salmon.

7.2 Adult Salmon Counts

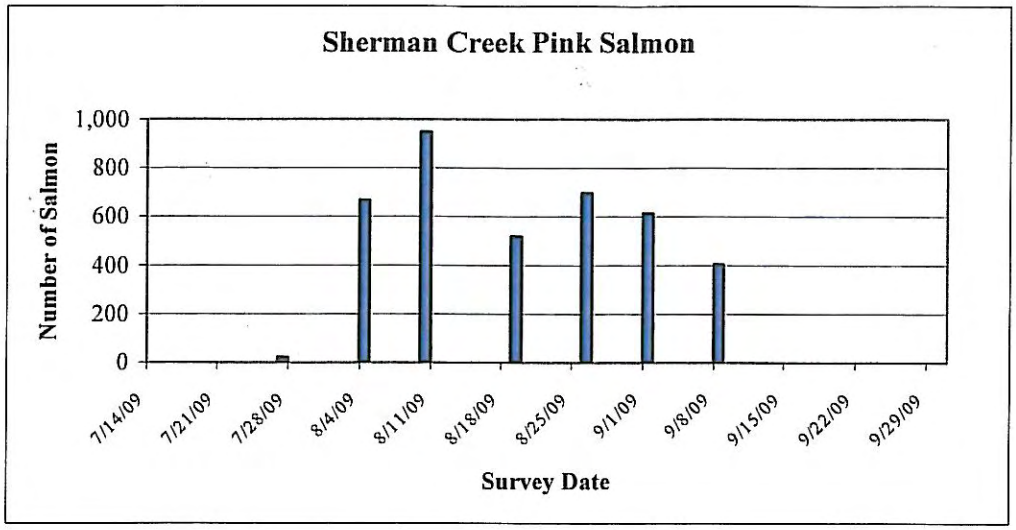
Weekly counts of adult salmon migrating into streams to spawn in 2009 are presented in Appendix 5. Figure 22 shows the magnitude and timing of the pink salmon spawning runs in Sherman, Johnson and Slate Creeks. Pink salmon were observed in Sherman Creek from July 22 to September 20 with a maximum of 921 live individuals observed on August 10. No chum or coho salmon were observed in Sherman Creek. At Johnson Creek, pink salmon were observed from July 21 to September 16, with numbers peaking at around 4270 fish on August 12. Around 80 chum salmon were observed in Johnson Creek on July 21, around 500 on July 27, and 400 on August 6.

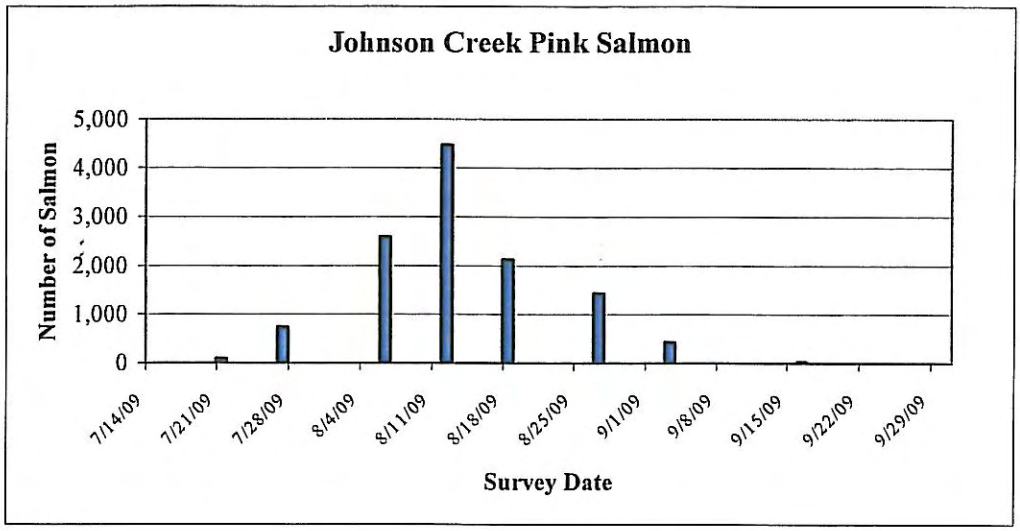
At Slate Creek, pinks were observed from July 21 to September 9 with numbers peaking at 755 on August 18. No chum salmon were observed in Slate Creek in 2009. The stream mouth was visited in early November, but no coho were observed. Numbers of pink salmon reached a peak around mid-August in each stream. The magnitude of the pink salmon escapement in Johnson Creek was almost 3 times that of Sherman Creek and 7 times that of Slate Creek (Table 21).

Table 21: Salmon Escapement by stream for 2009.

	Salmon Escapement		
	Sherman Creek	**Johnson Creek**	**Slate Creek**
Pink	**2060**	**5968**	**837**
Chum	**0**	**605**	**0**

Figure 22: Weekly Counts of Adult Pink Salmon.





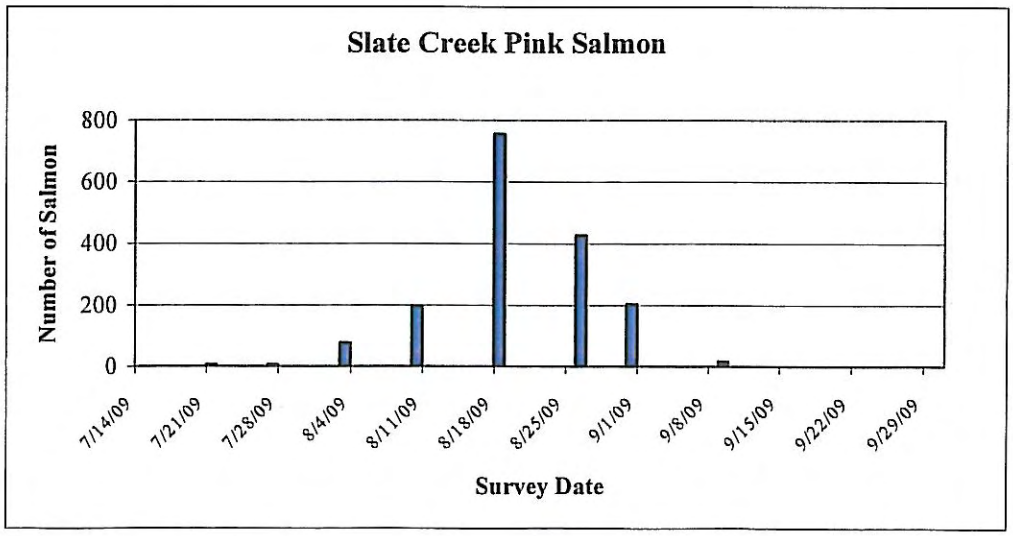


Figure 22 cont: Weekly Counts of Adult Pink Salmon.

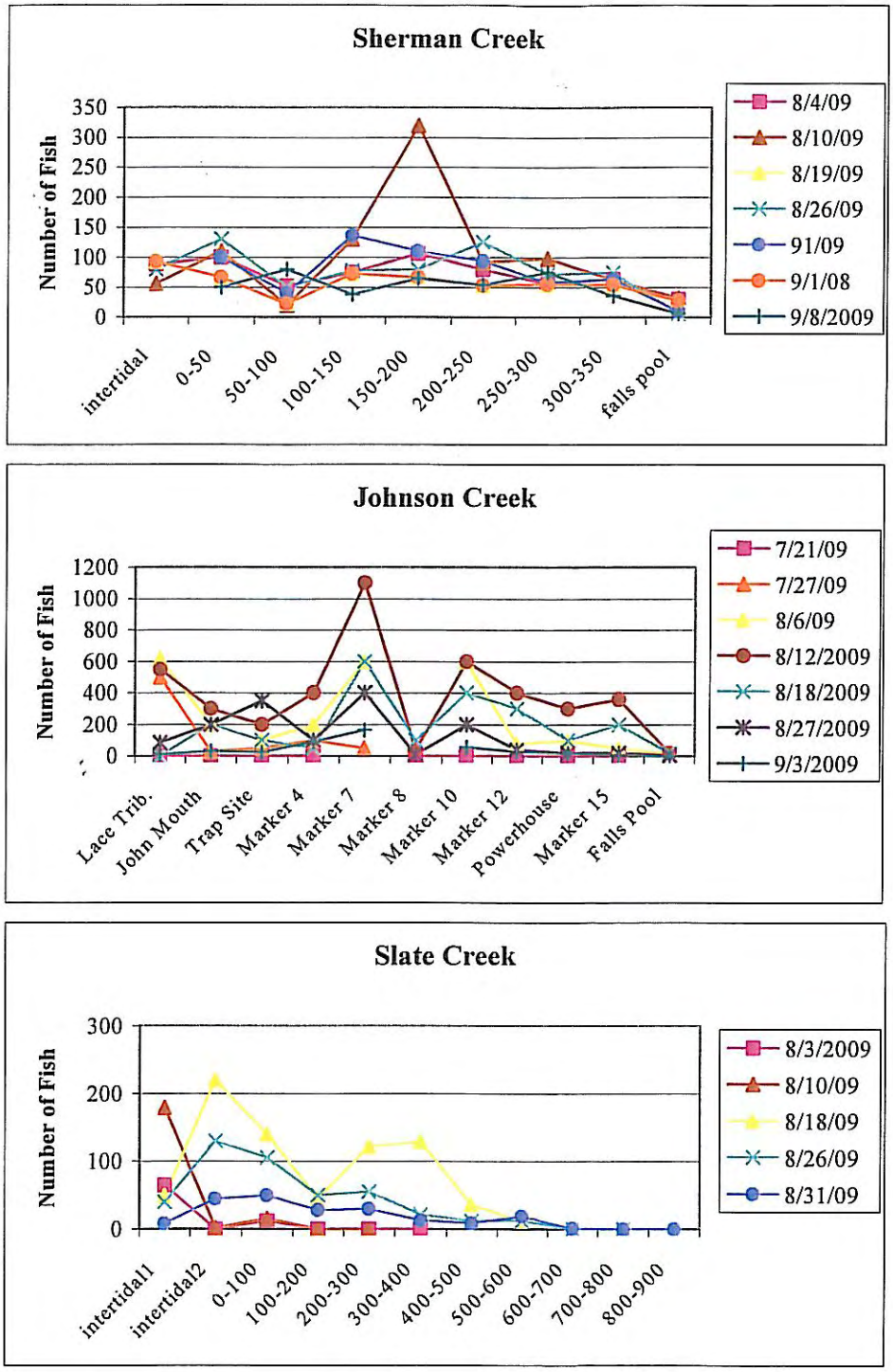


Figure 23: Distribution of pink salmon at Sherman, Johnson and Slate Creeks.

The distribution of salmon in each stream throughout the surveys is shown in Figure 23. Salmon were fairly evenly distributed throughout Sherman Creek on all survey dates except for lower numbers between 50 and 100m, which is dominated by fast riffle, and a larger number of salmon at the peak of the run between 150 and 200m. In Johnson Creek, there were large numbers of pink salmon all the way up to the old powerhouse site about 1km upstream from the mouth, with the highest numbers observed between 400 and 500m upstream. The stream changes here from gentle riffle and deep pools to faster, steeper riffle with less spawning habitat available. Similarly the majority of salmon at Slate Creek were observed below 600m, prior to the creek changing from gravel to bedrock substrate. Salmon were present only in the intertidal zone for the first two surveys as low flow prevented access further upstream.

7.3 Pink Salmon Escapement Comparison

A comparison of pink salmon escapement between 2005 and 2009 is shown in Figure 24. In South-East Alaska, the size of the adult pink salmon return is generally higher in even-years than odd-years due to their 2 year life cycle and lack of interbreeding between two distinct populations (Quinn 2005). It is thought that the even-year salmon populations are better adapted to cooler water. The last ice age may have divided one population into a warm-water adapted southern (odd-year) population and a cooler water northern (even-year) population.

This pattern can be seen in the lower numbers returning to Johnson and Slate Creeks in 2005 and 2007 and higher returns 2006 and 2008. The pattern does not hold well in drier summers, particularly at Sherman and Slate Creeks where low flow inhibits upstream migration. 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. Sherman Creek may have the opposite pattern of higher odd year returns, based on numbers in 2005 and 2009 being higher than other years. If odd years are higher here, then 2007 should also have been a high year, but 2007 did not have a high return due to low flow that inhibited access as salmon could not negotiate the falls near the mouth of the creek. The 2009 return at Sherman Creek was not as large as the 2005 return, but was twice as high as even-year returns. The Johnson and Slate Creeks salmon returns in 2009 were markedly higher than previous odd-year returns.

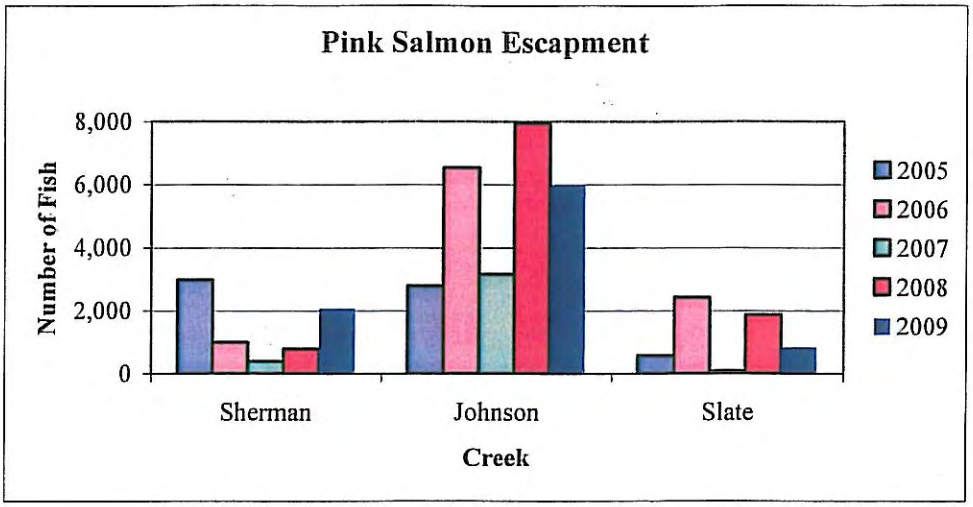


Figure 24: Estimated pink salmon escapement from 2005 to 2009.

Figure 25: Pink salmon observed in Sherman Creek.

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 9 and 16, Slate Creek on July 8 and Johnson Creek on July 14, 2009. At Sherman Creek, Reach 1 lies between 3 and 29m, and Reach 2 lies between 288 and 315m from the stream mouth, as defined by Konopacky (1992). The two sampling reaches at Slate Creek are located between 125 and 150m, and between 175 and 200m from the stream mouth. At Johnson Creek the sampling reaches 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 as described by Valentine (1995).

Figure 26: Different sizes of gravel being sorted on site.

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) for baseline sampling. 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 poured into Imhoff cones to settle out; and this volume read directly from each cone.

Figure 27: Displacement of water used to measure volumes of gravel.

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

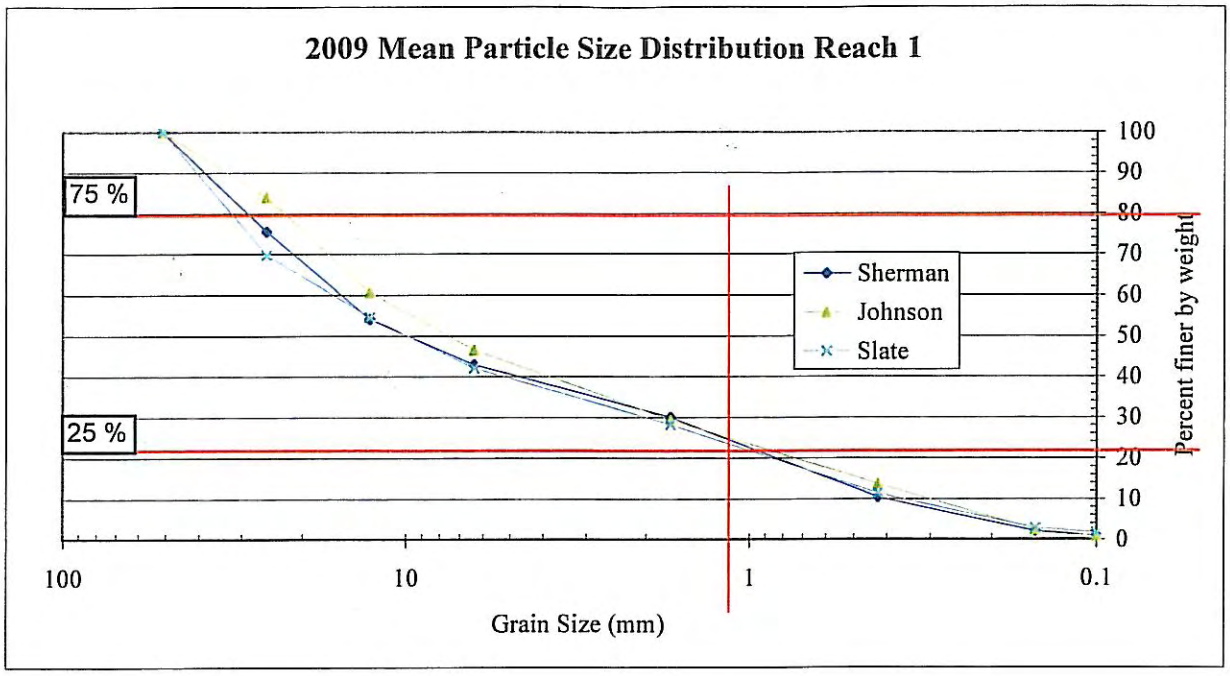
v = decimal fraction by volume of particles retained by a given sieve

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 22. Embryo survival predictions and grain size percentiles are obtained graphically from Lotspeich & Everest (1981). The average geometric mean particles size at Sherman Creek was 12.95mm at Reach 2 and 13.3mm at Reach 1. At Johnson Creek, Average d_g ranged from 11.8 to 11.95 mm and Slate Creek from 12.06 to 12.3mm. Sherman and Slate Creeks had similar gravel composition, but Johnson Creek generally had smaller gravel (Figure 29).



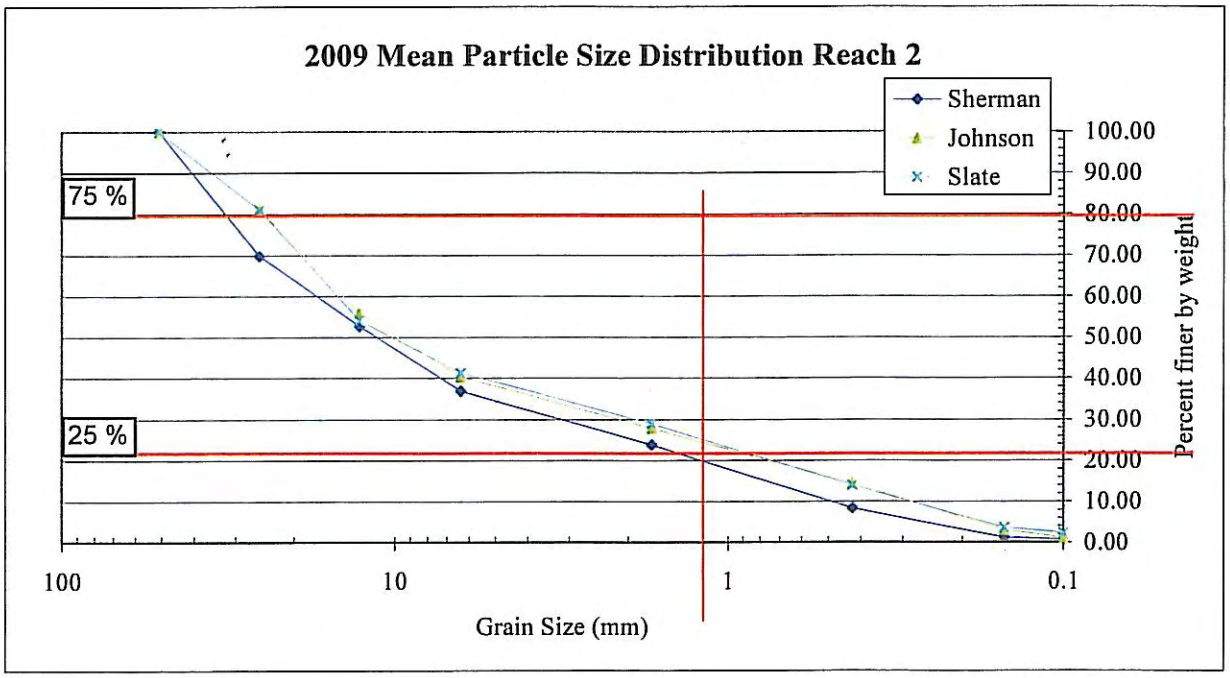


Figure 29: Cumulative size distribution curves for gravel samples collected in 2009. Vertical red line used to find where the data crosses the 25% and 75% percentiles.

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 2008 gravel samples, predict embryo survival to range from 15 to 25% for Sherman and Sweeny Creeks and from 13% to 35% for Johnson and Slate Creeks. The Fredle index is lower than previous years due to less medium-sized gravel present at all sites, but actual survival based on fry counts appeared high. The amount of fine material in the gravel was lower at Sherman and Johnson Creeks, but higher at Slate Creek.

Sample		Geometric Mean (mm) dg	Grain size percentile (75th and 25th) d75	d25	Sorting Coefficient So	Fredle Index (f = dg/So)	Survival-to-Emergence Prediction (%)
Sherman Creek							
Reach 1	1	12.23	59	14	4.21	2.90	45.0
	2	13.22	58	5.7	10.18	1.30	15.0
	3	14.25	65	8	8.13	1.75	23.0
	4	13.46	36	5.7	6.32	2.13	27.0
	Mean	**13.29**	**54.50**	**8.35**	**7.21**	**2.02**	**27.5**
	Standard Deviation	0.83	12.71	3.92	2.54	0.68	12.7
	95% Confidence Interval	0.81	12.46	3.84	2.49	0.67	12.4
Reach 2	1	13.54	59	14	4.21	3.21	50.0
	2	12.61	58	5.7	10.18	1.24	10.0
	3	14.25	65	8	8.13	1.75	23.0
	4	11.39	36	3.3	10.91	1.04	5.0
	Mean	**12.95**	**54.50**	**7.75**	**8.36**	**1.81**	**22.0**
	Standard Deviation	1.24	12.71	4.59	3.00	0.98	20.1
	95% Confidence Interval	1.21	12.46	4.50	2.94	0.96	19.7
Johnson Creek							
Reach 1	1	11.32	31	3.7	8.38	1.35	15.0
	2	11.88	49	4.8	10.21	1.16	10.0
	3	12.62	52	5.7	9.12	1.38	20.0
	4	11.32	36	3.7	9.73	1.16	10.0
	Mean	**11.79**	**42.00**	**4.48**	**9.36**	**1.27**	**13.8**
	Standard Deviation	0.62	10.10	0.97	0.79	0.12	4.8
	95% Confidence Interval	0.61	9.90	0.95	0.77	0.12	4.7
Reach 2	1	12.21	43	5.2	8.27	1.48	22.0
	2	11.55	42	4.1	10.24	1.13	10.0
	3	12.62	50	7.5	6.67	1.89	25.0
	4	11.42	36	3.7	9.73	1.17	10.0
	Mean	**11.95**	**42.75**	**5.13**	**8.73**	**1.42**	**16.8**
	Standard Deviation	0.57	5.74	1.71	1.61	0.35	7.9
	95% Confidence Interval	0.56	5.62	1.67	1.58	0.35	7.7
Slate Creek							
Reach 1	1	11.76	43	4	10.75	1.09	6.0
	2	12.53	48	4.8	10.00	1.25	12.0
	3	12.01	58	5.1	11.37	1.06	6.0
	4	13.03	62	6.4	9.69	1.34	15.0
	Mean	**12.33**	**52.75**	**5.08**	**10.45**	**1.19**	**9.8**
	Standard Deviation	0.56	8.77	1.00	0.76	0.14	4.5
	95% Confidence Interval	0.55	8.59	0.98	0.74	0.13	4.4
Reach 2	1	10.75	27	2.6	10.38	1.03	5.0
	2	12.73	41	3.9	10.51	1.21	11.0
	3	12.01	41	6.7	6.12	1.96	26.0
	4	12.75	55	6.7	8.21	1.55	22.0
	Mean	**12.06**	**41.00**	**4.98**	**8.81**	**1.44**	**16.0**
	Standard Deviation	0.94	11.43	2.06	2.08	0.41	9.7
	95% Confidence Interval	0.92	11.20	2.02	2.04	0.40	9.5

Table 22. Calculated indices for gravel samples collected from Sherman, Johnson, and Slate Creeks in 2009. Geometric mean particle sizes are expressed in mm.

Geometric Mean (*dg*) mm

Site	2005	2006	2007	2008	2009	p value
Sherman Reach 1	9.57	9.34	12.64	12.72	13.29	4.075E-05
Sherman Reach 2	10.74	14.57	12.54	12.96	12.95	0.0056
Johnson Reach 1	10.8	10.98	11.11	11.22	11.79	0.2701
Johnson Reach 2	12.2	12.24	11.28	11.02	11.95	0.1019
Slate Reach 1	12.3	11.87	11.55	11.64	12.33	0.2763
Slate Reach 2	14.23	12.01	12.29	12.1	12.06	0.0932

*significant at 95% level

Table 23: Comparison of *dg* for 2005 -2009.

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 through 2009 by applying a single factor ANOVA to the data. Table 23 shows geometric means for 2005 to 2009 and p values from ANOVA. Both reaches of Sherman Creek showed significant differences in geometric mean particle size over time with *dg* at Reach 1 being higher from 2007 to 2009 than previous years and Reach 2 high in 2006. A larger geometric mean particle size indicates samples contain less fine material and are more suitable for salmon spawning. There were no significant differences in *dg* at other sites over time.

The amount of fine sediment in the gravel depends on how much sediment is deposited and also how frequently high flows flush fine sediment from the gravel so there could be substantial variation over time.

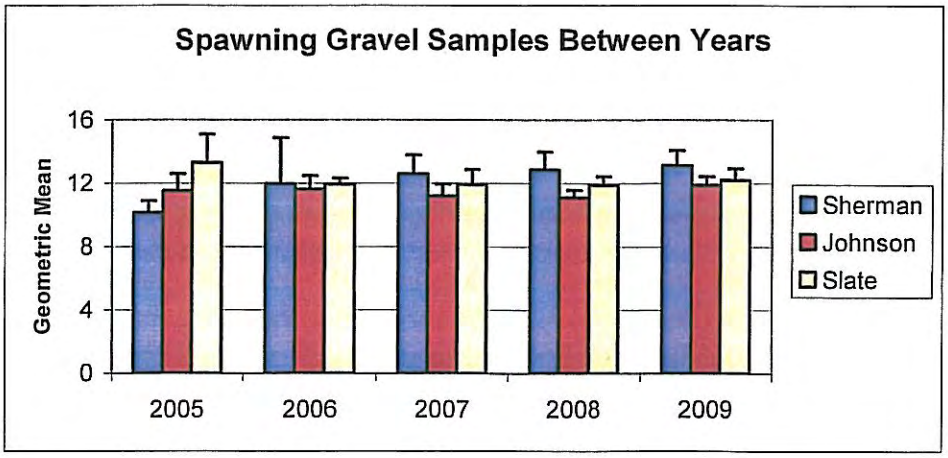


Figure 30: A comparison of geometric mean from 2005 to 2009.

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 2009 during resident fish surveys. These reaches are downstream of outfall 001 (Sherman Creek), downstream from the proposed outfall 002 (Slate Creek) and downstream from the mill process site (Johnson Creek).

In Sherman Creek, aquatic vegetation consisted of a single layer of green algae on the larger, more stable rocks in pools (Figure 31) whereas other parts of the creek with faster flowing water have little algal growth (Figure 32). Algal growth was likely encouraged during 2009 by the warm, dry summer providing low flow in the creek and plenty of sunlight.

Johnson and Slate Creeks showed very little aquatic vegetation on the substrate (Figures 33 and 34). Middle Slate had some moss and very light algal growth. Periodic high flows in these steep, coastal streams likely disturb the substrate and restrict aquatic plant growth. Some mosses and ferns are present in the splash zone, particularly near waterfalls. Spawning salmon in the lower reaches of streams likely disturb and remove algae from rocks when they dig their redds.

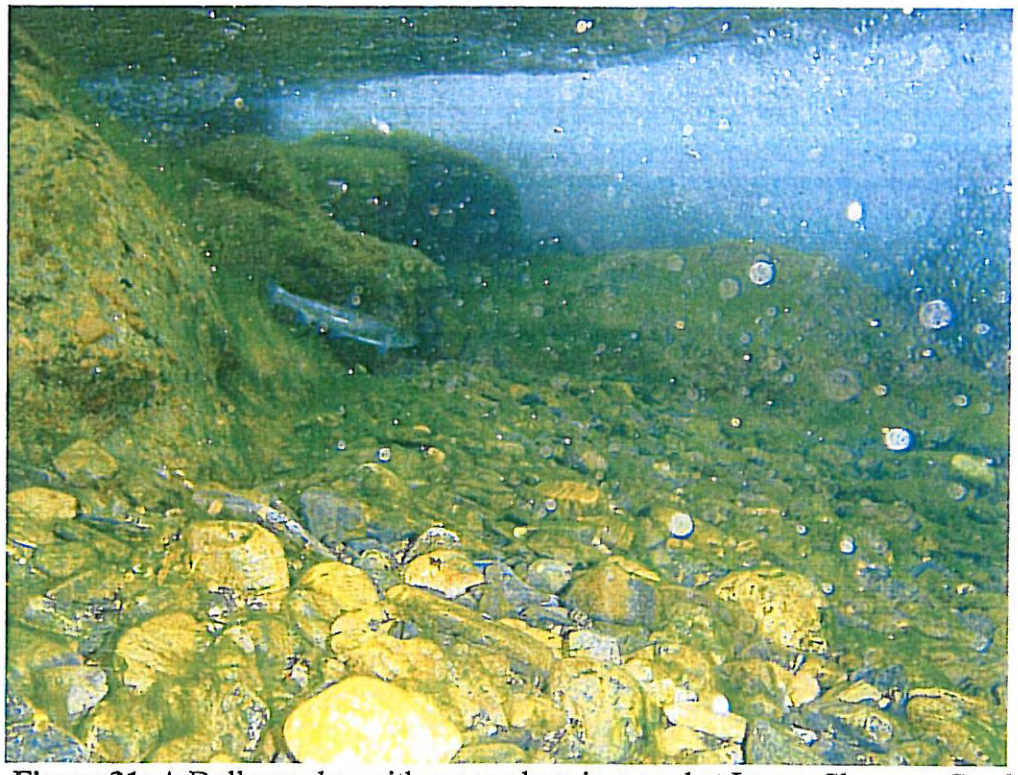


Figure 31: A Dolly varden with green algae in a pool at Lower Sherman Creek.

Figure 32: Underwater view of Sherman Creek showing little vegetation in a riffle.

Figure 33: An aerial view of Lower Johnson Creek with adult salmon and little aquatic vegetation.

Figure 34: Negligible aquatic vegetation in Lower Slate Creek.

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APPENDIX 1A: TOXICITY LAB REPORT FOR *Chironomus dilutus*

Coeur Alaska, Inc.
Juneau, Alaska

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

Prepared by

AECOM

AECOM Environment
Environmental Toxicology
Fort Collins, CO

08503-134-058-(039, 041, 043, 045)
September 2009

AECOM

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

Project IDs: 08503-134-058-(039, 041, 043, 045)
September 2009

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	AECOM Environment 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 (2006)	
Test Protocol	CT3AK.TIE058.006	
Test Period	September 11, 2009 @ 1500 to September 21, 2009 @ 1600	
Test Length	10 days	
Species	*Chironomus dilutus*	
Test Material	Whole sediment	
Sediment ID	Sample ID	AECOM Laboratory ID
	Johnson Creek	23120
	Slate Creek	23119
	Lower Sherman	23118
	Middle Sherman	23121
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	

- *Results described in this report apply only to the samples submitted to the laboratory and analyzed, as listed in the report*
- *Test results comply with NELAC standards. Reports are intended to be considered in their entirety; AECOM is not responsible for consequences arising from use of a partial report*
- *This report contains 7 pages plus 3 appendices*

Sediment Collection and Receipt

Sample ID	Collection Date and Time	AECOM No.	Date of Receipt	Temp. at Arrival (°C)
Johnson Creek	08/23/09 @ 1200	23120	09/03/09	11.6
Slate Creek	08/31/09 @ 1200	23119	09/03/09	10.1
Lower Sherman	09/01/09 @ 1200	23118	09/03/09	10.1
Middle Sherman	09/02/09 @ 1100	23121	09/03/09	11.6

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
Johnson Creek	September 11, 2009	1447-1451
Slate Creek		1458-1501
Lower Sherman		1420-1424
Middle Sherman		1425-1428

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
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

Test Organism

From the lot of *Chironomus dilutus* received for use in the test, 20 were collected, preserved, and used to determine head capsule widths. The mean head capsule width of lot 09-032 was 0.46 mm and the range was 0.37 to 0.51 mm. Some of the organisms were slightly larger than the upper limit for third instar (0.45 mm). However, all organisms were smaller than fourth instars according to the range given in USEPA (2000). All organisms were, therefore, third instars.

Species and Lot Number	*Chironomus tentans*, Lot 09-032
Age	3rd instar
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (48 mg/L) as NaCl, RW # 9196
Reference Toxicant Testing	Initiated September 11, 2009 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Ash Free Dry Weights

Sample ID	Percent Survival[a]	Ash Free Dry Weight (mg)[b]	
		Per original organism	Per surviving organism
Sand Control	91.25	1.2597	1.4205
Lab. Formulated Sediment Control	93.75	2.1998	2.3508
Johnson Creek	95.00	1.5496[c]	1.6463[c]
Slate Creek	91.25	1.3729[c]	1.5459[c]
Lower Sherman	83.75	1.5461[c]	1.9603[c]
Middle Sherman	90.00	1.5964[c]	1.8127[c]
Control Performance	Acceptable	N/A	N/A

[a] The Sand and Formulated Sediment controls were pooled for statistical comparisons of survival
[b] AFDW in the two controls was significantly different; all statistical comparisons of AFDW were made against the Formulated Sediment control
[c] Significantly lower weight compared to the formulated sediment control
Note: See Appendix B for test data sheets

Data Analysis

For each test metric (survival, AFDW/original organism and AFDW/surviving organism), the sand and Formulated Sediment controls were compared using a T-test. If there was not a significant difference between the two, the controls were pooled and comparisons were made against the pooled control data. If there was a significant difference, all statistical comparisons were made against the Formulated Sediment control since the organic content of the Formulated Sediment is more reflective of the organic content of the test sediments. For survival, the two controls were pooled; for growth, statistical comparisons were made only against the Formulated Sediment control.

Biological Endpoint	Comparison[a]	Procedure
Survival	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Pooled Controls	Wilxocon's Rank Sum Test with Bonferroni Adjustment (α = 0.05)
Growth (AFDW per Original Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	DunnettsTest (α = 0.05)
Growth (AFDW per Surviving Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	DunnettsTest (α = 0.05)

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

Analytical Data

Parameter	Sample Identification			
	Johnson Creek	Slate Creek	Lower Sherman	Middle Sherman
Metals (mg/Kg-dry)[a]				
Aluminum	13,000	10,400	14,600	10,500
Chromium	33.2	17.5	42.1	23.3
Zinc	93.5	155	126	101
Arsenic	8.91	22.8	46.4	29.4
Cadmium	0.240	0.717	0.466	0.283
Copper	66.6	44.3	105	65.1
Lead	7.64	13.4	12.6	7.88
Nickel	48.4	27.4	33.8	21.8
Selenium	0.405J	1.24	1.80	1.09
Silver	0.369	0.180J	0.319J	0.252J
Mercury	0.0540H	0.0822H	0.0786	0.0579
Particle Size (%)[b]				
Clay	9.0	8.0	8.0	4.0
Sand	50.0	82.0	79.0	80.0
Silt	41.0	10.0	13.0	16.0
Texture	Loam	Loamy Sand	Loamy Sand	Loamy Sand
Coarse Material	ND	ND	ND	ND
TOC (%-dry)[c]	2.02	6.58	5.05	2.53
Acid Volatile Sulfide (umoles/g)	ND	ND	1.37J	1.19J

[a] Al, Cr, Ni and Zn by SW-846 Method 6010B; As, Cd, Cu, Pb, Se and Ag by SW-846 Method 6020; Hg by SW-846 7471B (USEPA 1986)
[b] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[c] TOC was determined using the Walkley Black Method
J = The concentration was below the Reporting Limit but above the Method Detection Limit
H = Holding time for preparation or analysis exceeded
ND = Not Detected at the Method Detection Limit; see Appendix C for detection limits
Note: See Appendix C for a copy of the report from the analytical laboratory (MSE-TA Analytical Laboratory, Butte, MT)

Total and Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Johnson Creek	65.82	2.16
Slate Creek	56.00	6.66
Lower Sherman	62.18	4.16
Middle Sherman	73.24	2.97

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
All values are means of two analyzed samples
Note: See Appendix B for data sheets (these parameters were determined at the AECOM/FCETL)

Physical and Chemical Data (Min/Max)

Sample ID	pH (units)	DO (mg/L)	Cond. (µS/cm)	Temp. (°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	5.8/7.0	461/506	21/23	<1.0/1.6	86/94	65/72
Lab. Form. Sed.	7.5/8.0	5.4/6.9	503/508	21/23	<1.0	98/102	70/85
Johnson Creek	7.4/7.7	5.3/6.8	386/461	21/23	<1.0/1.8	82/84	43/57
Slate Creek	7.1/7.7	5.0/6.2	358/454	21/23	<1.0/1.3	78/80	35/54
Lower Sherman	7.4/7.7	5.0/6.2	430/487	21/23	<1.0/2.5	92/96	67/73
Middle Sherman	7.4/7.9	4.5/6.0	425/488	21/23	<1.0/1.5	92/100	68/70

[a] Temperature in test chambers

Reference Toxicant Test Results for *C. tentans*

Organism Lot Number	Test Dates	96-Hour LC_{50}	AECOM/FCETL Historical 95% Control Limits	
			Low	High
09-032	09/11/09 to 09/15/09	4691	3626	6525

Note: Values are expressed as mg/L chloride

References

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

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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 29 Oct 2009

David A. Pillard, Ph.D.
Study Director

Date

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 Reimer October 26, 2009

Quality Assurance Unit

Date

APPENDIX A

Chain of Custody

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Page 2 of 2

Client/Project Name: Cedar Alaska

Project Location: FEET

Project Number: 08503-134-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): Liz Flory, Aquatic Science

Chain of Custody Tape Nos.: 42090 intact

Signature: L. Flory

Send Results/Report to: Liz Flory, 4546 River Rd Juneau, AK 99801

TAT: 30 Days From End Date

Analysis Requested: Hyallella + Chironomus

Container Type	Preservation
P – Plastic	1 – HCl, 4°
A – Amber Glass	2 – H2SO4, 4°
G – Clear Glass	3 – HNO3, 4°
V – VOA Vial	4 – NaOH, 4°
O – Other	5 – NaOH/ZnAc, 4°
E – Encore	6 – Na2S2O3, 4°
	7 – 4°

Matrix Codes:

DW – Drinking Water	SO – Soil
WW – Wastewater	SL – Sludge
GW – Groundwater	SD – Sediment
SW – Surface Water	SO – Solid
ST – Storm Water	A – Air
W – Water	L – Liquid
	P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered	Lab I.D.	Remarks
JOHNSON CREEK	8-23-09	1200	✓		1 gal	S	ICE		# 23 120	Cooler temp
MIDDLE SHERMAN	9-2-09	1100	✓		1 gal	S	ICE		# 23 121	D-38 @ 11.6°C
–					1 gal	S	ICE			

Relinquished by: (Print Name)/(Affiliation)	Date	Received by: (Print Name)/(Affiliation)	Date
Liz Flory, Aquatic Science	9-2-09	Kelli Jopp	9/3/09
Signature: L. Flory	Time: 1600	Signature:	Time: 1350
Relinquished by: (Print Name)/(Affiliation)	Date:	Received by: (Print Name)/(Affiliation)	Date:
Signature:	Time:	Signature:	Time:
Relinquished by: (Print Name)/(Affiliation)	Date:	Received by: (Print Name)/(Affiliation)	Date:
Signature:	Time:	Signature:	Time:

Analytical Laboratory (Destination):

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: Ford Truck

UPS FedEx Courier Other

Temp blank: Yes No

Serial No. 49615

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Location: FCETL

Project Number: 08503-134-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY / AQUATIC SCIENCE

Chain of Custody Tape Nos.: 41642 intact

Signature: L. Flory

Send Results/Report to:

TAT:

Analysis Requested

Container Type: (P) – Plastic; A – Amber Glass; (G) – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; (S) – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered	MALELLA + CHIRONOMUS										Lab I.D.	Remarks
LOWER SHERMAN	9-1-09	1200	✓		1 gal	S	ICE		X								#	23	118	Cooler temp
SLATE CREEK	8-31-09	1200	✓		1 gal	S	ICE		X								#	23	119	D-38 @ 10.1°C
LOWER SHERMAN	9-1-09	1200	✓		Sm. Jar	S	ICE		X								#	23	122	
SLATE CREEK	8-31-09	1200	✓		Sm. Jar	S	ICE		X								#	23	123	
JOHNSON CREEK	8-23-09	1200	✓		Sm. Jar	S	ICE		X								#	23	124	
MIDDLE SHERMAN	9-2-09	1160	✓		Sm. Jar	S	ICE		X								#	23	125	
					Sm. Jar	S	ICE		X											
(1)									X											

Relinquished by: (Print Name)/(Affiliation)	Date	Received by: (Print Name)/(Affiliation)	Date
LIZ FLORY, AQUATIC SCIENCE Signature: L. Flory	Date: 9-2-09 Time: 1600	Kelly Trapp Signature: [signature]	Date: 9/3/09 Time: 1350
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):

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: Fast Track

UPS FedEx (Courier) Other

Temp blank: Yes (No)

(1) [initials] 8-6-09 Er

C:\BLOOSE FILES\PS\Chain-of-Custody_Ft. Collins_10_07.doc

Serial No. 49614

APPENDIX B

Data Sheets

Page 1 of ~~29~~ 30 ③

JK 10/23/09
QA: AR 10/23/09

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

Project Number:	8503-134-058 —		039, 041, 043, 045	Protocol #:	CT3AK.TIE058.005 ① ~~6~~ 8 ②		
Test Substance:	Sediment						
Test Species:	*C. dilutus**	Lot #:	09-032	Age:	2nd-3rd instar	Supplier:	ABS
Test Type:	Chronic, Static Renewal						
Dilution Water:	Mod Hard with 50 mg/L Chloride			Investigators:	JK/KB/AP/CW		
Sampling Date(s):	08/23/09, 08/31/09, 09/07/09, 09/02/09			Sampling Time(s):	1200, 1200, 1200, 1200		
FCETL Sample #(s):	23120, 23119, 23118, 23121						
Test Initiation Date/Time:	9/11/09 @ 1500						
Test Termination Date/Time:	9/21/09 @ 1600						

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)	Johnson Creek
	4)	Slate Creek	5)	Lower Sherman	6)	Middle Sherman
	7)		8)		9)	
	10)		11)			

Reference Tox. Dates:	9/11/09 - 9/15/09	LC50:	469 mg/L Cr	Hist. Limits:	3626-6525	Method:	S-K
Study Director Initials:	DAP	Date:	9/11/09				

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

* formerly known as *C. tentans*

① JK 10/19/09E
② AR for KT 10/26/09E
③ JK 10/27/09E

Page 2 of 3
Qy 10/23/09
QA: AR 10/23/09

BIOLOGICAL DATA

*C. dilutus** Chronic, Static Renewal Project 8503-134-058 - (039, 041, 043, 045)

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks:
Sand (cont)	# Surviving	10	10	10	①8▲⊙	②10⊛	10	8	9⊛■	91.25%
	# Observed Dead	0	0	0	1	②1⊛	0	1⊛	0	
	# Not Found	0	0	0	0	2	0	1	1	
Form sed (cont)	# Surviving	9	⊛10	9	9	10	9	10⊛	9■	93.75%
	# Observed Dead	1	0	0	0	0	0	0	1	
	# Not Found	0	0	1	1	0	1	0	0	
Johnson Creek	# Surviving	10	10▲	10▲	⊛7 8	10■	9⊛	9	10	95%
	# Observed Dead	0	0	0	0⊛	0	0	1⊛	0	
	# Not Found	0	0	0	2	0	1	0	0	
Slate Creek	# Surviving	10	9	7⊛*	8▲	9⊛	▲10⊙	10	10	*9/13/09 - Removed dead org.
	# Observed Dead	0	0	2⊛	0	1⊛	0	0	0	91.25%
	# Not Found	0	1	1	2	0	0	0	0	
Lower Sherman	# Surviving	10⊛	9⊙	9	7⊙	8■	9■	7■	8	
	# Observed Dead	0	0	1⊛	1	0	0	1⊛	0	83.75%
	# Not Found	0	1	0	2	2	1	2	2	
Middle Sherman	# Surviving	10⊛	9⊛	8⊙*	9	8⊙	⊛10⊙	8⊛■	10	*9/13/09 - Removed dead org.
	# Observed Dead	0	0	2	0	2⊙	0	0	0	
	# Not Found	0	1	0	1	0	0	2	0	90%
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									
0	# Surviving									
	# Observed Dead									
	# Not Found									

▲ 1 exuvia found
⊛ 1 pupae found
⊙ 2 pupae found
■ 2 exuvia found

①AK 9/21/09E
②KB 9/21/09E
③AK 10/27/09E

④AK 9/21/09E

Measure NH3!

Task 3 2930 ⑧ QA: AR 10/23/09

CHEMICAL DATA (Composite of Overlying Water) *C. dilutus** Chronic, Static Renewal Project 8503-134-058-(039, 041, 043, 045)

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)	7.0	6.6	6.5	6.6	5.8	6.0	6.2	6.3	6.4	6.9	6.7	0	5	9/11/09	1600	KB
	Form sed (cont)	6.9	6.4	5.8	5.9	6.0	5.4	6.2	6.0	6.8	5.5	5.4	1	5	9/12/09	1150	KB
	Johnson Creek	6.8	6.1	5.6	6.0	5.3	5.4	6.2	6.5	6.1	6.2	6.1	2	5	9/13/09	1550	KB
	Slate Creek	6.2	5.7	5.8	5.9	5.9	5.0	6.0	5.6	6.2	6.0	5.6	3	5	9/14/09	1055	AP
	Lower Sherman	6.0	5.0	5.3	5.3	6.2	5.0	5.9	5.6	5.5	6.1	6.0	4	5	9/15/09	1120	KB
	Middle Sherman	6.0	5.4	5.4	5.6	5.5	5.8	5.6	5.7	5.4	6.0	6.0	5	5	9/16/09	1620	KB
	0												6	5	9/17/09	1035	AP
	0												7	5	9/18/09	1105	AP
	0												8	5	9/19/09	1630	KB
	0												9	5	9/20/09	0905	CW
													10	5	9/21/09	0940	AP
Temp (deg C)	Sand (cont)	22	21*	22	22	22	22	22	23	23	22	23	0	D44	9/11/09	1050	KB
	Form sed (cont)	22	21*	22	22	22	22	22	23	23	22	22	1	D46	9/12/09	1145	KB
	Johnson Creek	22	21*	22	22	22	22	22	23	23	22	23	2	D44	9/13/09	1100	KB
	Slate Creek	22	21*	22	22	22	22	22	23	23	22	23	3	D44	9/14/09	1045	AP
	Lower Sherman	22	21*	22	22	22	22	22	22	23	22	23	4	D47	9/15/09	1125	KB
	Middle Sherman	22	21*	22	22	22	22	22	23	23	22	23	5	D46	9/16/09	1615	KB
	0												6	D45	9/17/09	1025	AP
	0												7	D44	9/18/09	1100	AP
	0												8	D45	9/19/09	1630	AP
	0												9	D45	9/20/09	0905	CW
													10	D45	9/21/09	0940	AP
pH	Sand (cont)	8.1	8.0	8.0	7.8	8.0	7.8	7.7	7.8	7.9	7.9	7.9	0	12	9/11/09	1055	KB
	Form sed (cont)	8.0	8.0	8.0	7.7	8.0	7.8	7.7	7.7	7.9	7.6	7.5	1	12	9/12/09	1155	KB
	Johnson Creek	7.5	7.7	7.6	7.4	7.5	7.5	7.4	7.7	7.8	7.5	7.6	2	12	9/13/09	1555	KB
	Slate Creek	7.1	7.3	7.6	7.1	7.7	7.3	7.3	7.4	7.5	7.4	7.2	3	12	9/14/09	1050	AP
	Lower Sherman	7.5	7.6	7.6	7.4	7.7	7.7	7.4	7.4	7.7	7.6	7.6	4	12	9/15/09	1130	KB
	Middle Sherman	7.7	7.7	7.8	7.4	7.8	7.9	7.5	7.6	7.8	7.7	7.5	5	12	9/16/09	1620	KB
	0												6	12	9/17/09	1035	AP
	0												7	12	9/18/09	1105	AP
	0												8	12	9/19/09	1630	KB
	0												9	12	9/20/09	0905	CW
	Replicate	A	B	C	D	E	F	G	H	A	B	C	10	12	9/21/09	0940	AP

* 9/12/09 checked all reps: KB

① KB 9/15/09 E

② AP 10/27/09 E

Page 4 2930 ②
[illegible] 10/23/09
QA: AR 10/23/09

OVERLYING WATER CHARACTERIZATION | *C. dilutus** | Chronic, Static Renewal | Project No. 8503-134-058-(039, 041, 043, 045

	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)	461	506	94	86	65	72	<1.0	1.2	1.6	1.2
Form sed (cont)	503	508	98	102	70	85	<1.0	<1.0	<1.0	<1.0
Johnson Creek	386	461	82	84	43	57	<1.0 ⊛	1.0	1.8 ⊛	<1.0
Slate Creek	358	454	80	78	35	54	NM	<1.0	1.3 ⊛	<1.0
Lower Sherman	430	487	96	92	67	73	<1.0 ⊛	1.4	⊛2.5 ⊛	<1.0
Middle Sherman	425	488	100	92	68	70	<1.0 ⊛	1.4	1.5	<1.0
0										
* Mod Hard (RW 9196)	444		88		64					
▲ Mod Hard RW 0	438		86		62					
9208 0										
Meter #	15						HA#1/2	HA#1	HA#1	HA#1
Date:	9/11/09	9/21/09	9/11/09	9/21/09	9/11/09	9/21/09	9/11/09	9/14/09	9/18/09	9/21/09
Time:	1620	0900	1620	0900	1620	0900	1600	1055	1150	1635
Initials:	KR	KR	KR	KR	KR	KR	[illegible]	[illegible]	[illegible]	KR

* mt (RW 9196) Cl⁻ = 48 mg/L, measured 9/10/09
* measured 9/19/09, Cl⁻ = 48 mg/L

⊛ measured 9/23/09, meter #2
s/s preserved

① [illegible] 10/21/09 E
② [illegible] 10/23/09 E

Page 5 2930
10/23/09 ③
QA: AR 10/23/09

DAILY TESTING LOG C. dilutus* Chronic, Static Renewal Project No. 8503-134-058- (039, 041, 043, 045)

Day -1	added sediment + overlying water to test chambers + placed into bath			
Day 0	initiated drips @ 10:30 w/ MH + 50 mg/L CT RW9196		Feeding: @1530 1.5 ml Tetrafin ① ~~[illegible]~~ Slurry	Initials/Date: KB 9/11/09
Day 1	Bath CT = 22.2°C	Range = 22.0 - 22.4 °C	Feeding: @1200	Initials/Date: KB 9/12/09
Day 2	Bath CT = 22.0 °C	Range = 22.0 - 22.4 °C	Feeding: 1610	Initials/Date: KB 9/13/09
Day 3	Bath CT = 22.2°C	Range = 22.0-22.4°C	Feeding: 1100	Initials/Date: 9/14/09
Day 4	Bath CT = 22.4 °C	Range = 22.0 - 22.6 °C	Feeding: 1130	Initials/Date: KB 9/15/09
Day 5	Bath CT = 22.4 °C	Range = 22.4 - 22.6 °C	Feeding: 1640	Initials/Date: KB 9/16/09
Day 6	Bath CT = 22.4°C	Range = 22.4-22.6°C	Feeding: 1030	Initials/Date: 9/17/09
Day 7	Bath CT = 23.2°C	Range = 22.4 - 23.4°C	Feeding: 1125	Initials/Date: 9/18/09
Day 8	Bath CT = 23.4°C started using MH RW9209	Range = 23.0-23.4°C	Feeding: 1630	Initials/Date: AP 9/19/09
Day 9	Bath CT = 23.4°C	Range = 23.0-23.4°C	Feeding: 0915	Initials/Date: 9/20/09
Day 10	Bath CT = 23.4°C	Range = 23.0 - 23.4°C	Feeding: none	Initials/Date: 9/21/09

① 9/11/09 E ② KB 9/13/09 E ③ 10/27/09 E

Page 6 of ~~29~~ 30 (1)

CK 10/23/09

(039, 041, 043, 045)

8503-134-058 C. dilutus

CONC	REP	RANDOM	RANK	
Sand	A	0.75649	9	B1
	B	0.660855	14	B6
	C	0.545046	20	C4
	D	0.64729	15	B7
	E	0.512377	21	C5
	F	0.494322	23	C7
	G	0.161037	39	E7
	H	0.596004	18	C2
Form	A	0.086195	45	F5
	B	0.919422	4	A4
	C	0.227708	36	E4
	D	0.988936	1	A1
	E	0.685125	12	B4
	F	0.276621	31	D7
	G	0.33091	29	D5
	H	0.254864	34	E2
Johnson Creek	A	0.038739	47	F7
	B	0.436366	25	D1
	C	0.392207	27	D3
	D	0.454299	24	C8
	E	0.253734	35	E3
	F	0.680168	13	B5
	G	0.612296	17	C1
	H	0.111981	43	F3
Slate, Creek	A	0.205755	37	E5
	B	0.326385	30	D6
	C	0.98202	2	A2
	D	0.741643	10	B2
	E	0.093159	44	F4
	F	0.077073	46	F6
	G	0.013996	48	F8
	H	0.122422	41	F1
Lower Sherman	A	0.558142	19	C3
	B	0.622717	16	B8
	C	0.866457	6	A6
	D	0.274113	32	D8
	E	0.435762	26	D2
	F	0.88469	5	A5
	G	0.263685	33	E1
	H	0.144974	40	E8
Middle Sherman	A	0.823235	7	A7
	B	0.730756	11	B3
	C	0.115497	42	F2
	D	0.384348	28	D4
	E	0.769689	8	A8
	F	0.976237	3	A3
	G	0.496756	22	C6
	H	0.193631	38	E6

CK 10/27/09 E

DK 10/23/09 QA: AEC 10/23/09

SEDIMENT/SOIL PREPARATION

8503-134-058 (034, 041, 043, 045)

Artificial soil	
Constituent/source	**Amount added (g)**
Coarse Silica Sand	1242
Silt/Clay (ASP 400)	219
Dolomite	7.5
α-cellulose	77.3
Humic Acid	0.15
Total	1545.95

Notes: Container was placed into tumbler for a minimum of an hour to homogenize prior to use

Soil/sediment	FCETL#	Homogenization			
		Date	From	To	Analyst
Johnson Creek	23120	9/11/09	1447	1451	DK
Slate Creek	23119	9/11/09	1458	1501	KB
Lower Sherman	23118	9/11/09	1420	1424	DK
Middle Sherman	23121	9/11/09	1425	1428	KB

DK 10/27/09 E

FCETL QA Form No.131
Revision 0
Effective 10/06
10/23/09
QA: Arc 10/22/09

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

Project No: 08503-134-058-(039, 041, 043, 045)

TARE: Date/time: 10/15/09 @ 1100 Analyst: ES

DRY GROSS: Date/time: 10/16/09 @ 1320 Analyst: ES

ASHED GROSS: Date/time: 10/16/09 @ 1710 Analyst: ES

Analytical Balance ID: AND

Dried in Oven # 2 from Date: 10/15/09 Time: 1130
Oven °C: 100 to Date: 10/16/09 Time: 1145

Ashed in Furnace from Date: 10/16/09 Time: 1330
Furnace °C: 550 to Date: 10/16/09 Time: 1500

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)
32	LS	A	18.6270	29.5329	25.3816	61.935 3/20	25.0919	4.2989
33	LS	B	17.7959	28.5921	24.5351	62.4220	24.2636	4.0287
34	SC	A	18.4825	28.3790	23.9966		23.6535	
35	SC	B	18.7594	29.2008	24.6370		24.2199	
36	JC	A	18.2340	28.6805	25.0794		24.9268	
37	JC	B	17.6820	27.9185	24.4486		24.3067	
38	MS	A	17.6404	27.9463	25.1772		24.9424	
39	MS	B	17.8875	28.5570	25.7134		25.4922	
40 Blank	Blank		18.3834		18.3834		18.3833	

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

(1) 10/20/09E

(2) 10/27/09E

10/26/09
QA: MR 10/26/09

Percent Total Solids and Percent Total Volatile Solids

Project Number: 08503-134-058-(038-045)

Treatment	Rep		Tare Weight (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Treatment Mean % Total Solids (g)	Ashed Gross Weight (g) (dish + sample) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)	Treatment Mean % Total Volatile Solids (g)
Johnson Creek	A		18.2340	28.6805	25.0794	65.5282	65.8154	24.9268	2.2292	2.1631
	B		17.6820	27.9185	24.4486	66.1027		24.8066	2.0971	
Slate Creek	A		18.4825	28.3790	23.9966	55.7177	56.0045	23.6535	6.2222	6.6593
	B		18.7594	29.2608	24.6370	56.2913		24.2499	7.0964	
Lower Sherman	A		18.6270	29.5329	25.3816	61.9353	62.1786	25.0949	4.2889	4.1588
	B		17.7959	28.5926	24.5351	62.4220		24.2636	4.0287	
Middle Sherman	A		17.6404	27.9463	25.1772	73.1309	73.2396	24.9424	3.1154	2.9709
	B		17.8875	28.5570	25.7134	73.3483		25.4922	2.8265	
Blank			18.3834		18.3834			18.3833		

10/26/09

OK 10/23/09
QA: AR 10/23/09

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

Project No: 8503134-058 (039 041 043 045) TARE: Date/time: 9/22/09 @ 1110 Analyst: OK

Species: C dilutus
Lot/Batch No.: 09-032

DRY GROSS: Date/time: 9/23/09 @ 1315 Analyst: KB

Analytical Balance ID: Sart #1

ASHED GROSS: Date/time: 9/24/09 @ 1030 Analyst: KB

Dried in Oven # 3 from Date: 9/22/09 Time: 1225
Oven °C: 70 to Date: 9/23/09 Time: 1235

Ashed in Furnace from Date: 9/23/09 Time: 1430
Furnace °C: 600 to Date: 9/23/09 Time: 1700

Indicate mean weight is Dry Weight or AFDW (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	1.98760	2.00252	0.001492		1.98878		9			9*		
2		B	2.20272	2.21745	0.01473		2.20378		10			10		
3		C	1.88496	1.89786	0.01290		1.88596		10			10		
4		D	2.12214	2.13081	0.00867		2.12290		7■			6		
5		E	2.21524	2.22419	0.00895		2.21597		8▲			5		
6		F	2.14745	2.16302	0.01557		2.14844		10			10		
7		G	2.56433	2.57525	0.01092		2.56512 ②		10			8		
8		H	2.22210	2.23235	0.01025		2.22279 ②		7⊛			6		
9	Form	A	2.19550	2.21755	0.02205		2.20103 ②		10			9		
10		B	1.93441	1.96982	0.03541		1.94239		9①			9		
11		C	2.22970	2.25652	0.02682		2.23731		10			9		
12		D	2.23114 ②	2.25717	0.02602		2.23715		10			9		
Blank	A		2.20599	2.20595			2.20600							

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

① OK 9/22/09 E
② KB 9/24/09 WP
③ [illegible]

*partial body found - excluded from crucible/wt.
■ 1 exuvia + 2 pupae ⊛ 2 exuvia + 1 pupae
▲ 1 exuvia + 1 pupae ① 1 pupae

FCETL QA Form No.108
Revision 0
Effective 08/99
10/23/09
QA: 10/23/09

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

Project No: 85051234-059 (039, 043, 041, 045) TARE: Date/time: 9/22/09 @ 1110 Analyst:

Species: C. dilutus
Lot/Batch No.: 09-032

DRY GROSS: Date/time: 9/23/09 @ 1315 Analyst: KB

Analytical Balance ID: Sart #1

ASHED GROSS: Date/time: 9/24/09 @ 1030 Analyst: KB

Dried in Oven # 3 from Date: 9/22/09 Time: 1225
Oven °C: 70 to Date: 9/23/09 Time: 1235

Ashed in Furnace from Date: 9/23/09 Time: 1430
Furnace °C: 600 to Date: 9/23/09 Time: 1700

Indicate mean weight is **Dry Weight** or **AFDW** (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)
13	Form	E	2.17951	2.20576	0.02725		2.18555		10			10		
14		F	1.82574	1.85472	0.02898		1.83376		10			9		
15		G	1.78051	1.80706	0.02655		1.78089		9*			9		
16		H	1.94(3)993	1.96423	0.02430		1.94494		8**			7		
Blank	A													

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

① 9/22/09 E
② 10/6/09 mc

*1 pupae
**2 exuvia

10/23/09
QA: AZ 10/23/09

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

Project No: 850314-059 (039, 043, 044, 046) TARE: Date/time: 9/22/09 @1110 Analyst: KB

Species: C. dilutus
Lot/Batch No.: 09-032

DRY GROSS: Date/time: 9/23/09 @1315 Analyst: KB

Analytical Balance ID: Smrt #1

ASHED GROSS: Date/time: 9/24/09 @1430 Analyst: KB

Dried in Oven #3 from Date: 9/22/09 Time: 1225
Oven °C: 70 to Date: 9/23/09 Time: 1335

Ashed in Furnace from Date: 9/23/09 Time: 1430
Furnace °C: 550 to Date: 9/23/09 Time: 1700

Indicate mean weight is **Dry Weight** or **AFDW** (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	J.C.	A	2.29286	2.32244	0.02958		2.30780		10			10		
18		B	2.23686	2.25970	0.02284		2.24548		8*			8*		
19		C	2.11457	2.13462	0.02005		2.12057		9▲			9		
20		D	2.32392	2.34345	0.01953		2.33024		9■			7		
21		E	1.87365	1.89671	0.02306		1.88319		7⊗			7⊗		
22		F	1.82774	1.85031	0.02257		1.83687		9■			8		
23		G	2.07904	2.10375	0.02471		2.08872		10			9		
24		H	2.32523	2.34464	0.01941		2.33240		10			10		
25	S.C.	A	2.30199	2.32115	0.01916		2.30507		10			10		
26		B	2.27455	2.29277	0.01822		2.27818		10			9		
27		C	1.98079	1.99531	0.01452		1.98356		9■			6		
28		D	2.06902	2.08623	0.01721		2.07232		9▲			7		
Blank	B		1.99122	1.99123			1.99121							

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

J.C. = Johnson Creek
S.C. = State Creek

■ 1 pupae

* 1 organism NF + 1 exuvia
⊗ removed 1 partial organism, 2 exuvia
▲ 1 exuvia

FCETL QA Form No.108
Revision 0
Effective 08/99

10/23/09
QA. AR 10/23/09

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

Project No: 8503-134058 (039, 041, 043, 045) TARE: Date/time: 9/22/09 @ 1110 Analyst: [signature]

Species: C. dilutus
Lot/Batch No.: 09-032

DRY GROSS: Date/time: 9/23/09 @ 1215 Analyst: KB

Analytical Balance ID: Sart #1

ASHED GROSS: Date/time: 9/24/09 @ 1030 Analyst: KB

Dried in Oven # 3 from Date: 9/22/09 Time: 1225
Oven °C: 70 to Date: 9/23/09 Time: 1235

Ashed in Furnace from Date: 9/23/09 Time: 1430
Furnace °C: 550 to Date: 9/23/09 Time: 1700

Indicate mean weight is **Dry Weight** or **AFDW** (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)
29	S.C.	E	2.03749	2.04974	0.01225		2.04055		9*			8		
30		F	2.05888	2.06968	0.01080		2.06117		7▲			7		
31		G	2.23125	2.24919	0.01794		2.23402		10			10		
32		H	1.85407	1.87107	0.01700		1.85706		10			10		
33	L.S.	A	2.24484	2.26579	0.01945		2.25055		9*			9		
34		B	1.82235	1.83261	0.01026		1.82449		6▲▲			5		
35		C	2.08129	2.10345	0.02216		2.08404		10			9		
36		D	1.95060	1.96333	0.01273		1.95345		8■			5		
37		E	1.87732	1.89032	0.01300		1.88037		7⊛			5		
38		F	1.97776	1.99836	0.02060		1.98270		8⊙			7		
39		G	1.94707	1.96320	0.01613		1.95135		8**			5		
40		H	1.75878	1.77750	0.01872		1.76264		10			8		
Blank	B													

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

10/23/09 QAC

S.C. = Slate Creek
L.S. = Lower Sherman

▲▲ 2 pupae, 2 NF
* 1 pupae
▲ 1 exuvia, 2 pupae
■ 2 pupae
⊛ 1 pupae, 2 exuvia
⊙ 1 exuvia, 1 pupae
** 2 exuvia

[illegible] 10/23/09
QA: AR 10/23/09

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

Project No: 8503134.059 (039, 041, 043, 045)
TARE: Date/time: 9/22/09 @ 1110 Analyst: [illegible]
Species: C. dilutus
Lot/Batch No.: 09-032
DRY GROSS: Date/time: 9/23/09 @ 1315 Analyst: KB
Analytical Balance ID: Sart #4
ASHED GROSS: Date/time: 9/24/09 @ 1230 Analyst: KB

Dried in Oven #3 from Date: 9/22/09 Time: 1225
Oven °C: 70 to Date: 9/23/09 Time: 1235
Ashed in Furnace from Date: 9/23/09 Time: 1430
Furnace °C: 550 to Date: 9/23/09 Time: 1700

Indicate mean weight is Dry Weight or AFDW (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)
41	M.S.	A	2.26870	2.28645	0.01775		2.27302		7 ▲			7		
42		B	1.93574	1.95462 ~~0.01775~~	0.01888		1.94194		8 *			7		
43		C	2.21722	2.23086	0.01364		2.22112		8 ■			6		
44		D	2.24503	2.26657	0.02154		2.25181		10			9		
45		E	2.18229	2.20255	0.02026		2.18944		9 ⊛			7		
46		F	1.89551 ~~1.91367~~	1.91759	0.02208		1.90109		8 ■			8		
47		G	1.91367	1.92634	0.01267		1.91727		7 **			5		
48		H	1.87904	1.90080	0.02176		1.88673		8 *			8		
Blank	B													

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

M.S. = Middle Sherman

① [illegible] 9/22/09 E, WP
② KB 9/23/09 WP

* 1 pupae, 1 exuvia
■ 2 pupae
⊛ 1 pupae
▲ 1 pupae, 2 partial bodies
** 1 pupae, 2 exuvia

QA 10/23/09

QA: AR 10/23/09

Spreadsheet for AFDW

Test Start Date:	9/11/2009			Test End Date:	9/21/2009
Test Number(s):	8503-134-058-(039-041-043-045)			Test Material:	Sediment
Species:	*C. dilutus*			Entered by:	KT

Boat #	Treatment	Rep	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry net wt (g)	Dry adjusted wet wt (g)	Ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	Number original organisms	Mean wt per org (mg)	Mean wt per treatment (corr) (mg)	Number surviving	Mean wt per surviving	Mean wt per treatment (surv) (mg)
1	Sand cont	A	[illegible]	[illegible]	0.01492	0.01496	[illegible]	0.01374	0.01374	[illegible]	1.5267	1.2597	[illegible]	1.5267	1.4204
2	Sand cont	B	[illegible]	[illegible]	0.01473	0.01477	[illegible]	0.01367	0.01367	[illegible]	1.3670		[illegible]	1.3670	
3	Sand cont	C	[illegible]	[illegible]	0.01290	0.01294	[illegible]	0.01190	0.01190	[illegible]	1.1900		[illegible]	1.1900	
4	Sand cont	D	[illegible]	[illegible]	0.00867	0.00871	[illegible]	0.00791	0.00791	[illegible]	1.1300		[illegible]	1.3183	
5	Sand cont	E	[illegible]	[illegible]	0.00895	0.00899	[illegible]	0.00822	0.00822	[illegible]	1.0275		[illegible]	1.6440	
6	Sand cont	F	[illegible]	[illegible]	0.01557	0.01561	[illegible]	0.01458	0.01458	[illegible]	1.4580		[illegible]	1.4580	
7	Sand cont	G	[illegible]	[illegible]	0.01092	0.01096	[illegible]	0.01013	0.01013	[illegible]	1.0130		[illegible]	1.2663	
8	Sand cont	H	[illegible]	[illegible]	0.01025	0.01029	[illegible]	0.00956	0.00956	[illegible]	1.3657		[illegible]	1.5933	
9	Form sed	A	[illegible]	[illegible]	0.02205	0.02209	[illegible]	0.01652	0.01652	[illegible]	1.6520	2.1998	[illegible]	1.8356	2.3508
10	Form sed	B	[illegible]	[illegible]	0.03541	0.03545	[illegible]	0.02743	0.02743	[illegible]	3.0478		[illegible]	3.0478	
11	Form sed	C	[illegible]	[illegible]	0.02682	0.02686	[illegible]	0.01921	0.01921	[illegible]	1.9210		[illegible]	2.1344	
12	Form sed	D	[illegible]	[illegible]	0.02602	0.02606	[illegible]	0.02002	0.02002	[illegible]	2.0020		[illegible]	2.2244	
13	Form sed	E	[illegible]	[illegible]	0.02725	0.02729	[illegible]	0.02121	0.02121	[illegible]	2.1210		[illegible]	2.1210	
14	Form sed	F	[illegible]	[illegible]	0.02898	0.02902	[illegible]	0.02202	0.02202	[illegible]	2.2020		[illegible]	2.4467	
15	Form sed	G	[illegible]	[illegible]	0.02655	0.02659	[illegible]	0.02017	0.02017	[illegible]	2.2411		[illegible]	2.2411	
16	Form sed	H	[illegible]	[illegible]	0.02430	0.02434	[illegible]	0.01929	0.01929	[illegible]	2.4113		[illegible]	2.7557	
Blank	A		[illegible]	[illegible]	-4E-05		[illegible]	0.00005							

QA 10/26/09

DK 10/23/09

QA: AKE 10/23/09

Spreadsheet for AFDW

Test Start Date:	9/11/2009			Test End Date:	9/21/2009
Test Number(s):	8503-134-058-(039-041-043-045)			Test Material:	Sediment
Species:	*C. dilutus*			Entered by:	KT

Boat#	Treatment	Rep	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry pan wt (g)	Dry adjusted net wt (g)	Ashed gross wt (g)	AFDW (g)	Adjusted AFDW (g)	Number of original organisms	Mean wt per organism (mg)	Mean wt per treatment (mg)	Number surviving	Mean wt per surviving	Mean wt per treatment (mg)
17	Johnson Creek	A	[illegible]	[illegible]	0.02958	0.02958	[illegible]	0.01464	0.01464	[illegible]	1.4640	1.5496	[illegible]	1.4640	1.6463
18	Johnson Creek	B	[illegible]	[illegible]	0.02284	0.02284	[illegible]	0.01402	0.01402	[illegible]	1.7525	-	[illegible]	1.7525	-
19	Johnson Creek	C	[illegible]	[illegible]	0.02005	0.02005	[illegible]	0.01405	0.01405	[illegible]	1.5611	-	[illegible]	1.5611	-
20	Johnson Creek	D	[illegible]	[illegible]	0.01953	0.01953	[illegible]	0.01321	0.01321	[illegible]	1.4678	-	[illegible]	1.8871	-
21	Johnson Creek	E	[illegible]	[illegible]	0.02306	0.02306	[illegible]	0.01352	0.01352	[illegible]	1.9314	-	[illegible]	1.9314	-
22	Johnson Creek	F	[illegible]	[illegible]	0.02257	0.02257	[illegible]	0.01344	0.01344	[illegible]	1.4933	-	[illegible]	1.6800	-
23	Johnson Creek	G	[illegible]	[illegible]	0.02471	0.02471	[illegible]	0.01503	0.01503	[illegible]	1.5030	-	[illegible]	1.6700	-
24	Johnson Creek	H	[illegible]	[illegible]	0.01941	0.01941	[illegible]	0.01224	0.01224	[illegible]	1.2240		[illegible]	1.2240	
25	Slate Creek	A	[illegible]	[illegible]	0.01926	0.01926	[illegible]	0.01608	0.01608	[illegible]	1.6080	1.3729	[illegible]	1.6080	1.5459
26	Slate Creek	B	[illegible]	[illegible]	0.01822	0.01822	[illegible]	0.01459	0.01459	[illegible]	1.4590	-	[illegible]	1.6211	
27	Slate Creek	C	[illegible]	[illegible]	0.01452	0.01452	[illegible]	0.01175	0.01175	[illegible]	1.3056		[illegible]	1.9583	
28	Slate Creek	D	[illegible]	[illegible]	0.01721	0.01721	[illegible]	0.01391	0.01391	[illegible]	1.5456		[illegible]	1.9871	
29	Slate Creek	E	[illegible]	[illegible]	0.01225	0.01225	[illegible]	0.00919	0.00919	[illegible]	1.0211		[illegible]	1.1487	
30	Slate Creek	F	[illegible]	[illegible]	0.01080	0.01080	[illegible]	0.00851	0.00851	[illegible]	1.2157		[illegible]	1.2157	
31	Slate Creek	G	[illegible]	[illegible]	0.01794	0.01794	[illegible]	0.01427	0.01427	[illegible]	1.4270		[illegible]	1.4270	
32	Slate Creek	H	[illegible]	[illegible]	0.01700	0.01700	[illegible]	0.01401	0.01401	[illegible]	1.4010		[illegible]	1.4010	
33	Lower Sherman	A	[illegible]	[illegible]	0.01945	0.01945	[illegible]	0.01524	0.01524	[illegible]	1.6933	1.5461	[illegible]	1.6933	1.9603
34	Lower Sherman	B	[illegible]	[illegible]	0.01026	0.01026	[illegible]	0.00812	0.00812	[illegible]	1.3533		[illegible]	1.6240	
35	Lower Sherman	C	[illegible]	[illegible]	0.02216	0.02216	[illegible]	0.01741	0.01741	[illegible]	1.7410		[illegible]	1.9344	
36	Lower Sherman	D	[illegible]	[illegible]	0.01273	0.01273	[illegible]	0.00988	0.00988	[illegible]	1.2350		[illegible]	1.9760	
37	Lower Sherman	E	[illegible]	[illegible]	0.01300	0.01300	[illegible]	0.00995	0.00995	[illegible]	1.4214		[illegible]	1.9900	
38	Lower Sherman	F	[illegible]	[illegible]	0.02060	0.02060	[illegible]	0.01566	0.01566	[illegible]	1.9575		[illegible]	2.2371	
39	Lower Sherman	G	[illegible]	[illegible]	0.01613	0.01613	[illegible]	0.01185	0.01185	[illegible]	1.4813		[illegible]	2.3700	
40	Lower Sherman	H	[illegible]	[illegible]	0.01872	0.01872	[illegible]	0.01486	0.01486	[illegible]	1.4860		[illegible]	1.8575	
41	Middle Sherman	A	[illegible]	[illegible]	0.01775	0.01775	[illegible]	0.01343	0.01343	[illegible]	1.9186	1.5963	[illegible]	1.9186	1.8127
42	Middle Sherman	B	[illegible]	[illegible]	0.01888	0.01888	[illegible]	0.01268	0.01268	[illegible]	1.5850		[illegible]	1.8114	
43	Middle Sherman	C	[illegible]	[illegible]	0.01364	0.01364	[illegible]	0.00974	0.00974	[illegible]	1.2175		[illegible]	1.6233	
44	Middle Sherman	D	[illegible]	[illegible]	0.02154	0.02154	[illegible]	0.01476	0.01476	[illegible]	1.4760		[illegible]	1.6400	
45	Middle Sherman	E	[illegible]	[illegible]	0.02026	0.02026	[illegible]	0.01311	0.01311	[illegible]	1.4567		[illegible]	1.8729	
46	Middle Sherman	F	[illegible]	[illegible]	0.02208	0.02208	[illegible]	0.01650	0.01650	[illegible]	2.0625	-	[illegible]	2.0625	-
47	Middle Sherman	G	[illegible]	[illegible]	0.01267	0.01267	[illegible]	0.00907	0.00907	[illegible]	1.2957	-	[illegible]	1.8140	-
48	Middle Sherman	H	[illegible]	[illegible]	0.02176	0.02176	[illegible]	0.01407	0.01407	[illegible]	1.7588		[illegible]	1.7588	
Blank	B		[illegible]	[illegible]	1E-05		[illegible]	0.00003							

DK 10/23/09 E

10/16/09

QA: AR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Summary of Survival

File: 058cs.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand	8	0.7000	1.0000	0.9125
2	Form Sed	8	0.9000	1.0000	0.9375
3	Johnson Creek	8	0.8000	1.0000	0.9500
4	Slate Creek	8	0.7000	1.0000	0.9125
5	Lower Sherman	8	0.7000	1.0000	0.8375
6	Middle Sherman	8	0.8000	1.0000	0.9000

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand	0.0127	0.1126	0.0398	12.3396
2	Form Sed	0.0027	0.0518	0.0183	5.5205
3	Johnson Creek	0.0057	0.0756	0.0267	7.9571
4	Slate Creek	0.0127	0.1126	0.0398	12.3396
5	Lower Sherman	0.0112	0.1061	0.0375	12.6646
6	Middle Sherman	0.0086	0.0926	0.0327	10.2869

Comparing Controls (sand and formulated) for Significant Difference

File: 058cs.dat Transform: ARC SINE(SQUARE ROOT(Y))
t-Test of Solvent and Blank Controls Ho: GRP1 Mean = GRP2 Mean

SAND FORM.

GRP1 (Solvent cntl) Mean = 1.2806 Calculated t value = -0.4572
GRP2 (Blank cntl) Mean = 1.3102 Degrees of freedom = 14
Difference in means = -0.0296

2-sided t value (0.05,14) = 2.1448 No 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!

No significant difference, therefore, controls were pooled for survival

10/21/09 ME

10/15/09
AA: AR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference for Survival Compared to the Pooled Control

File: 058cs.dat Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 0.8083
W = 0.9279

Critical W = 0.9290 (alpha = 0.01 , N = 48)
W = 0.9470 (alpha = 0.05 , N = 48)

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.

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 0.9844 (p-value = 0.9122)

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)

Using Average Degrees of Freedom
(Based on average replicate size of 9.60)

Calculated B2 statistic = 0.9861 (p-value = 0.9119)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

10/27/09

DS 10/15/09
QA: AR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference for Survival Compared to the Pooled Control

File: 058cs.dat Transform: ARC SINE(SQUARE ROOT(Y))

Wilcoxon's Rank Sum Test w/ Bonferroni Adjustment Ho: Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	REPS	SIG 0.05
1	GRPS 1&2 POOLED	1.2954				
2	Johnson Creek	1.3332	111.00	62	8	
3	Slate Creek	1.2806	99.00	62	8	
4	Lower Sherman	1.1695	69.00	62	8	
5	Middle Sherman	1.2569	89.00	62	8	

Critical values are 1 tailed (k = 4)

DS 10/27/09 QF

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10-day Sediment Test, Chironomus dilutes
List Data for AFDW, per original organism

File: 058cwo.dat Transform: NO TRANSFORMATION
Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand	1	1.5267	1.5267
1	Sand	2	1.3670	1.3670
1	Sand	3	1.1900	1.1900
1	Sand	4	1.1300	1.1300
1	Sand	5	1.0275	1.0275
1	Sand	6	1.4580	1.4580
1	Sand	7	1.0130	1.0130
1	Sand	8	1.3657	1.3657
2	Form Sed	1	1.6520	1.6520
2	Form Sed	2	3.0478	3.0478
2	Form Sed	3	1.9210	1.9210
2	Form Sed	4	2.0020	2.0020
2	Form Sed	5	2.1210	2.1210
2	Form Sed	6	2.2020	2.2020
2	Form Sed	7	2.2411	2.2411
2	Form Sed	8	2.4113	2.4113
3	Johnson Creek	1	1.4640	1.4640
3	Johnson Creek	2	1.7525	1.7525
3	Johnson Creek	3	1.5611	1.5611
3	Johnson Creek	4	1.4678	1.4678
3	Johnson Creek	5	1.9314	1.9314
3	Johnson Creek	6	1.4933	1.4933
3	Johnson Creek	7	1.5030	1.5030
3	Johnson Creek	8	1.2240	1.2240
4	Slate Creek	1	1.6080	1.6080
4	Slate Creek	2	1.4590	1.4590
4	Slate Creek	3	1.3056	1.3056
4	Slate Creek	4	1.5456	1.5456
4	Slate Creek	5	1.0211	1.0211
4	Slate Creek	6	1.2157	1.2157
4	Slate Creek	7	1.4270	1.4270
4	Slate Creek	8	1.4010	1.4010
5	Lower Sherman	1	1.6933	1.6933
5	Lower Sherman	2	1.3533	1.3533
5	Lower Sherman	3	1.7410	1.7410
5	Lower Sherman	4	1.2350	1.2350
5	Lower Sherman	5	1.4214	1.4214
5	Lower Sherman	6	1.9575	1.9575
5	Lower Sherman	7	1.4813	1.4813
5	Lower Sherman	8	1.4860	1.4860
6	Middle Sherman	1	1.9186	1.9186
6	Middle Sherman	2	1.5850	1.5850
6	Middle Sherman	3	1.2175	1.2175

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10-day Sediment Test, Chironomus dilutes
List Data for AFDW, per original organism

6	Middle Sherman	4	1.4760	1.4760
6	Middle Sherman	5	1.4567	1.4567
6	Middle Sherman	6	2.0625	2.0625
6	Middle Sherman	7	1.2957	1.2957
6	Middle Sherman	8	1.7588	1.7588

Page 22 of 30 ~~29~~ ①
CK 10/20/09
QA: HR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Summary of AFDW, per original organism

File: 058cwo.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand	8	1.0130	1.5267	1.2597
2	Form Sed	8	1.6520	3.0478	2.1998
3	Johnson Creek	8	1.2240	1.9314	1.5496
4	Slate Creek	8	1.0211	1.6080	1.3729
5	Lower Sherman	8	1.2350	1.9575	1.5461
6	Middle Sherman	8	1.2175	2.0625	1.5964

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand	0.0385	0.1963	0.0694	15.5850
2	Form Sed	0.1698	0.4121	0.1457	18.7330
3	Johnson Creek	0.0446	0.2113	0.0747	13.6336
4	Slate Creek	0.0356	0.1887	0.0667	13.7443
5	Lower Sherman	0.0552	0.2349	0.0830	15.1926
6	Middle Sherman	0.0879	0.2965	0.1048	18.5763

Comparing Controls (sand and formulated)for Significant Difference

File: 058cwo.dat Transform: NO TRANSFORMATION t-
Test of Solvent and Blank Controls Ho: GRP1 Mean = GRP2 Mean
==========GR
P1 (Solvent cntl) Mean = 1.2597 Calculated t value = -5.8248 GRP2
(Blank cntl) Mean = 2.1998 Degrees of freedom = 14 Difference in
means = -0.9400
==========2-
sided t value (0.05,14) = 2.1448** Significant difference at alpha=0.05 2-
sided t value (0.01,14) = 2.9768** Significant difference at alpha=0.10
WARNING: This procedure assumes normality and equal variances!

There was a significant difference; therefore, all statistical analyses for AFDW, per original organism were compared to the formulated sediment control.

CK 10/27/09 E

CK 10/20/09
QA: AR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference in AFDW, per original organism

File: 058cwo.dat Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 2.7522
W = 0.9683

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 = 5.5035 (p-value = 0.2394)

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)

DK 10/27/09 E

08/10/2009
QA: mc 10/23/08

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference in AFDW, per original organism

File: 058cwo.dat Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	4	3.2220	0.8055	10.2439
Within (Error)	35	2.7522	0.0786	
Total	39	5.9742		

(p-value = 0.0000)

Critical F = 3.9082 (alpha = 0.01, df = 4,35)
= 2.6415 (alpha = 0.05, df = 4,35)
Since F > Critical F 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	Form Sed	2.1998	2.1998		
2	Johnson Creek	1.5496	1.5496	4.6370	*
3	Slate Creek	1.3729	1.3729	5.8977	*
4	Lower Sherman	1.5461	1.5461	4.6622	*
5	Middle Sherman	1.5964	1.5964	4.3038	*

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	Form Sed	8			
2	Johnson Creek	8	0.3155	14.3	0.6501
3	Slate Creek	8	0.3155	14.3	0.8269
4	Lower Sherman	8	0.3155	14.3	0.6537
5	Middle Sherman	8	0.3155	14.3	0.6034

08/10/2009

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
List Data for AFDW, per surviving organism

File: 058cws.dat Transform: NO TRANSFORMATION
Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand	1	1.5267	1.5267
1	Sand	2	1.3670	1.3670
1	Sand	3	1.1900	1.1900
1	Sand	4	1.3183	1.3183
1	Sand	5	1.6440	1.6440
1	Sand	6	1.4580	1.4580
1	Sand	7	1.2663	1.2663
1	Sand	8	1.5933	1.5933
2	Form Sed	1	1.8356	1.8356
2	Form Sed	2	3.0478	3.0478
2	Form Sed	3	2.1344	2.1344
2	Form Sed	4	2.2244	2.2244
2	Form Sed	5	2.1210	2.1210
2	Form Sed	6	2.4467	2.4467
2	Form Sed	7	2.2411	2.2411
2	Form Sed	8	2.7557	2.7557
3	Johnson Creek	1	1.4640	1.4640
3	Johnson Creek	2	1.7525	1.7525
3	Johnson Creek	3	1.5611	1.5611
3	Johnson Creek	4	1.8871	1.8871
3	Johnson Creek	5	1.9314	1.9314
3	Johnson Creek	6	1.6800	1.6800
3	Johnson Creek	7	1.6700	1.6700
3	Johnson Creek	8	1.2240	1.2240
4	Slate Creek	1	1.6080	1.6080
4	Slate Creek	2	1.6211	1.6211
4	Slate Creek	3	1.9583	1.9583
4	Slate Creek	4	1.9871	1.9871
4	Slate Creek	5	1.1487	1.1487
4	Slate Creek	6	1.2157	1.2157
4	Slate Creek	7	1.4270	1.4270
4	Slate Creek	8	1.4010	1.4010
5	Lower Sherman	1	1.6933	1.6933
5	Lower Sherman	2	1.6240	1.6240
5	Lower Sherman	3	1.9344	1.9344
5	Lower Sherman	4	1.9760	1.9760
5	Lower Sherman	5	1.9900	1.9900
5	Lower Sherman	6	2.2371	2.2371
5	Lower Sherman	7	2.3700	2.3700
5	Lower Sherman	8	1.8575	1.8575
6	Middle Sherman	1	1.9186	1.9186

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
List Data for AFDW, per surviving organism

6	Middle Sherman	2	1.8114	1.8114
6	Middle Sherman	3	1.6233	1.6233
6	Middle Sherman	4	1.6400	1.6400
6	Middle Sherman	5	1.8729	1.8729
6	Middle Sherman	6	2.0625	2.0625
6	Middle Sherman	7	1.8140	1.8140
6	Middle Sherman	8	1.7588	1.7588

D 8/10/20/09
QA: ME 10/23/09

D 8/10/27/09E

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Summary of AFDW, per surviving organism

File: 058cws.dat Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand	8	1.1900	1.6440	1.4205
2	Form Sed	8	1.8356	3.0478	2.3508
3	Johnson Creek	8	1.2240	1.9314	1.6463
4	Slate Creek	8	1.1487	1.9871	1.5459
5	Lower Sherman	8	1.6240	2.3700	1.9603
6	Middle Sherman	8	1.6233	2.0625	1.8127

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand	0.0261	0.1616	0.0571	11.3739
2	Form Sed	0.1503	0.3877	0.1371	16.4908
3	Johnson Creek	0.0530	0.2302	0.0814	13.9856
4	Slate Creek	0.0966	0.3108	0.1099	20.1053
5	Lower Sherman	0.0630	0.2511	0.0888	12.8074
6	Middle Sherman	0.0208	0.1443	0.0510	7.9630

Comparing Controls (sand and formulated) for Significant Difference

File: 058cws.dat Transform: NO TRANSFORMATION t-Test of Solvent and Blank Controls Ho: GRP1 Mean = GRP2 Mean

GRP1 (Solvent cntl) Mean = 1.4205 Calculated t value = -6.2657 GRP2 (Blank cntl) Mean = 2.3508 Degrees of freedom = 14 Difference in means = -0.9304

2-sided t value (0.05,14) = 2.1448** Significant difference at alpha=0.05 2-sided t value (0.01,14) = 2.9768** Significant difference at alpha=0.10 WARNING: This procedure assumes normality and equal variances!

There was a significant difference; therefore, all statistical analyses for AFDW, per surviving organism were compared to the formulated sediment control.

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EK 10/20/09
QA: AVC 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference in AFDW, per surviving organism

File: 058cws.dat Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 2.6863
W = 0.9775

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 = 6.4168 (p-value = 0.1701)

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)

DK 10/27/09

Page 29 of 29 50 ①
CJ 10/20/09
AA: AR 10/23/09

Toxstat version 3.5
Study #8503-134-058-(039, 041, 043, 045)
Coeur 10- day Sediment Test, Chironomus dilutus
Determination of Statistical Difference in AFDW, per surviving organism

File: 058cws.dat Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	4	3.1803	0.7951	10.3588
Within (Error)	35	2.6863	0.0768	
Total	39	5.8666		

(p-value = 0.0000)

Critical F = 3.9082 (alpha = 0.01, df = 4,35)
= 2.6415 (alpha = 0.05, df = 4,35)
Since F > Critical F 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	Form Sed	2.3508	2.3508		
2	Johnson Creek	1.6463	1.6463	5.0864	*
3	Slate Creek	1.5459	1.5459	5.8112	*
4	Lower Sherman	1.9603	1.9603	2.8194	*
5	Middle Sherman	1.8127	1.8127	3.8850	*

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	Form Sed	8			
2	Johnson Creek	8	0.3117	13.3	0.7046
3	Slate Creek	8	0.3117	13.3	0.8050
4	Lower Sherman	8	0.3117	13.3	0.3906
5	Middle Sherman	8	0.3117	13.3	0.5382

DJ 10/27/09 E

[illegible] 10/27/09
QA: AC 10/28/09

Length/Width of Objects Using a Micrometer

Project/Study Number: 8503-134-058 (039 041 043, 045)	Project Name: Coeur
Study Initiation Date: 9/11/09	Species: C. dilutus
Source of Organisms: ABS	Organism Batch/Lot #: 09-032
Collected by: [illegible]	Date Collected: 9/11/09
Analyzed by: FS	Date Analyzed: 10/26/09

Specimen Number	Magnif.	# of Squares	Length of One Square (mm)	Total (mm)	Remarks
1	40X	2.8	0.175	0.49	
2		2.4		0.42	
3		2.8		0.49	
4		2.8		0.49	
5		2.9		0.51	
6		2.4		0.42	
7		2.7		0.47	
8		2.7		0.47	
9		2.5		0.44	
10		2.1		0.37	
11		2.9		0.51	
12		2.8		0.49	
13		2.4		0.42	
14		2.8		0.49	
15		2.8		0.49	
16		2.4		0.42	
17		2.7		0.47	
18		2.4		0.42	
19		2.8		0.49	
20		2.8		0.49	
Total				9.26	
Mean				0.46	

3rd instar = 0.33 to 0.45mm

APPENDIX C

Analytical Data

MSE Lab Services

Date: *12-Oct-09*

CLIENT: ENSR International
Lab Order: 0909111
Project: Sediment Analysis
Lab ID: 0909111-005

Client Sample ID: 23120/JOHNSON
Collection Date: 8/23/2009 12:00:00 PM
Matrix: SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**E200.2**			**Analyst: ja**
Aluminum	13000	11.1	13.3		mg/Kg-dry	1	10/6/2009
Chromium	33.2	5.60	6.90		mg/Kg-dry	1	10/6/2009
Nickel	48.4	6.16	7.37		mg/Kg-dry	1	10/6/2009
Zinc	93.5	2.16	2.95		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**E200.2**			**Analyst: SW**
Arsenic	8.81	0.128	0.442		mg/Kg-dry	2	9/30/2009
Cadmium	0.240	0.008	0.029		mg/Kg-dry	2	9/30/2009
Copper	66.6	0.121	0.369		mg/Kg-dry	2	9/30/2009
Lead	7.64	0.013	0.059		mg/Kg-dry	2	9/30/2009
Selenium	0.405	0.200	0.590	J	mg/Kg-dry	2	9/30/2009
Silver	0.369	0.109	0.295		mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**			**Analyst: YF**
Mercury	0.0540	0.00606	0.0362	H	mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK		**OM_WALKLEYBLACK**					**Analyst: yf/dk**
Organic Matter - Walkley Black	2.02	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL		**ASTMD422**					**Analyst: bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**					**Analyst: BO**
% Clay	9.0	0.1	0.1		%	1	9/28/2009
% Sand	50.0	0.1	0.1		%	1	9/28/2009
% Silt	41.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAM					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23124/JOHNSON
Lab Order:	0909111	**Collection Date:**	8/23/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-006	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS		AVS-SEM					Analyst: kgw
Sulfide	ND	1.08	3.00		µmoles/g	1	9/24/2009

Review

Qualifiers:		
	E	Value above quantitation range
	J	Analyte detected below the Reporting Limit
	MDL	Method Detection Limit
	R	Holding times for preparation or analysis exceeded
	Limit	Instrument Reporting Limit
	ND	Not Detected at the Method Detection Limit (MDL)

MSE Lab Services

Date: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23119/SLATE
Lab Order:	0909111	**Collection Date:**	8/31/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-007	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		**SW6010B**		**E200.2**			Analyst: **js**
Aluminum	10400	13.0	16.6		mg/Kg-dry	1	10/6/2009
Chromium	17.5	6.60	6.95		mg/Kg-dry	1	10/6/2009
Nickel	27.4	7.26	8.69		mg/Kg-dry	1	10/6/2009
Zinc	155	2.55	3.47		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES		**SW6020**		**E200.2**			Analyst: **SW**
Arsenic	22.8	0.151	0.521		mg/Kg-dry	2	9/30/2009
Cadmium	0.717	0.009	0.035		mg/Kg-dry	2	9/30/2009
Copper	44.3	0.143	0.434		mg/Kg-dry	2	9/30/2009
Lead	13.4	0.016	0.069		mg/Kg-dry	2	9/30/2009
Selenium	1.24	0.236	0.695		mg/Kg-dry	2	9/30/2009
Silver	0.180	0.128	0.347	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B		**E245.5**		**SW7471A**			Analyst: **YF**
Mercury	0.0822	0.00936	0.0443	H	mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK		**OM_WALKLEYBLACK**					Analyst: **yf/dk**
Organic Matter - Walkley Black	6.58	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL		**ASTMD422**					Analyst: **bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		**MSA15-5**					Analyst: **BO**
% Clay	8.0	0.1	0.1		%	1	9/28/2009
% Sand	82.0	0.1	0.1		%	1	9/28/2009
% Silt	10.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23123/SLATE
Lab Order:	0909111	**Collection Date:**	8/31/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-008	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS		AVS-SEM					Analyst: kgw
Sulfide	ND	1.08	3.00		µmoles/g	1	9/24/2009

Review

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

MSE Lab Services

Date: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23118/LOW
Lab Order:	0909111	**Collection Date:**	9/1/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-003	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS			**SW6010B**	**E200.2**			**Analyst: js**
Aluminum	14600	12.1	14.5		mg/Kg-dry	1	10/6/2009
Chromium	42.1	6.15	6.48		mg/Kg-dry	1	10/6/2009
Nickel	33.8	6.76	8.10		mg/Kg-dry	1	10/6/2009
Zinc	128	2.38	3.24		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES			**SW6020**	**E200.2**			**Analyst: SW**
Arsenic	46.4	0.141	0.486		mg/Kg-dry	2	9/30/2009
Cadmium	0.486	0.009	0.032		mg/Kg-dry	2	9/30/2009
Copper	105	0.133	0.405		mg/Kg-dry	2	9/30/2009
Lead	12.6	0.015	0.065		mg/Kg-dry	2	9/30/2009
Selenium	1.80	0.220	0.648		mg/Kg-dry	2	9/30/2009
Silver	0.319	0.119	0.324	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B			**E245.5**	**SW7471A**			**Analyst: YF**
Mercury	0.0766	0.00900	0.0426		mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK			**OM_WALKLEYBLACK**				**Analyst: yf/dk**
Organic Matter - Walkley Black	5.05	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL			**ASTMD422**				**Analyst: bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5			**MSA15-5**				**Analyst: BO**
% Clay	8.0	0.1	0.1		%	1	9/28/2009
% Sand	79.0	0.1	0.1		%	1	9/28/2009
% Silt	13.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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: 12-Oct-09

CLIENT:	ENSR International	**Client Sample ID:**	23122/LOW
Lab Order:	0909111	**Collection Date:**	9/1/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-004	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS		AVS-SEM					Analyst: kgw
Sulfide	1.37	1.08	3.00	J	µmoles/g	1	9/24/2009

Review

Qualifiers:	E	Value above quantitation range		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: *12-Oct-09*

CLIENT: ENSR International
Lab Order: 0909111
Project: Sediment Analysis
Lab ID: 0909111-001

Client Sample ID: 23121/MID
Collection Date: 9/2/2009 11:00:00 AM
Matrix: SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS			**SW6010B**	**E200.2**			Analyst: **js**
Aluminum	10500	10.7	12.8		mg/Kg-dry	1	10/6/2009
Chromium	23.3	5.42	5.70		mg/Kg-dry	1	10/6/2009
Nickel	21.8	5.95	7.13		mg/Kg-dry	1	10/6/2009
Zinc	101	2.09	2.85		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES			**SW6020**	**E200.2**			Analyst: **SW**
Arsenic	29.4	0.124	0.428		mg/Kg-dry	2	9/30/2009
Cadmium	0.283	0.007	0.029		mg/Kg-dry	2	9/30/2009
Copper	66.1	0.117	0.366		mg/Kg-dry	2	9/30/2009
Lead	7.88	0.013	0.057		mg/Kg-dry	2	9/30/2009
Selenium	1.09	0.194	0.570		mg/Kg-dry	2	9/30/2009
Silver	0.252	0.105	0.285	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B			**E246.5**	**SW7471A**			Analyst: **YF**
Mercury	0.0579	0.00796	0.0377		mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK			**OM_WALKLEYBLACK**				Analyst: **yf/dk**
Organic Matter - Walkley Black	2.53	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL			**ASTMD422**				Analyst: **bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5			**MSA15-5**				Analyst: **BO**
% Clay	4.0	0.1	0.1		%	1	9/28/2009
% Sand	80.0	0.1	0.1		%	1	9/28/2009
% Silt	16.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23126/MID
Lab Order:	0909111	**Collection Date:**	9/2/2009 11:00:00 AM
Project:	Sediment Analysis		
Lab ID:	0909111-002	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS		AVS-SEM					Analyst: kgw
Sulfide	1.19	1.08	3.00	J	µmoles/g	1	9/24/2009

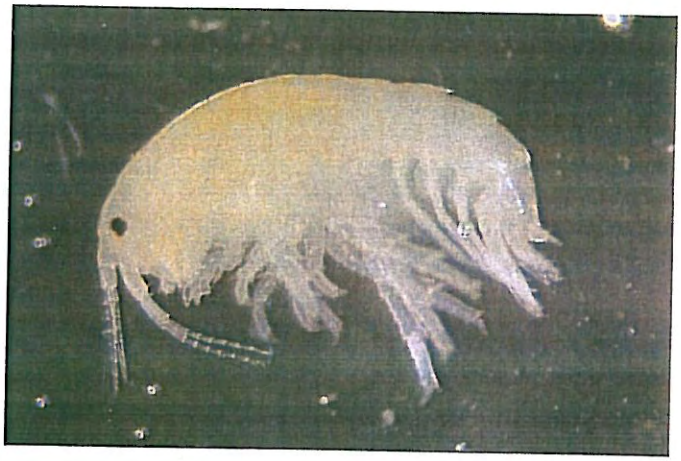
Review

Qualifiers:				
	E	Value above quantitation range	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)

APPENDIX 1B: TOXICITY LAB REPORT FOR *Hyalella azteca*

Coeur Alaska, Inc.
Juneau, Alaska

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



Prepared by

AECOM

AECOM Environment
Environmental Toxicology
Fort Collins, CO

08503-134-058-(038, 040, 042, 044)
September 2009

AECOM

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

Project IDs: 08503-134-058-(038, 040, 042, 044)
September 2009

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	AECOM Environment 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 (2006)	
Test Protocol	HA3AK.TIE058.007	
Test Period	Sept. 15, 2009 @ 1500 to Sept. 25, 2009 @ 1330	
Test Length	10 days	
Species	*Hyalella azteca*	
Test Material	Whole sediment	
Sediment ID	Sample ID	AECOM Laboratory ID
	Johnson Creek	23120
	Slate Creek	23119
	Lower Sherman	23118
	Middle Sherman	23121
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	

- *Results described in this report apply only to the samples submitted to the laboratory and analyzed, as listed in the report*
- *Test results comply with NELAC standards. Reports are intended to be considered in their entirety; AECOM is not responsible for consequences arising from use of a partial report*
- *This report contains 7 pages plus 3 appendices*

Sediment Collection and Receipt

Sample ID	Collection Date and Time	AECOM No.	Date of Receipt	Temp. at Arrival (°C)[a]
Johnson Creek	08/23/09 @ 1200	23120	09/03/09	11.6
Slate Creek	08/31/09 @ 1200	23119	09/03/09	10.1
Lower Sherman	09/01/09 @ 1200	23118	09/03/09	10.1
Middle Sherman	09/02/09 @ 1100	23121	09/03/09	11.6

[a] Air temperature of cooler
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
Johnson Creek	September 14, 2009	1402 – 1406
Slate Creek		1451 – 1455
Lower Sherman		1414 – 11418
Middle Sherman		1515 - 1518

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
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

Test Organism

Species and Lot Number	*Hyalella azteca*, FCETL Lot 09-033
Age	7 – 9 days
Source	Aquatic BioSystems (ABS), Fort Collins, CO
Overlying Water	Moderately Hard Reconstituted Water with added chloride (48 mg/L) as NaCl, RW # 9196
Reference Toxicant Testing	Initiated September 15, 2009 using sodium chloride (NaCl)

TEST RESULTS

Biological Data – Survival and Dry Weight

Sample ID	Percent Survival[a]	Dry Weight (mg)	
		Per original organism[b]	Per surviving organism[b]
Sand Control	98.75	0.069	0.070
Lab. Formulated Sediment Control	86.25	0.043	0.048
Johnson Creek	91.25	0.030	0.033[c]
Slate Creek	91.25	0.029[c]	0.032[c]
Lower Sherman	91.25	0.060	0.066
Middle Sherman	90.00	0.055	0.060
Control Performance	Acceptable	N/A	N/A

[a] The Sand and Formulated Sediment controls were pooled for statistical comparisons of survival
[b] Growth in the two controls was significantly different; all statistical comparisons of growth were made against the Formulated Sediment control
[c] Significantly lower weight compared to the formulated sediment control
Note: See Appendix B for test data sheets

Data Analysis

For each test metric (survival, weight/original organism and weight/surviving organism), the sand and Formulated Sediment controls were compared using a T-test. If there was not a significant difference between the two, the controls were pooled and comparisons were made against the pooled control data. If there was a significant difference, all statistical comparisons were made against the Formulated Sediment control since the organic content of the Formulated Sediment is more reflective of the organic content of the test sediments. For survival, the two controls were pooled; for growth, statistical comparisons were made only against the Formulated Sediment control.

Biological Endpoint	Comparison[a]	Procedure
Survival	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Pooled Controls	Wilxocon's Rank Sum Test with Bonferroni Adjustment (α=0.05)
Growth (Dry Wt. per Original Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	Dunnett'sTest (α = 0.05)
Growth (Dry Wt. per Surviving Organism)	Normality	Shapiro-Wilk's Test (α=0.01)
	Homogeneity of Variance	Bartlett's Test (α=0.01)
	Significant Reduction Relative to the Formulated Sediment Control	Dunnett'sTest (α = 0.05)

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

Analytical Data

Parameter	Sample Identification			
	Johnson Creek	Slate Creek	Lower Sherman	Middle Sherman
Metals (mg/Kg-dry)[a]				
Aluminum	13,000	10,400	14,600	10,500
Chromium	33.2	17.5	42.1	23.3
Zinc	93.5	155	126	101
Arsenic	8.91	22.8	46.4	29.4
Cadmium	0.240	0.717	0.466	0.283
Copper	66.6	44.3	105	65.1
Lead	7.64	13.4	12.6	7.88
Nickel	48.4	27.4	33.8	21.8
Selenium	0.405J	1.24	1.80	1.09
Silver	0.369	0.180J	0.319J	0.252J
Mercury	0.0540H	0.0822H	0.0786	0.0579
Particle Size (%)[b]				
Clay	9.0	8.0	8.0	4.0
Sand	50.0	82.0	79.0	80.0
Silt	41.0	10.0	13.0	16.0
Texture	Loam	Loamy Sand	Loamy Sand	Loamy Sand
Coarse Material	ND	ND	ND	ND
TOC (%-dry)[c]	2.02	6.58	5.05	2.53
Acid Volatile Sulfide (umoles/g)	ND	ND	1.37J	1.19J

[a] Al, Cr, Ni and Zn by SW-846 Method 6010B; As, Cd, Cu, Pb, Se and Ag by SW-846 Method 6020; Hg by SW-846 7471B (USEPA 1986)
[b] Particle size was determined using ASTM Method D422 and Modified ASA 15-5
[c] TOC was determined using the Walkley Black Method
J = The concentration was below the Reporting Limit but above the Method Detection Limit
H = Holding time for preparation or analysis exceeded
ND = Not Detected at the Method Detection Limit; see Appendix C for detection limits
Note: See Appendix C for a copy of the report from the analytical laboratory (MSE-TA Analytical Laboratory, Butte, MT)

Total and Total Volatile Solids

Sample ID	Percent Total Solids[a]	Percent Total Volatile Solids[b]
Johnson Creek	65.82	2.16
Slate Creek	56.00	6.66
Lower Sherman	62.18	4.16
Middle Sherman	73.24	2.97

[a] Total solids were determined using Standard Methods 2540B (APHA 1989)
[b] Total volatile solids were determined using Standard Methods 2540E (APHA 1989)
All values are means of two analyzed samples
Note: See Appendix B for data sheets (these parameters were determined at the AECOM/FCETL)

Physical and Chemical Data (Min/Max)

Sample ID	pH (units)	DO (mg/L)	Cond. (µS/cm)	Temp. (°C)[a]	Ammonia as N (mg/L)	Hardness (mg/L as $CaCO_3$)	Alkalinity (mg/L as $CaCO_3$)
Sand Control	7.9/8.2	6.8/7.9	459/473	22/23	<1.0	78/90	61/68
Lab. Form. Sed.	7.7/8.2	6.2/7.9	497/523	22/23	<1.0	96/104	75/78
Johnson Creek	7.3/8.0	6.2/7.7	484[b]	22/23	<1.0	72/94	43/55
Slate Creek	7.0/7.8	5.9/7.4	343/465	22/23	<1.0	70/90	31/56
Lower Sherman	7.6/7.9	5.8/7.0	442/486	22/23	<1.0/2.9	96/102	74/74
Middle Sherman	7.7/8.0	5.9/7.0	438/520	22/23	<1.0	106/110	62/76

[a] Temperature in test chambers
[b] Conductivity was not measured at test initiation

Reference Toxicant Test Results for *H. azteca*

Organism Lot Number	Test Dates	96-Hour LC_{50}	AECOM/FCETL Historical 95% Control Limits	
			Low	High
09-033	09/15/09 to 09/19/09	1626	873	3122

Note: Values are expressed as mg/L chloride

References

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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 29 Oct 2009

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 Rehmer October 26, 2009

Quality Assurance Unit Date

APPENDIX A

Chain of Custody

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Location: FEET

Project Number: 08503-134-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY, AQUATIC SCIENCE

Chain of Custody Tape Nos.: 42090 intact

Signature: L. Flory

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

TAT: 30 DAYS FROM END OF TEST

Analysis Requested: HYALELLA + CHIRO. NOAELS

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Matl)	Matrix	Preserv.	Field Filtered		Lab I.D.	Remarks
JOHNSON CREEK	8-23-09	1200	✓		1 gal	S	ICE		X	#23 120	Cooler temp
MIDDLE SHERMAN	9-2-09	1100	✓		1 gal	S	ICE		X	#23 121	D-38 @ 11.6°C
—					1 gal	S	ICE		X		

Relinquished by: (Print Name)/(Affiliation)	Date	Received by: (Print Name)/(Affiliation)	Date
LIZ FLORY, AQUATIC SCIENCE Signature: L. Flory	9-2-09 Time: 1600	Kelli Jopp Signature:	9/3/09 Time: 1350
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):

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: ~~FedEx~~ Truck — UPS, FedEx, (Courier), Other

Temp blank: Yes, (No)

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Serial No. 49615

ENSR | AECOM

CHAIN OF CUSTODY RECORD

Client/Project Name: Coeur Alaska

Project Location: FCETL

Project Number: 08503-134-058

Field Logbook No.:

Sampler (Print Name)/(Affiliation): LIZ FLORY / AQUATIC SCIENCE

Chain of Custody Tape Nos.: 41642 intact

Signature: L. Flory

Send Results/Report to:

TAT:

Analysis Requested

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered	MALELLA + CHIRONOMUS									Lab I.D.	Remarks
LOWER SHERMAN	9-1-09	1200	✓		1 gal	S	ICE		X							#	23	118	Cooler temp
SLATE CREEK	8-31-09	1200	✓		1 gal	S	ICE		X							#	23	119	D-38 @ 10.1
LOWER SHERMAN	9-1-09	1200	✓		Sm. jar	S	ICE		X							#	23	122	
SLATE CREEK	8-31-09	1200	✓		Sm. jar	S	ICE		X							#	23	123	
JOHNSON CREEK	8-23-09	1200	✓		Sm. jar	S	ICE		X							#	23	124	
MIDDLE SHERMAN	9-2-09	1160	✓		Sm. jar	S	ICE		X							#	23	125	
					Sm. jar	S	ICE		X										
(1)									X										

Relinquished by: (Print Name)/(Affiliation)	Date	Received by: (Print Name)/(Affiliation)	Date
LIZ FLORY, AQUATIC SCIENCE Signature: L. Flory	Date: 9-2-09 Time: 1600	Kelly Tapp Signature: [signature]	Date: 9/3/09 Time: 1350
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):

ENSR Toxicology Lab
4303 W. Laporte Avenue
Fort Collins, CO 80521
(970) 416-0916
(970) 490-2963 (FAX)

Sample Shipped Via: Fast Track

UPS FedEx Courier Other

Temp blank: Yes No

(1) [initials] 8-6-09 Er

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Serial No. 49614

APPENDIX B

Data Sheets

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

Project Number: 8503-134-058 – (038, 040, 042, 044)
Test Substance: Sediment
Test Species: *H. azteca* Lot #: 09-033
Test Type: Chronic, Static Renewal
Dilution Water: Mod Hard with 50 mg/L Chloride RW #9196
Sampling Date(s): 08/01/09, 08/31/09, 08/23/09, 09/02/09
FCETL Sample #(s): 23118, 23119, 23120, 23121
Test Initiation Date/Time: 9/5/09 @1500
Test Termination Date/Time: 9/25/09 @1330

Protocol #: HA3AK.TIE058.00[illegible]7 (1)
Age: 7-9 d Supplier: ABS
Investigators: KS/KR/AP/CW
Sampling Time(s): 1200, 1200, 1200, 1100

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: 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)	Johnson Creek – (23120)
4)	Slate Creek	5) – (23119)	Lower Sherman	6) – (23118)	Middle Sherman – (23121)
7)		8)		9)	
10)		11)			

Reference Tox. Dates: 09/15/09-09/19/09 LC50: 1626 mg Cl/L Hist. Limits: 873-3122 Method: Graphical
Study Director Initials: DAP Date: 9/15/09

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

(1) AK 10/22/09 E

2 of 30
10/23/09

BIOLOGICAL DATA *H. azteca* Chronic, Static Renewal Project 8503-134-058 – (038, 040, 042, 044)
AR 10/22/09

Sediment	Test Termination	A	B	C	D	E	F	G	H	Remarks:
Sand (cont)	# Surviving	10	10	10	10	10	9	10	10	98.75 %
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	0	0	0	0	0	1	0	0	
Form sed (cont)	# Surviving	10	10	9	9	7	10	4	10	86.25 %
	# Observed Dead	0	1	0	0	0	0	0	0	
	# Not Found	0	0	1	1	3	0	10	0	
Johnson Creek	# Surviving	7	8	10	10	9	10	10	9	91.25 %
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	0	2	0	0	1	0	0	1	
Slate Creek	# Surviving	8	① 8	10	10	10	9	10	8	91.25 %
	# Observed Dead	0	② 0	0	0	0	0	0	0	
	# Not Found	2	2	0	0	0	1	0	0	
Lower Sherman	# Surviving	9	9	9	10	10	10	7	9	91.25%
	# Observed Dead	0	0	0	0	0	0	0	0	
	# Not Found	1	1	1	0	0	0	3	1	
Middle Sherman	# Surviving	9	10	10	10	8	① 8	10	7	~~99.75~~ ②
	# Observed Dead	0	0	0	0	0	0	0	0	90%
	# Not Found	1	0	0	0	2	② 2	0	3	
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									

① ES 9/25/09 E ② DAP 9/28/09 E

CHEMICAL DATA (Composite of Overlying Water) — *H. azteca* — Chronic, Static Renewal — Project 8503-134-058-(038, 040, 042, 044)

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	6.8	7.0	7.2	6.9	7.1	7.1	7.9	7.4	6.8	7.3	0	5	9/15/09	1100	KB
	Form sed (cont)	6.8	6.2	6.3	6.8	6.6	6.8	7.0	7.9	7.6	6.4	6.5	1	5	9/16/09	1130	KB
	Johnson Creek	6.2	6.2	6.5	6.3	6.6	6.8	6.8	7.5	7.7	6.5	7.1	2	5	9/17/09	0950	CK
	Slate Creek	5.9	6.2	6.6	6.4	6.5	6.6	6.6	7.4	7.4	6.5	7.1	3	5	9/18/09	1055	JL
	Lower Sherman	5.8	6.1	6.2	6.1	6.5	6.1	6.6	7.0	6.8	6.6	6.3	4	5	9/19/09	1640	AM
	Middle Sherman	5.9	5.9	6.2	6.0	6.3	6.3	6.6	6.6	7.0	6.4	6.4	5	5	9/20/09	0900	CW
	0												6	5	9/21/09	1025	JL
	0												7	5	9/22/09	1530	JL
	0												8	5	9/23/09	1000	JL
	0												9	5	9/24/09	1110	JL
													10	5	9/25/09	0845	KB
Temp (deg C)	Sand (cont)	22	22	22	23	23	22	22	23	23	23	22	0	D37	9/15/09	1105	KB
	Form sed (cont)	22	22	22	23	23	22	22	23	23	23	22	1	D41	9/16/09	1135	KB
	Johnson Creek	22	22	22	22	23	22	23	23	22	22	22	2	D37	9/17/09	0950	CK
	Slate Creek	22	22	22	22	23	22	22	23	22	22	22	3	D44	9/18/09	1055	JL
	Lower Sherman	22	22	22	22	23	22	22	23	23	22	22	4	D45	9/19/09	1640	AM
	Middle Sherman	22	22	22	23	23	22	22	23	22	22	22	5	D45	9/20/09	0900	CW
	0												6	D46	9/21/09	1025	JL
	0												7	D47	9/22/09	1525	JL
	0												8	D47	9/23/09	0955	JL
	0												9	D47	9/24/09	1105	JL
													10	D41	9/25/09	0845	KB
pH	Sand (cont)	8.1	8.1	8.0	8.0	8.2	8.2	7.9	8.2	7.9	7.9	8.1	0	12	9/15/09	1110	KB
	Form sed (cont)	8.1	7.9	7.8	8.0	8.2	8.2	7.9	8.0	7.7	7.8	7.9	1	12	9/16/09	1130	KB
	Johnson Creek	7.5	7.7	7.6	7.7	7.8	7.9	7.3	7.7	7.8	7.6	8.0	2	12	9/17/09	0950	CK
	Slate Creek	7.0	7.5	7.0	7.5	7.8	7.2	7.5	7.2	7.6	7.5	7.8	3	12	9/18/09	1055	JL
	Lower Sherman	7.6	7.6	7.6	7.6	7.9	7.8	7.7	7.7	7.6	7.6	7.8	4	12	9/19/09	1640	AM
	Middle Sherman	7.7	7.7	7.7	7.7	7.8	7.9	7.9	7.8	7.8	7.9	8.0	5	12	9/20/09	0900	CW
	0												6	12	9/21/09	1025	JL
	0												7	12	9/22/09	1530	JL
	0												8	12	9/23/09	1000	JL
	0												9	12	9/24/09	1110	JL
	Replicate	A	B	C	D	E	F	G	H	A	B	C	10	12	9/25/09	0845	KB

QA: A2 10/22/09

QA: 10/26/09 E

QA: AR 10/22/09

OVERLYING WATER CHARACTERIZATION · *H. azteca* · Chronic, Static Renewal · Project No. 8503-134-058 (038, 040, 042

	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)	459	473	78	90	61	68	<1.0	<1.0	<1.0	<1.0
Form sed (cont)	523	497	96	104	75	78	<1.0	<1.0	<1.0	<1.0
Johnson Creek	NM	484	72	94	43	55	<1.0 *	<1.0	<1.0	<1.0
Slate Creek	343	4105	70	90	31	56	<1.0 *	<1.0 *	<1.0	<1.0
Lower Sherman	442	486	96	102	74	74	1.36 *	2.9	<1.0	<1.0
Middle Sherman	438	520	106	110	62	76	<1.0 *	<1.0	<1.0	<1.0
0										
⊛ Mod Hard (RW 9196)	444		88		64					
▲ Mod Hard RW 9208 0	438		96		62					
0										
Meter #	15	15					HA#1/2*	HA#1/2*	HA#1	HA#1
Date:	9/15/09	9/25/09	9/15/09	9/25/09	9/15/09	9/25/09	9/15/09	9/18/09	9/22/09	9/25/09
Time:	1330	1215	1600	1215	1600	1215	1600	1150	1540	1215
Initials:	KB	KB	KB	KB	KB	KB	[illegible]	[illegible]	[illegible]	KB KB

① KB 9/25/09 E

② KB 10/20/09 E

* measured 9/23/09, SX's preserved

⊛ measured 9/10/09, Cl⁻ = 49 mg/L

▲ measured 9/19/09, Cl⁻ = 48 mg/L

Tag # 30
CA - 9/23/09
QA = ARW 9/22/09

DAILY TESTING LOG | *H. azteca* | Chronic, Static Renewal | Project No. 8503-134-058 (038,040,042,0

Day -1	homogenized sediment + placed into beakers with overlying water			
Day 0	started drips @ 1000 MH RW 9196		Feeding: 1 ml YTC @ 1615	Initials/Date: KB 9/15/09
Day 1	Bath CT = 22.4 °C	Range = 22.4 - 22.6 °C	Feeding: @ 1640	Initials/Date: KB 9/16/09
Day 2	Bath CT = ~~22.4~~ 22.4 °C	Range = 22.4 - 22.6 °C	Feeding: @ 1105	Initials/Date: [illegible] 9/17/09
Day 3	Bath CT = 23.2 °C	Range = 22.4 - 23.4 °C	Feeding: @ 1125	Initials/Date: [illegible] 9/18/09
Day 4	Bath CT = 23.4 °C started using MH RW 9208	Range = 23.0 - 23.4 °C	Feeding: @ 1640	Initials/Date: AP 9/19/09
Day 5	Bath CT = 23.4 °C	Range = 23.0 - 23.4 °C	Feeding: @ 0915	Initials/Date: CW 9/20/09
Day 6	Bath CT = 23.4 °C	Range = 23.0 - 23.4 °C	Feeding: @ 1030	Initials/Date: [illegible] 9/21/09
Day 7	Bath CT = 23.0 °C	Range = 23.0 - 23.4 °C	Feeding: @ 1545	Initials/Date: [illegible] 9/22/09
Day 8	Bath CT = 23.0 °C	Range = 23.0 - 23.4 °C	Feeding: @ 1005	Initials/Date: [illegible] 9/23/09
Day 9	Bath CT = 23.0 °C	Range = 23.0 - 23.4 °C	Feeding: @ 1115	Initials/Date: [illegible] 9/24/09
Day 10	Bath CT = 23.2 °C	Range = 23.0 - 23.4 °C	Feeding: none	Initials/Date: KB 9/25/09

[illegible] 9/17/09 E

SEDIMENT/SOIL PREPARATION

10/23/09
dA: AR 10/22/09

Artificial soil	
Constituent/source	**Amount added (g)**
Coarse Silica Sand	1242
Silt/Clay (ASP 400)	219
Dolomite	7.5
α-cellulose	77.3
Humic Acid	0.15
Total	1545.95

Notes: Container was placed into tumbler for a minimum of an hour to homogenize prior to use

Test # 08503-134-058-(038,040,042,044)

Soil/sediment	FCETL#	Homogenization			
		Date	From	To	Analyst
Johnson Creek	23120	9/14/09	1402	1406	[illegible]
Slate Creek	23119	9/14/09	1451	1455	[illegible]
Lower Sherman	23118	9/14/09	1414	1418	[illegible]
Middle Sherman	23121	9/14/09	1516	1518	[illegible]

8503-134-058 H. azteca

CONC	REP	RANDOM	RANK	
Sand	A	0.549899	18	C12
	B	0.617675	15	B07
	C	0.324485	31	D07
	D	0.775299	8	A8
	E	0.606641	16	B08
	F	0.496476	21	C05
	G	0.298232	34	E12
	H	0.793586	7	A7
Form	A	0.428083	25	E6 D1
	B	0.890598	3	A3
	C	0.303861	33	D8 E1
	D	0.316753	32	D08
	E	0.267956	36	E04
	F	0.410762	27	D03
	G	0.637209	14	B06
	H	0.186389	40	E08
Johnson	A	0.587516	17	B8 C1
Creek	B	0.25865	37	E05
	C	0.338214	30	D10
	D	0.01422	48	F08
	E	0.886565	4	A04
	F	0.364625	29	D05
	G	0.205881	39	E07
	H	0.547532	19	C03
Slate	A	0.019811	47	F07
Creek	B	0.905247	2	A2
	C	0.812001	6	A6
	D	0.676491	12	B4
	E	0.469953	23	C07
	F	0.677491	11	B3
	G	0.957833	1	A1
	H	0.060682	43	F03
Lower	A	0.638506	13	B05
Sherman	B	0.817609	5	A5
	C	0.701822	10	B2
	D	0.714774	9	B1
	E	0.446907	24	C08
	F	0.068162	42	F12
	G	0.142293	41	E8 F1
	H	0.047998	44	F04
Middle	A	0.023506	45	F05
Sherman	B	0.539119	20	C04
	C	0.398288	28	D04
	D	0.023171	46	F06
	E	0.418128	26	D12
	F	0.211654	38	E06
	G	0.475194	22	C06
	H	0.279576	35	E03

FCETL QA Form No.131
Revision 0
Effective 10/06
QA: BR 10/23/09
QA: BR 10/22/09

PERCENT TOTAL SOLIDS AND PERCENT TOTAL VOLATILE SOLIDS (TVS)

Project No: 0850-134-058 – (038, 040, 042, 044)

TARE: Date/time: 10/15/09 @ 1100 Analyst: ES

DRY GROSS: Date/time: 10/16/09 @ 1320 Analyst: ES

Analytical Balance ID: AND

ASHED GROSS: Date/time: 10/16/09 @ 1710 Analyst: ES

Dried in Oven # 2 from Date: 10/15/09 Time: 1130
Oven °C: 100 to Date: 10/16/09 Time: 1145

Ashed in Furnace from Date: 10/16/09 Time: 1330
Furnace °C: 550 to Date: 10/16/09 Time: 1500

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)
32	LS	A	18.6270	29.5329	25.3816	61.935 3 20	25.0919	4.2889
33	LS	B	17.7959	28.5921	24.5351	62.4220	24.2636	4.0297
34	SC	A	18.4825	28.3790	23.9966		23.6535	
35	SC	B	18.7594	29.2008	24.6370		24.2199	
36	JC	A	18.2340	28.6805	25.0794		24.9268	
37	JC	B	17.6820	27.9185	24.4486		24.3067	
38	MS	A	17.6404	27.9463	25.1772		24.9424	
39	MS	B	17.8875	28.5570	25.7134		25.4922	
40 Blank	Blank		18.3834		18.3834		18.3833	

[1] Add in weight loss of blank boat, if appropriate. DH 10/20/09E

FCETL QA Form No. 132
Revision 0
Effective 10/09

10/26/09

Percent Total Solids and Percent Total Volatile Solids

Project Number: 08503-134-058-(038-045)

Treatment	Rep		Tare Weight (g) A	Dish + Wet Sample (g) B	Dry Gross Weight (g) (dish + dry sample) C	% Total Solids (g) [(C-A)(100)]/(B-A)	Treatment Mean % Total Solids (g)	Ashed Gross Weight (g) (dish + sample) D	% Total Volatile Solids (g) [(C-D)(100)]/(C-A)	Treatment Mean % Total Volatile Solids (g)
Johnson Creek	A		18.2340	28.6805	25.0794	65.5282	65.8154	24.9268	2.2292	2.1631
	B		17.6820	27.9135	24.4486	66.1027		24.3067	2.0971	
Slate Creek	A		18.4825	28.3790	23.9966	55.7177	56.0045	23.6535	6.2222	6.6593
	B		18.7594	29.2008	24.6370	56.2913		24.2199	7.0964	
Lower Sherman	A		18.6270	29.5329	25.3816	61.9353	62.1786	25.0919	4.2889	4.1588
	B		17.7959	28.5921	24.5351	62.4220		24.2636	4.0287	
Middle Sherman	A		17.6404	27.9463	25.1727	73.1309	73.2396	24.9424	3.1154	2.9709
	B		17.8875	28.5570	25.4134	73.3483		25.4922	2.8265	
Blank			18.3834		18.3834			18.3833		

rad

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

SK 10/23/09

Project Number: 8503-134-058 (036 040 044 042)	Test Substance: NA	Comments: AR 10/22/09
Species: H. azteca - Pre Weights	Analyst Tare: JAE Analyst Gross: KB	Analytical Balance ID: SART#1
Date/Time of Tare Wt.: 9/15/09 @ 1500	Date/Time of Gross Wt.: 9/22/09 @ 0930	Dried in Oven #3 from Date: 9/15/09 Time: 1700 to Date: 9/18/09 Time: 0905

Weight Type (Circle): Wet Blot Dry Dry (~~>100°C~~ 60-90°C) AFDW (>500°C) Lot or Batch Number: 09-033

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)
	organism pre wts.	A		0.71578	0.71603	0.00025					20		
		B		0.72992	0.73017	0.00025					20		
		C		0.72853	0.72871	0.00018					20		
		D		0.70452	0.70473	0.00021					20		
Blank				0.73151	0.73138								
Range													
Mean													

Test Solution Volume: Loading Rate:

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

AR 10/22/09E

Aqua

FCETL QA Form No.(
Revision 5
Effective 08/99
DK 10/23/09
AA: AR10/22/09

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 08503-134-058 (038 040 042 044)	Test Substance: Sediment	Comments: Analytical Balance ID: SART #1
Species: H. azteca	Analyst Tare: AP Analyst Gross: AP	Dried in Oven # 3 from Date: 9/25/09 Time: 1700 to Date: 9/28/09 Time: 0940
Date/Time of Tare Wt.: 9/25/09 @ 1415	Date/Time of Gross Wt.: 9/28/09 @ 1030	

Weight Type (Circle): Wet Blot Dry Dry (>~~100°C~~ 66-90°C)② AFDW (>500°C) Lot or Batch Number: 09-033

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		0.69730	0.69792	0.00062		10			10		
		B		0.69069	0.69135	0.00066		9(10)①			9		
		C		0.69143	0.69203	0.00060		10			10		
		D		0.69690	0.69761	0.00071		10			10		
		E		0.69993	0.70063	0.00070		10			10		
		F		0.69254	0.69310	0.00056		10			9		
		G		0.69641	0.69708	0.00067		10			10		
		H		0.68811	0.68869	0.00058		10			10		
	Formulated Sediment	A		0.69229	0.69284	0.00055		9(10)①			9		
		B		0.69983	0.70029	0.00046		10			10		
		C		0.69605	0.69657	0.00052		10			9		
		D		0.68535	0.68589	0.00054		10			9		
Blank				0.68538	0.68534	-0.00004							
Range													
Mean													

Test Solution Volume: Loading Rate:

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

① 10 alive @ test termination; 1 lost in transfer. (DAP) ② AR10/22/09 CF

FCETL QA Form No.6
Revision 5
Effective 08/99
DH 10/23/09
Eff: AP 10/20/09

Aqua

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 08503-134-058 (039 040 042 044) Test Substance: Sediment

Species: H. azteca Analyst Tare: AP Analyst Gross: AP

Date/Time of Tare Wt.: 9/25/09 @ 1415 Date/Time of Gross Wt.: 9/28/09 @ 1030

Comments:
Analytical Balance ID: Sart #1
Dried in Oven # 3 from Date: 9/25/09 Time: 1700
to Date: 9/28/09 Time: 0910

Weight Type (Circle): Wet Blot Dry Dry (60-90°C) (>100°C) AFDW (>500°C) Lot or Batch Number: 09-033

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)
	Farm Sed.	E		0.69546	0.69568	0.00022		10			7		
		F		0.69049	0.69074	0.00025		9(10)[2]			9		
		G		0.68213	0.68222	0.00009		10			4		
		H		0.70048	0.70085	0.00037		10			10		
	Johnson Creek	A		0.68815	0.68832	0.00017		10			7		
		B		0.68821	0.68845	0.00024		10			8		
		C		0.69032	0.69068	0.00036		10			10		
		D		0.70498	0.70519	0.00021		10			10		
		E		0.70639	0.70674	0.00035		10			9		
		F		0.69010	0.69038	0.00028		10			9 10.		
		G		0.69455	0.69477	0.00022		9(10)[2]			9		
		H		0.68213	0.68233	0.00020		10			9		
Blank													
Range													
Mean													

Test Solution Volume: Loading Rate:

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

AP 9/28/09 E

[2] 10 alive @ test termination; 1 lost in transfer (DAP)

Aqua

FCETL QA Form No.0
Revision 5
Effective 08/99
dk 10/23/09
QA: AR 10/22/09

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 08503-134-058 (038 040 042 044)
Test Substance: Sediment
Species: H. azteca
Analyst Tare: AP
Analyst Gross: AP
Date/Time of Tare Wt.: 9/25/09 @ 1415
Date/Time of Gross Wt.: 9/28/09 @ 1030

Comments:
Analytical Balance ID: Sart #1
Dried in Oven # 3 from Date: 9/25/09 Time: 1700
to Date: 9/28/09 Time: 0910

Weight Type (Circle): Wet Blot Dry Dry (>100°C) AFDW (>500°C) Dry 60-90°C
Lot or Batch Number: 09-033

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)
	Stout Creek	A		0.68910	0.68930	0.00020		10			8		
		B		0.69228	0.69255	0.00027		10			8		
		C		0.69668	0.69703	0.00035		10			10		
		D		0.69921	0.69943	0.00022		10			10		
		E		0.68953	0.68976	0.00023		10			10		
		F		0.69546	0.69576	0.00030		10			9		
		G		0.69929	0.69950	0.00021		9(10)①			9		
		H		0.70260	0.70279	0.00019		10			8		
	Lower Sherman	A		0.69955	0.70009	0.00054		10			9		
		B		0.69697	0.69749	0.00052		10			9		
		C		0.68439	0.68492	0.00053		10			9		
		D		0.68458	0.68521	0.00063		10			10		
Blank													
Range													
Mean													

Test Solution Volume:
Loading Rate:

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

① 10 alive @ test termination; 1 lost in transfer (DAP)

FCETL QA Form No.0
Revision 5
Effective 08/99
10/23/09
AD: AD 10/22/09

Aqua

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project Number: 0858-134-058 (038, 040, 042, 044) Test Substance: Sediment

Species: H. azteca

Analyst Tare: AP Analyst Gross: AP

Date/Time of Tare Wt.: 9/25/09 @ 1415

Date/Time of Gross Wt.: 9/28/09 @ 1030

Comments:
Analytical Balance ID: Smart #1
Dried in Oven # 3 from Date: 9/25/09 Time: 1700
to Date: 9/25/09 Time: 0910

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

Lot or Batch Number: 09-033

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	E		0.69442	0.69500	0.00058		10			10		
		F		0.67575	0.67638	0.00063		10			10		
		G		0.69105	0.69143	0.00038		10			7		
		H		0.69842	0.69909	0.00067		10			9		
	Middle Sherman	A		0.69935	0.69983	0.00048		10			9		
		B		0.69636	0.69706	0.00070		9(10)①			9		
		C		0.67999	0.68049	0.00050		10			10		
		D		0.68868	0.68923	0.00055		10			10		
		E		0.69614	0.69666	0.00052		10			8		
		F		0.68769	0.68813	0.00044		10			8		
		G		0.69318	0.69370	0.00052		10			10		
		H		0.68838	0.68865	0.00027		10			7		
Blank													
Range													
Mean													

Test Solution Volume: Loading Rate:

[1] Add in weight loss of blank boat, if appropriate. ① 10 alive @ test termination; 1 lost in transfer (DSP) (2) 10/23/09G

Spreadsheet for Determining Dry Weight of Hyalella azteca

Test Start Date:	9/15/2009	Test End Date:	9/25/2009
Test Number(s):	08503-134-058- (038, 040, 042, 044)	Test Material:	Sediment
Species:	Hyalella azteca (Lot 09-033)	Entered by:	Pillard

Boat #	Treatment	Rep	Length	Tarewt (dry) (g)	Gross wt (dry) (g)	Dry Net wt (g)	Dry ind wt/rep (g)	Number Originally Organisms	Mean wt per Body (mg)	Mean wt per treatment (orig) (mg)	Number Surviving	Mean wt per Survivor (mg)	Mean wt per treatment (surv) (mg)
1	Sand	A		0.69430	0.69792	0.00052	0.00066	10	0.066	-	10	0.066	-
2	Sand	B		0.69069	0.69135	0.00066	0.00070	9	0.078	-	9	0.078	-
3	Sand	C		0.69243	0.69303	0.00060	0.00064	10	0.064	-	10	0.064	-
4	Sand	D		0.69690	0.69763	0.00071	0.00075	10	0.075	-	10	0.075	-
5	Sand	E		0.69993	0.70063	0.00070	0.00074	10	0.074	-	10	0.074	-
6	Sand	F		0.69254	0.69310	0.00056	0.00060	10	0.060	-	9	0.067	-
7	Sand	G		0.69641	0.69708	0.00067	0.00071	10	0.071	-	10	0.071	-
8	Sand	H		0.68811	0.68869	0.00058	0.00062	10	0.062	0.068722222	10	0.062	0.069555556
9	Formulated Sed	A		0.69229	0.69284	0.00055	0.00059	9	0.066	-	9	0.066	-
10	Formulated Sed	B		0.69983	0.70029	0.00046	0.00050	10	0.050	-	10	0.050	-
11	Formulated Sed	C		0.69605	0.69657	0.00052	0.00056	10	0.056	-	9	0.062	-
12	Formulated Sed	D		0.68535	0.68589	0.00054	0.00058	10	0.058	-	9	0.064	-
13	Formulated Sed	E		0.69546	0.69568	0.00022	0.00026	10	0.026	-	7	0.037	-
14	Formulated Sed	F		0.69049	0.69074	0.00025	0.00029	9	0.032	-	9	0.032	-
15	Formulated Sed	G		0.68243	0.68222	0.00009	0.00013	10	0.013	-	4	0.033	-
16	Formulated Sed	H		0.70048	0.70085	0.00037	0.00041	10	0.041	0.042722222	10	0.041	0.048135913
17	Johnson Creek	A		0.68845	0.68882	0.00017	0.00021	10	0.021	-	7	0.030	-
18	Johnson Creek	B		0.68823	0.68846	0.00024	0.00028	10	0.028	-	8	0.035	-
19	Johnson Creek	C		0.69032	0.69068	0.00036	0.00040	10	0.040	-	10	0.040	-
20	Johnson Creek	D		0.70498	0.70519	0.00021	0.00025	10	0.025	-	10	0.025	-
21	Johnson Creek	E		0.70639	0.70674	0.00035	0.00039	10	0.039	-	9	0.043	-
22	Johnson Creek	F		0.69840	0.69868	0.00028	0.00032	10	0.032	-	10	0.032	-
23	Johnson Creek	G		0.69455	0.69477	0.00022	0.00026	9	0.029	-	9	0.029	-
24	Johnson Creek	H		0.68213	0.68233	0.00020	0.00024	10	0.024	0.029736111	9	0.027	0.032611111
25	Slate Creek	A		0.68910	0.68930	0.00020	0.00024	10	0.024	-	8	0.030	-
26	Slate Creek	B		0.69228	0.69255	0.00027	0.00031	10	0.031	-	8	0.039	-
27	Slate Creek	C		0.69668	0.69703	0.00035	0.00039	10	0.039	-	10	0.039	-
28	Slate Creek	D		0.69923	0.69943	0.00022	0.00026	10	0.026	-	10	0.026	-
29	Slate Creek	E		0.68953	0.68976	0.00023	0.00027	10	0.027	-	10	0.027	-
30	Slate Creek	F		0.69546	0.69576	0.00030	0.00034	10	0.034	-	9	0.038	-
31	Slate Creek	G		0.69929	0.69950	0.00021	0.00025	9	0.028	-	9	0.028	-
32	Slate Creek	H		0.70260	0.70279	0.00019	0.00023	10	0.023	0.028972222	8	0.029	0.031881944
33	Lower Sherman	A		0.69955	0.70009	0.00054	0.00058	10	0.058		9	0.064	-
34	Lower Sherman	B		0.69693	0.69749	0.00052	0.00056	10	0.056	-	9	0.062	-
35	Lower Sherman	C		0.68439	0.68492	0.00053	0.00057	10	0.057	-	9	0.063	-
36	Lower Sherman	D		0.68458	0.68523	0.00063	0.00067	10	0.067	-	10	0.067	-
37	Lower Sherman	E		0.69442	0.69500	0.00058	0.00062	10	0.062	-	10	0.062	-
38	Lower Sherman	F		0.67575	0.67638	0.00063	0.00067	10	0.067	-	10	0.067	-
39	Lower Sherman	G		0.69105	0.69143	0.00038	0.00042	10	0.042	-	7	0.060	-
40	Lower Sherman	H		0.69842	0.69909	0.00067	0.00071	10	0.071	0.06	9	0.079	0.065611111
41	Middle Sherman	A		0.69935	0.69983	0.00048	0.00052	10	0.052	-	9	0.058	-
42	Middle Sherman	B		0.69636	0.69706	0.00070	0.00074	9	0.082	-	9	0.082	-
43	Middle Sherman	C		0.67999	0.68049	0.00050	0.00054	10	0.054	-	10	0.054	-
44	Middle Sherman	D		0.68858	0.68923	0.00055	0.00059	10	0.059	-	10	0.059	-

10/23/09

QA: AR 10/22/09

Spreadsheet for Determining Dry Weight of Hyalella azteca

Test Start Date:	9/15/2009	Test End Date:	9/25/2009
Test Number(s):	08503-134-058- (038, 040, 042, 044)	Test Material:	Sediment
Species:	Hyalella azteca (Lot 09-033)	Entered by:	Pillard

Boat #	Treatment	Rep	Length	Tare wt (dry) (g)	Gross wt (dry) (g)	Dry Net wt (g)	Dry adjusted net wt (g)	Number Original Organisms	Mean wt per org (mg)	Mean wt per treatment (adj) (mg)	Number Surviving	Mean wt per surviving (mg)	Mean wt per treatment (surv) (mg)
45	Middle Sherman	E		0.69614	0.69666	0.00052	0.00056	10	0.056	-	8	0.070	-
46	Middle Sherman	F		0.68869	0.68913	0.00044	0.00048	10	0.048	-	8	0.060	-
47	Middle Sherman	G		0.69378	0.69430	0.00052	0.00056	10	0.056	-	10	0.056	-
48	Middle Sherman	H		0.68838	0.68865	0.00027	0.00031	10	0.031	0.054777778	7	0.044	0.060410714
Blank				0.68538	0.68534	-4E-05							

CK 10/23/09
QA: AR 10/26/09

Title: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Sand	8	0.9000	1.0000	0.9875
2	Formulated	8	0.4000	1.0000	0.8625
3	Johnson Cr	8	0.7000	1.0000	0.9125
4	Slate Cr	8	0.8000	1.0000	0.9125
5	Lower Sherman	8	0.7000	1.0000	0.9125
6	Middle Sherman	8	0.7000	1.0000	0.9000

Title: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Sand	0.0013	0.0354	0.0125	3.5803
2	Formulated	0.0455	0.2134	0.0754	24.7410
3	Johnson Cr	0.0127	0.1126	0.0398	12.3396
4	Slate Cr	0.0098	0.0991	0.0350	10.8606
5	Lower Sherman	0.0098	0.0991	0.0350	10.8606
6	Middle Sherman	0.0143	0.1195	0.0423	13.2803

Title: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

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

GRP1 (Solvent cntl) Mean =	1.3916	Calculated t value =	1.7160
GRP2 (Blank cntl) Mean =	1.2278	Degrees of freedom =	14
Difference in means =	0.1639		

2-sided t value (0.05,14) = 2.1448 No 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!

CP 10/23/09
QA: BRD 10/26/09

Title: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

D = 1.3145
W = 0.8083
Critical W = 0.9290 (alpha = 0.01 , N = 48)
W = 0.9470 (alpha = 0.05 , N = 48)

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: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 1.5580 (p-value = 0.8163)

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)

Using Average Degrees of Freedom
(Based on average replicate size of 9.60)

Calculated B2 statistic = 1.2244 (p-value = 0.8741)

Data PASS B2 homogeneity test at 0.01 level. Continue analysis.

Title: 08503-134-058-038, 040, 042, 044 H azteca, survival
File: 134058HA.SUR Transform: ARC SINE(SQUARE ROOT(Y))

Wilcoxon's Rank Sum Test w/ Bonferroni Adjustment Ho: Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	RANK SUM	CRIT. VALUE	REPS	SIG 0.05
1	GRPS 1&2 POOLED	1.3097				
2	Johnson Cr	1.2806	88.50	62	8	
3	Slate Cr	1.2773	87.50	62	8	
4	Lower Sherman	1.2779	83.00	62	8	
5	Middle Sherman	1.2628	87.00	62	8	

Critical values are 1 tailed (k = 4)

SK 10/22/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original

File: 058HA_WT.ORG Transform: NO TRANSFORMATION

QA: mc 10/22/09

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

==========

GRP1 (Solvent cntl) Mean = 0.0688 Calculated t value = 3.8194

GRP2 (Blank cntl) Mean = 0.0428 Degrees of freedom = 14

Difference in means = 0.0260

==========

2-sided t value (0.05,14) = 2.1448** Significant difference at alpha=0.05

2-sided t value (0.01,14) = 2.9768** Significant difference at alpha=0.10

WARNING: This procedure assumes normality and equal variances!

Group 1 = Sand Control
Group 2 = Formulated Sediment

Print this table? (Y/N) ==>

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08/06/09

AA: Arc 10/23/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058ha_wt.org Transform: NO TRANSFORMATION
Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand	1	0.0660	0.0660
1	Sand	2	0.0780	0.0780
1	Sand	3	0.0640	0.0640
1	Sand	4	0.0750	0.0750
1	Sand	5	0.0740	0.0740
1	Sand	6	0.0600	0.0600
1	Sand	7	0.0710	0.0710
1	Sand	8	0.0620	0.0620
2	Formulated	1	0.0660	0.0660
2	Formulated	2	0.0500	0.0500
2	Formulated	3	0.0560	0.0560
2	Formulated	4	0.0580	0.0580
2	Formulated	5	0.0260	0.0260
2	Formulated	6	0.0320	0.0320
2	Formulated	7	0.0130	0.0130
2	Formulated	8	0.0410	0.0410
3	Johnson Cr	1	0.0210	0.0210
3	Johnson Cr	2	0.0280	0.0280
3	Johnson Cr	3	0.0400	0.0400
3	Johnson Cr	4	0.0250	0.0250
3	Johnson Cr	5	0.0390	0.0390
3	Johnson Cr	6	0.0320	0.0320
3	Johnson Cr	7	0.0290	0.0290
3	Johnson Cr	8	0.0240	0.0240
4	Slate Cr	1	0.0240	0.0240
4	Slate Cr	2	0.0310	0.0310
4	Slate Cr	3	0.0390	0.0390
4	Slate Cr	4	0.0260	0.0260
4	Slate Cr	5	0.0270	0.0270
4	Slate Cr	6	0.0340	0.0340
4	Slate Cr	7	0.0280	0.0280
4	Slate Cr	8	0.0230	0.0230
5	Lower Sherman	1	0.0580	0.0580
5	Lower Sherman	2	0.0560	0.0560
5	Lower Sherman	3	0.0570	0.0570
5	Lower Sherman	4	0.0670	0.0670
5	Lower Sherman	5	0.0620	0.0620
5	Lower Sherman	6	0.0670	0.0670
5	Lower Sherman	7	0.0420	0.0420
5	Lower Sherman	8	0.0710	0.0710
6	Middle Sherman	1	0.0520	0.0520
6	Middle Sherman	2	0.0820	0.0820
6	Middle Sherman	3	0.0540	0.0540
6	Middle Sherman	4	0.0590	0.0590
6	Middle Sherman	5	0.0560	0.0560

08503-134-058-038,040,042,044

10/23/09

AS: Ae 10/23/09

6	Middle Sherman	6	0.0480	0.0480
6	Middle Sherman	7	0.0560	0.0560
6	Middle Sherman	8	0.0310	0.0310

QA: ARTO/22/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

D = 0.0048
W = 0.9673

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.

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 12.3765 (p-value = 0.0148)

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)

08/10/2009

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original dft: Arc 10/22/09
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Formulated	8	0.0130	0.0660	0.0428
2	Johnson Cr	8	0.0210	0.0400	0.0298
3	Slate Cr	8	0.0230	0.0390	0.0290
4	Lower Sherman	8	0.0420	0.0710	0.0600
5	Middle Sherman	8	0.0310	0.0820	0.0548

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Formulated	0.0003	0.0181	0.0064	42.2674
2	Johnson Cr	0.0000	0.0069	0.0024	23.1316
3	Slate Cr	0.0000	0.0054	0.0019	18.6152
4	Lower Sherman	0.0001	0.0091	0.0032	15.1186
5	Middle Sherman	0.0002	0.0140	0.0050	25.6592

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	4	0.0064	0.0016	11.6954
Within (Error)	35	0.0048	0.0001	
Total	39	0.0112		

(p-value = 0.0000)

Critical F = 3.9082 (alpha = 0.01, df = 4,35)
= 2.6415 (alpha = 0.05, df = 4,35)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

10/22/09

QA: MR 10/22/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

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	Formulated	0.0428	0.0428		
2	Johnson Cr	0.0298	0.0298	2.2252	
3	Slate Cr	0.0290	0.0290	2.3535	*
4	Lower Sherman	0.0600	0.0600	-2.9526	
5	Middle Sherman	0.0548	0.0548	-2.0540	

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

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/original
File: 058HA_WT.ORG Transform: NO TRANSFORMATION

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	Formulated	8			
2	Johnson Cr	8	0.0131	30.7	0.0130
3	Slate Cr	8	0.0131	30.7	0.0137
4	Lower Sherman	8	0.0131	30.7	-0.0172
5	Middle Sherman	8	0.0131	30.7	-0.0120

① Prefer? 10/22/09 WP

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin

File: 058HA_WT.SUR Transform: NO TRANSFORMATION

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

GRP1 (Solvent cntl) Mean = 0.0696 Calculated t value = 3.9480

GRP2 (Blank cntl) Mean = 0.0481 Degrees of freedom = 14

Difference in means = 0.0215

2-sided t value (0.05,14) = 2.1448** Significant difference at alpha=0.05

2-sided t value (0.01,14) = 2.9768** Significant difference at alpha=0.10

WARNING: This procedure assumes normality and equal variances!

Group 1 = Sand Control
Group 2 = Formulated Sediment

Output this table to a disk file? (Y/N) ==>

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CK 10/27/09

AB: AR 10/23/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058ha_wt.sur Transform: NO TRANSFORMATION
Number of Groups: 6

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	Sand	1	0.0660	0.0660
1	Sand	2	0.0780	0.0780
1	Sand	3	0.0640	0.0640
1	Sand	4	0.0750	0.0750
1	Sand	5	0.0740	0.0740
1	Sand	6	0.0670	0.0670
1	Sand	7	0.0710	0.0710
1	Sand	8	0.0620	0.0620
2	Formulated	1	0.0660	0.0660
2	Formulated	2	0.0500	0.0500
2	Formulated	3	0.0620	0.0620
2	Formulated	4	0.0640	0.0640
2	Formulated	5	0.0370	0.0370
2	Formulated	6	0.0320	0.0320
2	Formulated	7	0.0330	0.0330
2	Formulated	8	0.0410	0.0410
3	Johnson Cr	1	0.0300	0.0300
3	Johnson Cr	2	0.0350	0.0350
3	Johnson Cr	3	0.0400	0.0400
3	Johnson Cr	4	0.0250	0.0250
3	Johnson Cr	5	0.0430	0.0430
3	Johnson Cr	6	0.0320	0.0320
3	Johnson Cr	7	0.0290	0.0290
3	Johnson Cr	8	0.0270	0.0270
4	Slate Cr	1	0.0300	0.0300
4	Slate Cr	2	0.0390	0.0390
4	Slate Cr	3	0.0390	0.0390
4	Slate Cr	4	0.0260	0.0260
4	Slate Cr	5	0.0270	0.0270
4	Slate Cr	6	0.0380	0.0380
4	Slate Cr	7	0.0280	0.0280
4	Slate Cr	8	0.0290	0.0290
5	Lower Sherman	1	0.0640	0.0640
5	Lower Sherman	2	0.0620	0.0620
5	Lower Sherman	3	0.0630	0.0630
5	Lower Sherman	4	0.0670	0.0670
5	Lower Sherman	5	0.0620	0.0620
5	Lower Sherman	6	0.0670	0.0670
5	Lower Sherman	7	0.0600	0.0600
5	Lower Sherman	8	0.0790	0.0790
6	Middle Sherman	1	0.0580	0.0580
6	Middle Sherman	2	0.0820	0.0820
6	Middle Sherman	3	0.0540	0.0540
6	Middle Sherman	4	0.0590	0.0590
6	Middle Sherman	5	0.0700	0.0700

08503-134-058-038/040, 042, 044

CK 10/27/09
QA: AR 10/23/09

6	Middle Sherman	6	0.0600	0.0600
6	Middle Sherman	7	0.0560	0.0560
6	Middle Sherman	8	0.0440	0.0440

10/27/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/surviving
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

Shapiro - Wilk's Test for Normality

AB: BR 10/27/09

D = 0.0031
W = 0.9507

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.

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 9.8654 (p-value = 0.0428)

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)

10/27/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

AT: AC 10/22/09

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	Formulated	8	0.0320	0.0660	0.0481
2	Johnson Cr	8	0.0250	0.0430	0.0326
3	Slate Cr	8	0.0260	0.0390	0.0320
4	Lower Sherman	8	0.0600	0.0790	0.0655
5	Middle Sherman	8	0.0440	0.0820	0.0604

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	Formulated	0.0002	0.0143	0.0051	29.7085
2	Johnson Cr	0.0000	0.0063	0.0022	19.3119
3	Slate Cr	0.0000	0.0057	0.0020	17.6777
4	Lower Sherman	0.0000	0.0060	0.0021	9.1239
5	Middle Sherman	0.0001	0.0113	0.0040	18.7378

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	4	0.0076	0.0019	21.6328
Within (Error)	35	0.0031	0.0001	
Total	39	0.0107		

(p-value = 0.0000)

Critical F = 3.9082 (alpha = 0.01, df = 4,35)
= 2.6415 (alpha = 0.05, df = 4,35)

Since F > Critical F REJECT Ho: All equal (alpha = 0.05)

TAB 50 of 50

10/27/09

AR: AR 10/22/09

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

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					0.05
1	Formulated	0.0481	0.0481		
2	Johnson Cr	0.0326	0.0326	3.3053	*
3	Slate Cr	0.0320	0.0320	3.4386	*
4	Lower Sherman	0.0655	0.0655	-3.7052	
5	Middle Sherman	0.0604	0.0604	-2.6123	

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

Title: 08503-134-058-038, 040, 042, 044, H azteca, Wt/survivin
File: 058HA_WT.SUR Transform: NO TRANSFORMATION

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	Formulated	8			
2	Johnson Cr	8	0.0106	21.9	0.0155
3	Slate Cr	8	0.0106	21.9	0.0161
4	Lower Sherman	8	0.0106	21.9	-0.0174
5	Middle Sherman	8	0.0106	21.9	-0.0122

① AR for ? 10/22/09 WP

APPENDIX C

Analytical Data

MSE Lab Services

Date: *12-Oct-09*

CLIENT: ENSR International
Lab Order: 0909111
Project: Sediment Analysis
Lab ID: 0909111-005

Client Sample ID: 23120/JOHNSON
Collection Date: 8/23/2009 12:00:00 PM
Matrix: SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS		SW6010B		E200.2			Analyst: js
Aluminum	13000	11.1	13.3		mg/Kg-dry	1	10/6/2009
Chromium	33.2	5.60	5.90		mg/Kg-dry	1	10/6/2009
Nickel	46.4	6.16	7.37		mg/Kg-dry	1	10/6/2009
Zinc	93.5	2.16	2.95		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES		SW6020		E200.2			Analyst: SW
Arsenic	8.91	0.128	0.442		mg/Kg-dry	2	9/30/2009
Cadmium	0.240	0.008	0.029		mg/Kg-dry	2	9/30/2009
Copper	66.6	0.121	0.369		mg/Kg-dry	2	9/30/2009
Lead	7.84	0.013	0.059		mg/Kg-dry	2	9/30/2009
Selenium	0.405	0.200	0.590	J	mg/Kg-dry	2	9/30/2009
Silver	0.369	0.109	0.295		mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B		E245.5		SW7471A			Analyst: YF
Mercury	0.0540	0.00806	0.0362	H	mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK		OM_WALKLEYBLACK					Analyst: yf/dk
Organic Matter - Walkley Black	2.02	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL		ASTMD422					Analyst: bo/dk
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5		MSA15-5					Analyst: BO
% Clay	9.0	0.1	0.1		%	1	9/28/2009
% Sand	50.0	0.1	0.1		%	1	9/28/2009
% Silt	41.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAM					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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

MSE Lab Services

Date: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23124/JOHNSON
Lab Order:	0909111	**Collection Date:**	8/23/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-008	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS			AVS-SEM				Analyst: kgw
Sulfide	ND	1.08	3.00		µmoles/g	1	9/24/2009

Review

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

MSE Lab Services

Date: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23119/SLATE
Lab Order:	0909111	**Collection Date:**	8/31/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-007	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS			**SW6010B**	**E200.2**			Analyst: **js**
Aluminum	10400	13.0	15.6		mg/Kg-dry	1	10/6/2009
Chromium	17.5	6.60	6.95		mg/Kg-dry	1	10/6/2009
Nickel	27.4	7.26	8.69		mg/Kg-dry	1	10/6/2009
Zinc	155	2.65	3.47		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES			**SW6020**	**E200.2**			Analyst: **SW**
Arsenic	22.8	0.151	0.521		mg/Kg-dry	2	9/30/2009
Cadmium	0.717	0.009	0.035		mg/Kg-dry	2	9/30/2009
Copper	44.3	0.143	0.434		mg/Kg-dry	2	9/30/2009
Lead	13.4	0.016	0.069		mg/Kg-dry	2	9/30/2009
Selenium	1.24	0.236	0.695		mg/Kg-dry	2	9/30/2009
Silver	0.160	0.126	0.347	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B			**E245.5**	**SW7471A**			Analyst: **YF**
Mercury	0.0822	0.00936	0.0449	H	mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK			**OM_WALKLEYBLACK**				Analyst: **yf/dk**
Organic Matter - Walkley Black	6.66	0.03	0.05		%	1	9/28/2009
PERCENT COARSE MATERIAL			**ASTMD422**				Analyst: **bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5			**MSA15-5**				Analyst: **BO**
% Clay	8.0	0.1	0.1		%	1	9/28/2009
% Sand	82.0	0.1	0.1		%	1	9/28/2009
% Silt	10.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:	E	Value above quantitation range	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: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23123/SLATE
Lab Order:	0909111	**Collection Date:**	8/31/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-008	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS			AVS-SEM				Analyst: kgw
Sulfide	ND	1.08	3.00		µmoles/g	1	9/24/2009

Review

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

MSE Lab Services

Date: 12-Oct-09

CLIENT: ENSR International
Lab Order: 0909111
Project: Sediment Analysis
Lab ID: 0909111-003

Client Sample ID: 23118/LOW
Collection Date: 9/1/2009 12:00:00 PM
Matrix: SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS			**SW6010B**	**E200.2**			**Analyst: js**
Aluminum	14600	12.1	14.6		mg/Kg-dry	1	10/6/2009
Chromium	42.1	6.15	6.48		mg/Kg-dry	1	10/6/2009
Nickel	33.8	6.76	8.10		mg/Kg-dry	1	10/6/2009
Zinc	126	2.38	3.24		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES			**SW6020**	**E200.2**			**Analyst: SW**
Arsenic	46.4	0.141	0.466		mg/Kg-dry	2	9/30/2009
Cadmium	0.466	0.009	0.032		mg/Kg-dry	2	9/30/2009
Copper	105	0.133	0.405		mg/Kg-dry	2	9/30/2009
Lead	12.6	0.015	0.065		mg/Kg-dry	2	9/30/2009
Selenium	1.80	0.220	0.648		mg/Kg-dry	2	9/30/2009
Silver	0.319	0.119	0.324	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B			**E245.5**	**SW7471A**			**Analyst: YF**
Mercury	0.0786	0.00900	0.0426		mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK			**OM_WALKLEYBLACK**				**Analyst: yf/dk**
Organic Matter - Walkley Black	5.05	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL			**ASTMD422**				**Analyst: bo/dk**
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5			**MSA15-5**				**Analyst: BO**
% Clay	8.0	0.1	0.1		%	1	9/28/2009
% Sand	79.0	0.1	0.1		%	1	9/28/2009
% Silt	13.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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: 12-Oct-09

CLIENT:	ENSR International	**Client Sample ID:**	23122/LOW
Lab Order:	0909111	**Collection Date:**	9/1/2009 12:00:00 PM
Project:	Sediment Analysis		
Lab ID:	0909111-004	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS		AVS-SEM					Analyst: kgw
Sulfide	1.37	1.08	3.00	J	µmoles/g	1	9/24/2009

Review

Qualifiers:	E	Value above quantitation range		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

MSE Lab Services

Date: *12-Oct-09*

CLIENT: ENSR International
Lab Order: 0909111
Project: Sediment Analysis
Lab ID: 0909111-001

Client Sample ID: 23121/MID
Collection Date: 9/2/2009 11:00:00 AM
Matrix: SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
SW-846-ICP-AES TOTAL METALS			**SW6010B**	**E200.2**			Analyst: js
Aluminum	10500	10.7	12.8		mg/Kg-dry	1	10/6/2009
Chromium	23.3	5.42	5.70		mg/Kg-dry	1	10/6/2009
Nickel	21.8	5.95	7.13		mg/Kg-dry	1	10/6/2009
Zinc	101	2.09	2.85		mg/Kg-dry	1	10/6/2009
ICP-MS METALS, SOLID SAMPLES			**SW6020**	**E200.2**			Analyst: SW
Arsenic	29.4	0.124	0.428		mg/Kg-dry	2	9/30/2009
Cadmium	0.283	0.007	0.029		mg/Kg-dry	2	9/30/2009
Copper	65.1	0.117	0.368		mg/Kg-dry	2	9/30/2009
Lead	7.88	0.013	0.057		mg/Kg-dry	2	9/30/2009
Selenium	1.09	0.194	0.570		mg/Kg-dry	2	9/30/2009
Silver	0.252	0.105	0.285	J	mg/Kg-dry	2	9/30/2009
MERCURY IN SOIL/SEDIMENT - SW846 7471B			**E245.5**	**SW7471A**			Analyst: YF
Mercury	0.0579	0.00786	0.0377		mg/Kg-dry	1	9/30/2009
ORGANIC MATTER-WALKLEY BLACK			**OM_WALKLEYBLACK**				Analyst: yf/dk
Organic Matter - Walkley Black	2.53	0.03	0.05		%	1	9/29/2009
PERCENT COARSE MATERIAL			**ASTMD422**				Analyst: bo/dk
1" Gradation	ND	0.05	0.10		%	1	9/28/2009
2mm Gradation	ND	0.05	0.10		%	1	9/28/2009
RAPID HYDROMETER (2 HOUR) MOD ASA 15-5			**MSA15-5**				Analyst: BO
% Clay	4.0	0.1	0.1		%	1	9/28/2009
% Sand	80.0	0.1	0.1		%	1	9/28/2009
% Silt	16.0	0.1	0.1		%	1	9/28/2009
Soil Class	LOAMY SAND					1	9/28/2009

Review

Qualifiers:				
	E	Value above quantitation range	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

MSE Lab Services

Date: *12-Oct-09*

CLIENT:	ENSR International	**Client Sample ID:**	23125/MID
Lab Order:	0909111	**Collection Date:**	9/2/2009 11:00:00 AM
Project:	Sediment Analysis		
Lab ID:	0909111-002	**Matrix:**	SEDIMENT

Analyses	Result	MDL	Rpt Limit	Qualifier	Units	DF	Date Analyzed
ACID VOLATILE SULFIDE-SIM. EXT. METALS			AVS-SEM				Analyst: kgw
Sulfide	1.19	1.08	3.00	J	µmoles/g	1	9/24/2009

Review

Qualifiers:				
	E	Value above quantitation range	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)

APPENDIX 2: BENTHIC INVERTEBRATE DATA

Appendix 2: Benthic Invertebrates collected in 2009.

			Slate Creek samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeropte	Baetidae	Baetis	34	16	5	2	1	19
	Heptageniidae	Epeorus	6	4				14
		Cinygmula	22	31	3	3	1	9
		Rithrogena		1	1	0	0	0
	Ephemerellidae	Attenella						
		Drunella	3	3	0	0	0	0
		Caudatella						
	Leptophlebiidae	Paraleptophlebia	17	17	1	2	1	11
Plecoptera	Chloroperlidae	Alaskaperla	2	1	1	9	0	0
		Haploperla						
		Suwallia	8	16	3	1	1	4
		Kathroperla						
		Plumiperla	11	2	0	0	0	0
		Neaviperla	0	0	0	1	0	0
	Capniidae	Paracapnia						
	Nemouridae	Shipsa	59	69	4	8	13	42
		Zapada	11	13	3	6	1	7
	Perlidae	Claassenia	1	0	1	0	0	3
		Hesperoperla	1	1	0	0	0	0
	Perlodidae	Salmoperla	10	2	1	0	0	0
		Megarcys						
	Leuctridae	Perlomyia	0	1	0	0	1	0
		Despaxia	0	0	1	0	0	0
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche						
		Arctopsyche	1	1	0	0	0	1
	Glossosomatidae	Glossoma	0	1	0	0	0	0
		Anagapetus						
	Polycentropidae	Neureclipses	1	0	0	0	0	0
		Paranyctiophylax						
	Rhyacophilidae	Rhyacophila	3	2	1	0	0	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	8	7	0	2	1	6
		Tvetenia						
		Parachaetocladius						
	Diamesinae	Pagastia	14	5	0	3	0	0
	Tanytarsini	Tanytarsus	96	43	3	7	0	3
		Stempellinella						
		Corynoneura						
Nematocera	Tipulidae	Dicranota						
		Tipula	2	2	2	2	0	1
Brachycera	Ceratopogonidae	Probezzia						
	Empididae	Clinocera						
Collembola	Entomobryidae	Tomocerus	5	1	1	1	1	2
		Semicerura		1	1	0	0	0
Oligochaetae			5	0	1	0	1	1
Simuliidae	Simuliidae	Prosimulium	22	191	92	9	18	58
Hydrachnidae	Eylaidae	Eylais	0	0	0	0	0	1
Sphaeriidae	Psidiinae	Psidium (pea clam)	267	39	103	45	65	146
		Total	**609**	**470**	**228**	**101**	**105**	**328**

Appendix 2 cont.

			Johnson Creek Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	473	428	710	463	51	552
	Heptageniidae	Epeorus	12	45	51	7	3	17
		Cinygmula	148	61	67	46	7	191
		Rithrogena	12	6	3	5	4	14
	Ephemerellidae	Attenella						
		Drunella	137	95	104	36	5	271
		Caudatella	10	29	101	37	0	41
	Leptophlebiidae	Paraleptophlebia	2	0	0	0	0	1
Plecoptera	Chloroperlidae	Triznaka						
		Haploperla						
		Suwallia	3	1	0	0	0	0
		Kathroperla		2	1	1	0	1
		Plumiperla	3	20	3	2	0	1
		Alaskaperla						
		Neaviperla						
	Leuctridae	Despaxia						
		Perlomyia	1	11	2	5	0	1
	Nemouridae	Zapada	46	9	35	20	1	37
		Nemoura	2	0	0	0	0	0
		Shipsa	0	1	2	2	0	2
		Prostoia	0	0	0	1	0	0
	Capniidae	Paracapnia	1	11	1	1	0	2
		Allocapnia						
		Eucanopsis						
	Perlodidae	Megarcys	1	1	0	0	0	2
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche	9	6	6	5	1	7
		Arctopsyche	3	0	0	0	0	0
	Glossosomatidae	Glossoma	114	14	25	9	1	31
	Rhyacophilidae	Rhyacophila	27	26	30	23	0	32
Diptera	Chironomidae							
sub-family	Orthocladiinae	Eukiefferiella A	18	33	26	34	0	58
		Tvetenia	5	2	5	2	0	12
		Corynoneura						
	Diamesinae	Pagasta	1	1	0	0	0	0
	Tanytarsini	Tanytarsus	11	4	3	3	0	6
	Tanypodinae	Telmatopelopia	1	0	1	0	0	0
Nematocera	Tipulidae	Dicranota	2	1	4	0	0	5
		Tipula						
Brachycera	Ceratopogonidae	Probezzia						
	Simuliidae	Prosimulium	4	8	38	10	0	2
Oligochaetae			1	0	0	0	0	2
Collembola		Folsomina						
Mites			0	0	2	0	0	2
		Total	**1047**	**815**	**1220**	**712**	**73**	**1288**

Appendix 2 cont. Sherman Reach 1 samples.

Order	Family	Genus	1	2	3	4	5	6
Ephemeroptera	Baetidae	Baetis	0	10	3	3	11	31
		Diphetor						
	Heptageniidae	Epeorus	2	3	1	3	4	12
		Cinygmula						
		Rithrogena	0	0	1	0	0	0
	Ephemerellidae	Caudatella	1				1	2
		Drunella	3	6	2	4	6	8
		Attenella						
	Leptophlebiidae	Leptophlebia	0	0	0	0	1	0
		Paraleptophlebia	0	0	0	0	0	0
	Ameletidae	Ameletus					1	
Plecoptera	Chloroperlidae	Alaskaperla	3	9	0	4	3	13
		Haploperla						
		Suwallia	0	0	0	0	2	1
		Kathroperla	1	0	0	1	2	0
		Plumiperla	1	5	2	3	5	0
		Neaviperla						
	Capniidae	Allocapnia						
		Paracapnia						
	Leuctricidae	Perlomyia						
	Nemouridae	Zapada	0	4	0	1	2	9
		Nemoura	0	1	0	0	0	0
		Shipsa						
	Perlodidae	Megarcys						
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche	0	0	0	1	0	0
	Glossosomatidae	Glossoma						
	Rhyacophilidae	Rhyacophila	1	2	3	3	1	4
	Limnephilidae	Moselyana	1	0	0	0	0	0
		Grensia	1	3	0	0	0	4
		Ecclisomyia						
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	5	7	4	5	5	11
		Tvetania	1	3	0	0	1	4
		Parachaetocladius	0	0	0	1	0	0
		Corynoneura						1
	Diamesinae	Diamesa	0	0	2	0	0	0
	Tanytarsini	Tanytarsus						
	Tanypodinae	Telmatopelopia	0	0	0	2	1	1
Nematocera	Tipulidae	Dicranota	4	0	0	0	0	3
		Prionocera	0	1	0	0	0	0
		Hexatoma	1	0	1	0	2	1
	Empididae	Clinocera	0	1	0	0	0	0
Brachycera	Ceratopogonidae	Dasyhelea	0	0	0	1	0	0
Simuliidae	Simuliidae	Prosimulium						
	Oligochaetae		2	4	1	5	2	5
Collembola	Onychiuridae	Lophognathella	0	1	0	1	1	0
	Sminthuridae	Dicyrtoma	0	0	0	0	0	1
Coleoptera	Haliplidae	Haliplus	0	1	0	0	0	1
Lepidoptera	Pyralidae	Crambus	0	0	1	0	0	0
		Total	**27**	**61**	**21**	**38**	**51**	**112**

Appendix 2 cont.

			Sherman Creek Reach 2					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeropte	Baetidae	Baetis	9	3	18	5	9	12
		Diphetor						
	Heptageniidae	Epeorus	0	3	14	2	1	3
		Cinygmula	0	0	1	0	0	0
		Rithrogena	0	0	1	0	0	0
	Ephemerellidae	Caudatella	3	0	1	1	1	1
		Drunella	3	1	5	2	0	6
		Attenella						
	Leptophlebiidae	Leptophlebia						
		Paraleptophlebia						
Plecoptera	Chloroperlidae	Alaskaperla	1	0	0	2	2	2
		Haploperla						
		Suwallia	1	3	0	2	0	0
		Kathroperla					2	1
		Plumiperla	6	5	13	4	6	2
		Neaviperla	0	0	0	4	0	0
	Capniidae	Allocapnia						
		Paracapnia						
	Leuctricidae	Perlomyia						
	Nemouridae	Zapada	0	0	0	0	0	1
		Nemoura	0	0	0	0	1	0
		Shipsa						
	Perlodidae	Megarcys						
Trichoptera	Brachycentridae	Micrasema						
	Hydropsychidae	Parapsyche						
	Glossosomatidae	Glossoma						
	Rhyacophilidae	Rhyacophila	2	6	0	0	0	3
		Himalopsyche						
		Grensia	0	0	0	0	0	1
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	5	1	4	2	2	3
		Tvetania	3	0	2	0	0	1
	Tanytarsini	Tanytarsus	1	0	0	0	0	0
	Tanypodinae	Telmatopelopia	1	0	0	0	1	0
	Podonominae	Paraboreochlus	0	0	1	0	0	0
Nematocera	Tipulidae	Dicranota	2	0	5	1	0	0
		Prionocera						
		Hexatoma	0	0	0	0	2	0
	Empididae	Clinocera	0	0	0	0	1	0
	Blephariceridae	Agathon	0	0	0	0	1	0
Brachycera	Ceratopogonidae	Dasyhelea						
Simuliidae	Simuliidae	Prosimulium						
	Oligochaetae		3	4	3	1	1	0
Collembola	Onychiuridae	Lophognathella	0	0	1	0	0	0
		Total	**40**	**26**	**69**	**26**	**30**	**36**

Appendix 2 cont.

			Sweeny Reach 1 Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	73	85	44	45	85	204
	Heptageniidae	Epeorus	2	4	2		2	4
		Cinygmula	1	3	4	2	12	2
		Rithrogena	2	1	2	7	2	1
	Ephemerellidae	Drunella	0	0	4	0	1	0
	Leptophlebiidae	Paraleptophlebia						
Plecoptera	Chloroperlidae	Alaskaperla						
		Haploperla						
		Kathroperla						
		Plumiperla	0	9	4	8	11	7
		Suwallia	2	0	0	0	1	0
	Capniidae	Paracapnia	4	2	2	7	5	7
	Leuctridae	Perlomyia	0	0	0	0	9	0
	Perlidae	Hesperoperla						
	Nemouridae	Zapada	2	1	1	0	2	0
		Nemoura						
	Perlodidae	Megarcys						
Trichoptera	Hydropsychidae	Parapsyche	0	1	0	0	1	0
		Arctopsyche						
	Glossosomatidae	Glossoma	1	1	0	0	0	1
		Agapetus						
	Polycentropidae	Neureclipses						
		Paranyctiophylax						
	Rhyacophilidae	Rhyacophila	0	0	0	0	1	0
	Limnephilidae	Rossiana	0	0		0	1	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	1	4	2	1	0	3
		Tvetania						
		Corynoneura						
	Podominae	Paraboreochlus						
	Tanytarsini	Tanytarsus						
	Tipulidae	Dicranota	0	0	0	0	1	0
		Hexatoma						
		Tipula						
	Simuliidae	Prosimulium						
	Oligochaetae		0	0	0	1	0	0
		Total	**88**	**111**	**65**	**71**	**134**	**229**

Appendix 2 cont.

			Sweeny Reach 2 Samples					
Order	**Family**	**Genus**	**1**	**2**	**3**	**4**	**5**	**6**
Ephemeroptera	Baetidae	Baetis	32	47	17	25	42	6
	Heptageniidae	Epeorus	6	9	3	2	6	0
		Cinygmula	8	11	4	7	7	2
		Rithrogena	6	3	2	5		1
	Ephemerellidae	Drunella	1	3	1	0	1	0
		Caudatella	0	0	0	0	1	0
	Leptophlebiidae	Paraleptophlebia						
Plecoptera	Chloroperlidae	Alaskaperla						
		Haploperla						
		Kathroperla	1	0	0	2	0	0
		Plumiperla	6	9	2	17	10	4
		Suwallia						
	Capniidae	Paracapnia	4	4	0	0	1	0
	Leuctridae	Perlomyia	7	2	1	3	0	1
	Perlidae	Hesperoperla						
	Nemouridae	Zapada	1	4	1	5	3	1
		Nemoura	0	1	0	0	0	1
		Shipsa	0	3	1	4	1	1
	Perlodidae	Megarcys						
Trichoptera	Hydropsychidae	Parapsyche						
		Arctopsyche						
	Glossosomatidae	Glossoma	0	0	0	1	0	0
	Rhyacophilidae	Rhyacophila	0	0	0	0	1	0
	Limnephilidae	Rossiana						
		Moselyana	1	0	0	0	0	0
Diptera								
Chironomidae	Orthocladiinae	Eukiefferiella	2	2	0	0	1	1
		Tvetania	2	0	0	0	1	0
		Corynoneura						
	Podominae	Paraboreochlus						
	Tanytarsini	Tanytarsus	1	0	0	0	1	0
	Tipulidae	Dicranota	3	0	0	1	0	0
		Hexatoma						
		Tipula						
	Empididae	Chelifera	2	0	0	0	0	0
	Ceratopogonidae	Dasyhelea	0	0	0	0	0	1
Simuliidae	Simuliidae	Prosimulium						
	Oligochaetae		0	0	0	0	1	0
Collembola	Onychiuridae	Lophognathella	0	0	0	0	0	1
		Total	**83**	**98**	**32**	**72**	**77**	**19**

APPENDIX 3A: ADFG FISH RESOURCE PERMIT
(SF2009-199, Resident Fish Survey)

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME

P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

Permit #: SF2009-199

Expires: 9/30/2009

Collections Report Due: 10/30/2009

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes Liz Flory *(whose signature is required on page 2 for permit validation)*
person

of Aquatic Sciences, Inc. *agency or organization* at 3031 Clinton Drive, Suite 202, Juneau, AK 99801 *address*

to conduct the following activities **from** July 1, 2009 **to** September 30, 2009 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/Sweeney/Slate/Johnson Creeks in the Berner's Bay area

Species Collected: Dolly Varden, cutthroat trout

Method of Capture: Minnow trap, backpack electrofisher **(Stipulation #7)**

Final Disposition: ≤240 Dolly Varden and ≤60 cutthroat trout may be captured, measured and released alive at the capture site.
All mortalities must be recorded/reported with carcasses returned to the capture site

-Continued on Back-

REPORT DUE October 30, 2009. 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. *It must also include the date/time the local biologist was contacted for final authorization to carry out collecting activities.* A completion report (abstract, background, methods, data, analysis), if not submitted with the collection report described above, must be submitted to the department by: ***March/2010***. 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 Begtz for Director
Division of Sport Fish

6-26-09
Date

Authorized Personnel: The following persons may perform collecting activities under terms of this permit:

Brian Flory, Elizabeth Flory, Katie Goodwin, Charmagne Gutierrez, Jill Michalak

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 (AMB), **Brian Glynn** (465-4318; brian.glynn@alaska.gov) Juneau, must be notified **prior** to you engaging in any collecting activities. *The time/date of this contact must be included in your collections report (using the "data submission form" furnished by ADF&G).* This biologist has 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 must be; 1) labeled with the permittee's name, telephone number, and permit number, 2) securely tied to substrate, 3) allowed to soak no more than twenty-four hours at a time, 4) located with GPS coordinates, and 5) 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) Because the use of Aqui-S as a fish sedative is specifically prohibited by the FDA and MS-222 is prohibited from being used on any fish that may be eaten by humans for 21 days after treatment, the Division of Sport Fish position is that food grade clove oil, purchasable at grocery stores, is the most logical choice with the least concern for liability as a fish anesthesia for tagging and telemetry studies.
5) 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 is adequate.
6) If anadromous fish species new to permitted streams and rivers are found, 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@alaska.gov
7) 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. All electroshocked fish should be monitored before release. Mortalities or injuries must be reported on the collections report. Operators of electroshockers must have formal training.
8) Atlantic salmon and other non-native invasive aquatic species encountered should be killed. Contact the nearest AMB (**Stipulation #1**) immediately with species identification or description, capture or sighting location, number captured, size, and sex. Preserve/turn in the whole specimen to the nearest ADF&G office.
9) *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.*
10) 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.
11) Fish and Game, Division of Sport Fish HQ, P.O. Box 115525, Juneau, AK 99811-5525, Attention: Bob Piorkowski (465-6109; Robert.Piorkowski@alaska.gov), and to the Biologist listed under **Stipulation #1** 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), 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.

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, Division of Habitat, Juneau
Fish and Wildlife Protection, Juneau

APPENDIX 3B: FISH HABITAT DIMENSIONS

Appendix 3b: Dimensions of each habitat unit.

2009 Resident Fish Habitat Summary						
Stream Reach	**Habitat Variable**	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Lower Johnson	Number of Units	**31**	**29**	**3**	**0**	**63**
	Total Length (m)	256.6	114.4	11.9	0.0	383
	Mean Length (m)	8.3	3.9	4.0	-	6.1
	Mean Width (m)	4.3	2.9	3.2	0.0	3.5
	Mean Area (m^2)	38.0	12.7	12.2	-	25.1
	Total Area (m^2)	**1176.5**	**368.8**	**36.7**	**0**	**1582.0**
	% of Total Area	74.4	23.3	2.3	0.0	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Johnson	Number of Units	**20**	**66**	**0**	**6**	**92**
	Total Length (m)	149.6	271.6	-	43.1	462.2
	Mean Length (m)	7.5	4.1	-	7.2	5.0
	Mean Width (m)	6.3	2.8	-	5.8	5.0
	Mean Area (m^2)	42.2	16.7	-	42.1	23.9
	Total Area (m^2)	**843.1**	**1099.0**	**-**	**252.4**	**2194.5**
	% of Total Area	38.4	50.1	0.0	11.5	100.0
	Habitat Variable	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Upper Johnson	Number of Units	**17**	**41**	**4**	**4**	**66**
	Total Length (m)	159.1	225.8	27.1	40.2	452.2
	Mean Length (m)	9.4	5.5	6.8	10.1	6.9
	Mean Width (m)	4.2	3.8	3.0	3.3	3.6
	Mean Area (m^2)	38.7	26.4	20.4	29.2	29.6
	Total Area (m^2)	**657.2**	**1082.6**	**81.4**	**116.7**	**1952.9**
	% of Total Area	33.7	55.4	4.2	6.0	100.0

Appendix 3b cont.

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Lower Sherman	Number of Units	17	46	3	4	70
	Total Length (m)	127.5	62.4	25.6	127.5	343
	Mean Length (m)	7.5	1.4	8.5	0.0	4.9
	Mean Width (m)	6.5	3.4	6.0	-	5.3
	Mean Area (m^2)	50.0	10.8	51.2	-	23.6
	Total Area (m^2)	**849.7**	**497.5**	**153.6**	**151**	**1652.0**
	% of Total Area	51.4	30.1	9.3	9.2	100.0
	Habitat Variable	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Middle Sherman	Number of Units	24	84	0	9	117
	Total Length (m)	180.0	142.0	-	22.3	344.3
	Mean Length (m)	7.5	1.7	-	2.5	2.9
	Mean Width (m)	6.0	2.3	-	2.5	3.7
	Mean Area (m^2)	20.0	4.9	-	8.6	8.3
	Total Area (m^2)	**478.9**	**413.3**	-	**77.1**	**969.3**
	% of Total Area	49.4	42.6	0.0	8.0	100.0
	Habitat Variable	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Upper Sherman	Number of Units	9	64	2	13	88
	Total Length (m)	78.2	210.4	12.2	46.5	347.3
	Mean Length (m)	8.7	3.3	6.1	3.6	3.9
	Mean Width (m)	2.6	1.6	2.7	2.6	1.9
	Mean Area (m^2)	12.0	8.4	9.1	7.2	8.6
	Total Area (m^2)	**107.6**	**536.8**	**18.2**	**93.4**	**756.0**
	% of Total Area	14.2	71.0	2.4	12.4	100.0
Stream Reach	**Habitat Variable**	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Lower Slate	Number of Units	24	37	17	2	80
	Total Length (m)	150.3	118.3	135.7	3.0	407.3
	Mean Length (m)	6.3	3.2	8.0	1.5	5.1
	Mean Width (m)	3.8	2.5	4.5	-	3.3
	Mean Area (m^2)	22.5	11.8	32.8	-	19.3
	Total Area (m^2)	**540.7**	**437.7**	**558.0**	**6**	**1542.4**
	% of Total Area	35.1	28.4	36.2	0.4	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Middle Slate	Number of Units	21	34	15	8	78
	Total Length (m)	113.5	59.0	141.2	31.1	344.8
	Mean Length (m)	5.4	1.7	9.4	3.9	4.4
	Mean Width (m)	3.9	2.7	3.7	3.3	3.4
	Mean Area (m^2)	11.7	3.1	32.5	6.7	11.5
	Total Area (m^2)	**246.4**	**106.8**	**488.2**	**53.8**	**895.2**
	% of Total Area	27.5	11.9	54.5	6.0	100.0
	Habitat Variable	**Riffle**	**Pool**	**Glide**	**Cascade**	**All Units**
Upper Slate	Number of Units	57	55	6	0	118
	Total Length (m)	175.2	150.4	20.1	0.0	345.7
	Mean Length (m)	3.1	2.7	3.4	0.0	2.9
	Mean Width (m)	1.9	1.7	2.2	-	1.9
	Mean Area (m^2)	5.3	3.7	4.7	-	4.5
	Total Area (m^2)	**301.6**	**202.7**	**28.2**	**0**	**532.5**
	% of Total Area	56.6	38.1	5.3	0.0	100.0

APPENDIX 3C: RESIDENT FISH SURVEY DATA

Appendix 3c: Resident fish survey data – fish counts per habitat unit.

Lower Sherman

Habitat Type	Distance (ft)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
SDPool	0.0	1.0	1.0	1.00	0			
SDPool	0.0	1.0	1.0	1.00	0			
Riffle	12.0	4.6	4.5	20.57	0			
SDPool	27.0	1.0	1.0	1.00	1	1	2	
Riffle	38.0	14.3	8.0	114.60		1		1
Riffle	85.0	14.3	7.0	100.28		1		1
Glide	132.0	9.8	6.0	58.52	0	0		
SDPool	164.0	3.0	3.0	9.00	5	2		
SDPool	189.0	6.4	3.5	22.40	0			
Cascade	210.0	8.5	4.0	34.14	NS			
Riffle	238.0	6.7	6.0	40.23	0			
SDPool	260.0	1.0	1.0	1.00	0			
SDPool	265.0	1.5	1.5	2.25	NS			
Cascade	278.0	5.5	7.0	38.40	NS			
Riffle	296.0	5.0	7.0	35.00	0			
SDPool	301.0	1.0	1.0	1.00		1	2	
Riffle	316.0	5.8	7.5	43.43		0		0
SDPool	335.0	2.0	2.0	4.00		0		
SDPool	343.0	1.5	1.5	2.25		1	2	
SDPool	344.0	1.0	1.0	1.00		0	1	1
Riffle	347.0	5.2	8.0	41.45		0		
SDPool	364.0	1.5	1.5	2.25		0		
SDPool	377.0	0.5	1.0	0.50		1		
Riffle	385.0	7.3	5.0	36.58		0		
Glide	409.0	5.5	6.0	32.92	1	0		
SDPool	427.0	3.0	2.0	6.00	2			
SDPool	445.0	2.0	1.5	3.00	1			
SDPool	462.0	3.0	2.0	6.00	0			
SDPool	481.0	1.5	0.5	0.75	0			
Riffle	500.0	5.2	5.0	25.91	0			
SDPool	517.0	1.5	1.0	1.50		1		
Riffle	530.0	4.6	6.0	27.43		0		
SDPool	545.0	1.0	1.0	1.00		NS		
SDPool	546.0	2.0	2.0	4.00		0		
Riffle	556.0	6.4	6.0	38.40		0		
SDPool	577.0	2.0	1.0	2.00		0		
Riffle	580.0	6.1	7.0	42.67		NS		
SDPool	600.0	2.0	2.0	4.00		0		
SDPool	608.0	2.0	2.0	4.00		0		
SDPool	625.0	3.0	3.0	9.00		2		
Riffle	626.0	11.3	8.0	90.22		NS		
Riffle	663.0	5.8	6.0	34.75		0		
SDPool	682.0	2.0	2.0	4.00		0		
SDPool	694.0	2.0	2.0	4.00		NS		
SDPool	712.0	3.0	2.0	6.00		0		
SDPool	718.0	2.0	2.0	4.00		NS		
SDPool	724.0	3.0	2.5	7.50		1		
Cascade	733.0	7.3	5.0	36.58		NS		
SDPool	757.0	1.5	2.0	3.00	1	1		
SDPool	758.0	1.5	2.0	3.00	NS			
SDPool	787.0	2.0	1.0	2.00	0			
SDPool	797.0	4.0	3.0	12.00	1			
SDPool	829.0	2.0	1.0	2.00	0			
SDPool	842.0	2.0	1.5	3.00	1			
SDPool	850.0	1.5	2.0	3.00	NS			
Riffle	858.0	5.5	7.5	41.15	0			
Glide	876.0	10.4	6.0	62.18	1			
SDPool	910.0	1.5	1.5	2.25	NS			
SDPool	918.0	1.5	2.0	3.00	0			
Cascade	920.0	7.0	6.0	42.06	NS			
SDPool	943.0	2.0	2.0	4.00	0			
SDPool	964.0	1.0	1.0	1.00	0			
Riffle	965.0	10.7	6.0	64.01	0			
SDPool	1000.0	2.0	2.0	4.00	0			
SDPool	1012.0	2.0	2.0	4.00	0			
Riffle	1013.0	8.8	6.0	53.04	NS			
SDPool	1042.0	1.0	1.0	1.00	0			
Pool	1071.0	15.8	6.0	95.10	5	1		
SDPool	1123.0	2.5	2.0	5.00	NS			
Pool	1178.0	16.8	14.0	234.70	13	1		

Middle Sherman

Habitat Type	Distance (ft)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
Riffle	0.0	0.9	5.0	4.42	NS			
SDPool	2.9	2.0	3.0	6.00	1			
SDPool	5.1	1.0	1.0	1.00	1			
Pool	8.5	3.5	2.5	8.75	NS			
Sriff	8.5	1.1	1.0	1.07	0		0	
Riffle	12.0	1.1	6.0	6.40	NS			
SDPool	12.0	2.0	3.0	6.00	3		2	
SDPool	12.0	1.5	1.5	2.25	NS			
SDPool	16.3	2.0	2.0	4.00	1			
SDPool	0.0	4.0	3.0	12.00	1			
Pool	13.0	5.0	5.5	27.50	6		2	
Pool	21.0	5.0	4.0	20.00	2			
Cascade	38.0	5.2	1.0	5.18	NS			
SDPool	38.0	4.0	3.0	12.00	1			
Riffle	51.0	4.0	3.0	11.89	NS			
SDPool	51.0	3.0	2.0	6.00	1			
SDPool	62.0	6.0	4.0	24.00	1			
Riffle	62.0	3.4	5.0	16.76	0		0	
SDPool	77.0	2.0	1.0	2.00	NS			
SDPool	90.0	2.0	1.0	2.00	1		2	
SDPool	118.0	2.0	2.0	4.00	1			
SDPool	131.0	3.0	2.0	6.00	1			
Riffle	132.0	21.3	5.0	106.68	NS			
Pool	147.0	2.0	1.0	2.00	1			
SDPool	150.0	4.0	2.0	8.00	2			
SDPool	159.0	2.0	1.0	2.00	NS			
SDPool	164.0	4.0	3.0	12.00	1			
SDPool	164.0	2.0	2.0	4.00	NS			
SDPool	180.0	5.0	3.0	15.00	2		2	
Riffle	180.0	4.9	5.0	24.38	1		1	
Pool	199.0	6.0	4.0	24.00	0			
Riffle	199.0	4.0	6.5	26.00	0			
SDPool	199.0	1.5	1.5	2.25	0			
SDPool	217.0	0.5	0.5	0.25	0			
Pool	221.0	2.0	2.0	4.00	1			
SDPool	225.0	2.0	1.0	2.00	0			
Riffle	228.0	2.1	8.0	17.07	NS			
SDPool	228.0	2.0	2.0	4.00	0			
SDPool	242.0	2.0	2.0	4.00	2		1	
SDPool	261.0	2.0	2.0	4.00	0			
SDPool	264.0	2.0	1.0	2.00	0			
Pool	289.0	4.0	1.5	6.00	2			
SDPool	289.0	4.0	1.0	4.00	0			
SDPool	300.0	2.0	2.0	4.00	0			
SDPool	317.0	1.0	2.0	2.00	0			
SDPool	317.0	1.0	1.0	1.00	1			
SDPool	317.0	1.0	2.0	2.00	0			
Riffle	330.0	12.5	7.0	87.48	0		0	
SDPool	342.0	2.0	2.0	4.00	0			
SDPool	350.0	4.0	4.0	16.00	2			
SDPool	366.0	2.0	1.0	2.00	0			
SDPool	366.0	2.0	2.0	4.00	NS			
SDPool	375.0	3.0	2.0	6.00	1			
SDPool	380.0	2.0	2.0	4.00	0			
SDPool	393.0	3.0	2.0	6.00	0			
Pool	396.0	2.0	2.0	4.00	1			
SDPool	400.0	3.0	3.0	9.00	2			
Riffle	415.0	2.0	2.0	4.00	1			

Middle Sherman cont.

Habitat Type	Distance (ft)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
					Dv	Ct	Dv	Ct
SDPool	419.0	2.0	2.0	4.00	NS			
Riffle	437.0	6.7	7.0	46.94	0			
SDPool	437.0	2.0	2.0	4.00	0			
Cascade	449.0	3.7	5.0	18.29	NS			
Pool	461.0	2.0	2.0	4.00	1			
Pool	473.0	5.0	5.0	25.00	5			
Cascade	485.0	3.7	5.0	18.29	0			
Pool	500.0	1.0	2.0	2.00	0			
Pool	524.0	2.0	2.0	4.00	2			
Pool	536.0	2.0	2.0	4.00	1			
Cascade	542.0	1.8	2.0	3.66	NS			
SDPool	553.0	1.5	1.5	2.25	0			
Riffle	554.0	3.7	4.0	14.63	1			
Pool	561.0	3.0	2.0	6.00	1			
Pool	571.0	1.0	2.0	2.00	0			
Riffle	579.0	2.4	4.0	9.75	0			
SDPool	595.0	2.0	1.0	2.00	1			
Cascade	605.0	7.9	4.0	31.70	NS			
Riffle	623.0	8.5	2.0	17.07	0			
Riffle	623.0	5.5	2.0	10.97	1			
Riffle	652.0	8.8	5.0	44.20	0			
SDPool	664.0	1.0	1.0	1.00	0			
Pool	675.0	4.0	4.0	16.00	2			
Riffle	691.0	4.9	3.0	14.63	0			
SDPool	699.0	2.0	2.0	4.00	0			
Pool	699.0	2.0	2.0	4.00	1			
Riffle	711.0	3.7	4.0	14.63	0			
Pool	719.0	4.0	4.0	16.00	1			
Pool	729.0	3.0	2.0	6.00	0			
Pool	735.0	2.0	2.0	4.00	0			
Pool	739.0	2.0	2.0	4.00	1			
Pool	748.0	2.0	2.0	4.00	0			
Pool	755.0	1.0	2.0	2.00	NS			
Riffle	763.0	2.4	5.0	12.19	NS			
Pool	780.0	5.2	6.0	31.09	2			
Pool	788.0	2.4	3.0	7.32	1			
SDPool	806.0	5.5	3.0	16.46	1			
SDPool	822.0	4.0	2.0	8.00	0			
Pool	826.0	3.0	2.0	6.00	0			
Pool	836.0	3.0	2.0	6.00	1			
Riffle	843.0	2.1	3.0	6.40	0			
Pool	855.0	1.0	2.0	2.00	0			
Pool	870.0	3.0	2.0	6.00	0			
Pool	887.0	3.0	2.0	6.00	1			
Pool	905.0	4.0	3.0	12.00	1			
Cascade	920.0	4.6	2.5	11.43	NS			
Riffle	930.0	3.0	2.5	7.62	NS			
Pool	940.0	3.0	2.0	6.00	2			
Cascade	948.0	2.4	4.0	9.75	NS			
Pool	980.0	2.0	2.0	4.00	NS			
Pool	986.0	3.0	2.0	6.00	1			
Pool	1008.0	4.0	3.0	12.00	NS			
Riffle	1020.0	3.7	3.5	12.80	NS			
SDPool	1058.0	2.0	2.0	4.00	1			
Cascade	1067.0	2.7	2.0	5.49	NS			
Pool	1097.0	6.0	6.0	36.00	2			
Cascade	1120.0	7.0	2.0	14.02	NS			
Pool	1133.0	3.0	2.0	6.00	NS			
Pool	1140.0	3.0	2.0	6.00	0			
Riffle	1147.0	2.1	2.0	4.27	NS			
Pool	1155.0	4.0	2.0	8.00	1			
Pool	1180.0	4.0	4.0	16.00	2			

Upper Sherman

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Length (m)	Area (m²)	Snorkel		E-fisher	
							Dv	Ct	Dv	Ct
SDPool	0.0	0.0	3.0	2.0	3.0	6.00	2	n/a		n/a
Pool	12.0	3.7	3.7	2.0	3.7	7.32	NS			
SDPool	12.0	3.7	3.0	11.0	3.0	33.00	1			
Pool	23.0	7.0	3.4	4.0	3.4	13.42	1			
Pool	36.0	11.0	4.0	5.0	4.0	19.83	3			
Riffle	58.0	17.7	6.7	8.0	6.7	53.68	2		2	
Riffle	74.0	22.6	4.9	8.0	4.9	39.04	0			
Pool	92.0	28.1		1.0	2.0	2.00	1			
Pool	115.0	35.1		2.0	2.0	4.00	NS			
Riffle	120.0	36.6	1.5		1.5	0.00	0			
SDPool	129.0	39.3		2.0	2.0	4.00	2			
Riffle	147.0	44.8	5.5		5.5	0.00	1			
SDPool	152.0	46.4	1.5	1.0	1.0	1.00	0		0	
Pool	158.0	48.2	1.8	5.0	1.8	9.15	4		4	
Cascade	174.0	53.1	4.9		4.9	0.00	NS			
Pool	188.0	57.3	4.3	3.0	4.3	12.81	3		3	
Cascade	206.0	62.8	5.5	2.0	2.0	4.00	NS			
Pool	216.0	65.9	3.1	3.5	3.1	10.68	3		4	
Riffle	222.0	67.7	1.8		1.8	0.00	NS			
Pool	253.0	77.2	9.5	4.0	4.0	16.00	2		2	
SDPool	264.0	80.5	3.4	4.0	4.0	16.00	2		2	
Pool	274.0	83.6	3.1	2.0	3.1	6.10	1		2	
Riffle	295.0	90.0	6.4		6.4	0.00	1		1	
Cascade	299.0	91.2	1.2		1.2	0.00	NS			
SDPool	312.0	95.2	4.0	1.0	2.0	2.00	0		0	
SDPool	327.0	99.7	4.6	1.0	2.0	2.00	NS			
Riffle	340.0	103.7	4.0		4.0	0.00	1		1	
Pool	353.0	107.7	4.0	3.0	4.0	11.90	3		3	
Cascade	367.0	111.9	4.3		4.3	0.00	NS			
SDPool	375.0	114.4	2.4	2.0	3.0	6.00	1		1	
Cascade	385.0	117.4	3.1		3.1	0.00	NS			
SDPool	395.0	120.5	3.1	1.0	1.5	1.50	0			
SDPool	417.0	127.2	6.7	1.5	1.5	2.25	1		1	
SDPool	430.0	131.2	4.0	1.5	1.5	2.25	2		3	
SDPool	438.0	133.6	2.4	2.0	2.0	4.00	0			
Cascade	447.0	136.3	2.7		2.7	0.00	NS			
Glide	462.0	140.9	4.6		4.6	0.00	1		1	
Pool	485.0	147.9	7.0	2.0	7.0	14.03	2		2	
Cascade	492.0	150.1	2.1		2.1	0.00	NS			
Pool	510.0	155.6	5.5	4.0	5.5	21.96	2		3	
Pool	520.0	158.6	3.1	3.0	3.1	9.15	0			

Upper Sherman cont.

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Length (m)	Area (m²)	Snorkel		E-fisher	
							Dv	Ct	Dv	Ct
SDPool	536.0	163.5	4.9	2.0	3.0	6.00	1		1	
SDPool	541.0	165.0	1.5	1.0	1.0	1.00	1		1	
SDPool	549.0	167.4	2.4	1.5	1.5	2.25	0			
Pool	554.0	169.0	1.5	1.0	1.0	1.00	1			
Pool	561.0	171.1	2.1	3.0	2.1	6.40	1			
Pool	573.0	174.8	3.7	1.0	2.0	2.00	0		0	
SDPool	583.0	177.8	3.1	2.0	2.0	4.00	2			
SDPool	595.0	181.5	3.7	1.0	2.0	2.00	NS			
SDPool	606.0	184.8	3.4	3.0	3.4	10.07	1			
Pool	610.0	186.1	1.2	2.5	1.2	3.05	2			
Pool	624.0	190.3	4.3	3.0	3.0	9.00	0			
Pool	636.0	194.0	3.7	3.0	3.7	10.98	2			
Pool	663.0	202.2	8.2	2.0	3.0	6.00	0			
SDPool	671.0	204.7	2.4	1.0	1.0	1.00	0			
SDPool	682.0	208.0	3.4	2.0	3.0	6.00	1			
Cascade	689.0	210.1	2.1	2.0	2.1	4.27	NS			
Pool	701.0	213.8	3.7	6.0	5.0	30.00	13			
Pool	723.0	220.5	6.7	2.0	3.0	6.00	1			
SDPool	742.0	226.3	5.8	1.5	1.5	2.25	0			
SDPool	760.0	231.8	5.5	2.0	2.0	4.00	0			
SDPool	770.0	234.9	3.1	2.0	2.0	4.00	1			
Riffle	772.0	235.5	0.6	2.0	0.6	1.22	2			
SDPool	795.0	242.5	7.0	1.0	2.0	2.00	0			
Pool	833.0	254.1	11.6	2.0	2.0	4.00	1			
SDPool	833.0	254.1	0.0	2.0	3.0	6.00	0			
Pool	854.0	260.5	6.4	2.0	3.0	6.00	1			
Glide	859.0	262.0	1.5	3.0	1.5	4.58	3			
Cascade	880.0	268.4	6.4	3.0	6.4	19.21	NS			
Pool	890.0	271.5	3.1	1.5	1.5	2.25	NS			
SDPool	900.0	274.5	3.1	1.0	2.0	2.00	0			
Pool	901.0	274.8	0.3	3.0	3.0	9.00	NS			
Pool	916.0	279.4	4.6	2.0	3.0	6.00	NS			
Pool	929.0	283.3	4.0	3.0	4.0	11.89	3			
Pool	955.0	291.3	7.9	3.0	7.9	23.79	2			
Pool	970.0	295.9	4.6	2.5	4.6	11.44	3			
Pool	979.0	298.6	2.7	3.0	2.7	8.24	1			
Cascade	995.0	303.5	4.9	3.0	4.9	14.64	NS			
SDPool	1001.0	305.3	1.8	1.0	3.0	3.00	0			
SDPool	1016.0	309.9	4.6	1.0	3.0	3.00	1			
Pool	1019.0	310.8	0.9	4.0	0.9	3.66	2			
Cascade	1029.0	313.8	3.0	4.0	3.0	12.20	NS			
SDPool	1029.0	313.8	0.0	2.0	2.0	4.00	2			
Riffle	1051.0	320.6	6.7	2.0	6.7	13.42	2			
Pool	1071.0	326.7	6.1	4.0	6.1	24.40	4			
Cascade	1087.0	331.5	4.9	4.0	4.9	19.52	NS			
SDPool	1124.0	342.8	11.3	4.5	11.3	50.78	1			
Cascade	1140.0	347.7	4.9	4.0	4.9	19.52	NS			

Lower Johnson

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel			E-fisher		
						Dv	Ct	Co	Dv	Ct	Co
Riffle	0.0	0.0	3.0	2.5	7.62	1	0		1		
SDPool	10.0	3.0	5.5	1.0	5.49	0	0		0		
Riffle	28.0	8.5	3.7	2.0	7.32	0	0		0		
Pool	40.0	12.2	1.5	4.5	6.86	3	0	6			
Riffle	45.0	13.7	9.4	3.0	28.35	1	0	5			
SDPool	76.0	23.2	2.0	1.5	3.00	0	0		0		
SDPool	76.0	23.2	2.0	3.0	6.00	0	0				
SDPool	90.0	27.4	3.0	2.5	7.62	1	0		1		
Riffle	100.0	30.5	16.8	2.5	41.91	NS					
Riffle	120.0	36.6	6.1	2.5	15.24	0	0		0		
SDPool	135.0	41.1	2.0	0.5	1.00			3			
SDPool	135.0	41.1	2.0	3.0	6.00			2			
Riffle	144.0	43.9	7.3	4.0	29.26			2			
Riffle	156.0	47.5	3.7	4.0	14.63	NS					
Riffle	167.0	50.9	3.4	4.5	15.09	1	0		1		
Riffle	190.0	57.9	7.0	4.0	28.04	NS					
SDPool	205.0	62.5	2.0	3.0	6.00	1	1		1	1	
Riffle	205.0	62.5	4.6	3.0	13.72	NS					
Riffle	215.0	65.5	3.0	3.5	10.67	2	0		2		
SDPool	252.0	76.8	2.0	3.5	7.00			2			
Pool	264.0	80.5	14.9	2.5	37.34			2			
Glide	280.0	85.3	4.9	2.5	12.19	0	2		0	0	
Riffle	305.0	93.0	7.6	3.5	26.67	1	0		1		
Riffle	320.0	97.5	4.6	1.5	6.86	NS					
SDPool	339.0	103.3	4.0	2.0	8.00	1	0				
Riffle	339.0	103.3	5.8	3.5	20.27	2	0				
SDPool	374.0	114.0	2.0	2.0	4.00			8			
Cascade	393.0	119.8	16.5	2.5	41.15	NS					
Glide	400.0	121.9	2.1	3.5	7.47	3	0				
Riffle	434.0	132.3	10.4	3.5	36.27	NS					
Pool	450.0	137.2	4.9	4.5	21.95	2	0	4	2		
Pool	472.0	143.9	1.0	3.0	3.00	5	0				
Riffle	500.0	152.4	8.5	2.0	17.07	NS					
Riffle	516.0	157.3	4.9	2.5	12.19	0	0				
Glide	532.0	162.2	4.9	3.5	17.07	2	0		2	0	
SDPool	556.0	169.5	1.5	1.0	1.50	1	0		1		
SDPool	556.0	169.5	1.5	1.0	1.50	NS					
Riffle	560.0	170.7	8.5	2.0	17.07	NS					
Riffle	580.0	176.8	7.3	2.5	18.29	1	0				
Pool	607.0	185.0	4.0	4.5	18.00	5	0				
Pool	658.0	200.6	5.0	4.0	20.00	5	0		6		
Riffle	660.0	201.2	0.6	8.5	5.18	0	0		1		
SDPool	680.0	207.3	8.0	4.0	32.00	15	0		16		
Pool	690.0	210.3	3.0	6.0	18.29	8	0		9		
SDPool	695.0	211.8	6.0	2.0	12.00	9	0		9		
Pool	713.0	217.3	10.0	6.0	60.00	NS					
Riffle	738.0	224.9	7.6	6.5	49.53	0	0				
SDPool	750.0	228.6	2.0	2.0	4.00	1	0		1		
Riffle	750.0	228.6	3.7	6.5	23.77	1	0				
SDPool	773.0	235.6	3.0	2.0	6.00	0	0		0		
Riffle	792.0	241.4	12.8	7.5	96.01	0	0				
SDPool	792.0	241.4	4.0	1.5	6.00	4	0				
Riffle	810.0	246.9	5.5	4.0	21.95	NS					
SDPool	862.0	262.7	2.0	2.0	4.00	2	0				
Riffle	900.0	274.3	27.4	4.5	123.44	0	0				
Riffle	909.0	277.1	14.3	4.5	64.47	NS					
Riffle	930.0	283.5	9.1	3.5	32.00	1	0				
Riffle	974.0	296.9	19.8	9.5	188.21	13	0				
Pool	1031.0	314.2	6.0	6.0	36.00	0	0		0		
Riffle	1040.0	317.0	2.7	7.0	19.20	NS					
Pool	1110.0	338.3	8.0	3.0	24.00	2	0				
Riffle	1156.0	352.3	14.0	8.5	119.18	2	0				
SDPool	1190.0	362.7	1.5	1.5	2.25	1	0				
Riffle	1200.0	365.8	13.4	5.0	67.06	NS					

Middle Johnson

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
Riffle	0.0	0.0	6.1	8.0	48.77	0		0	
SDPool	20.0	6.1	3.0	2.0	6.00	1		1	
SDPool	28.0	8.5	4.0	2.0	8.00	0		0	
Riffle	53.0	16.2	7.6	5.0	38.10	0			
Riffle	82.0	25.0	8.8	4.5	39.78	0		0	
Pool	87.0	26.5	1.5	3.5	5.33	3			
Riffle	95.0	29.0	2.4	3.5	8.53	NS			
Riffle	111.0	33.8	4.9	8.0	39.01	0			
SDPool	114.0	34.7	1.5	1.5	2.25	1		1	
SDPool	124.0	37.8	2.0	1.0	2.00	0		0	
SDPool	125.0	38.1	2.0	1.0	2.00	0			
SDPool	133.0	40.5	2.0	1.5	3.00	0		0	
Riffle	139.0	42.4	8.5	6.0	51.21	0		0	
SDPool	152.0	46.3	1.5	1.5	2.25	0		0	
Riffle	159.0	48.5	6.1	8.0	48.77	NS			
SDPool	175.0	53.3	2.0	1.0	2.00	1		1	
SDPool	185.0	56.4	1.0	1.0	1.00	0		0	
SDPool	185.0	56.4	2.0	1.5	3.00	3			
Riffle	195.0	59.4	11.0	8.0	87.78	2		2	
SDPool	207.0	63.1	2.0	1.0	2.00	1			
SDPool	231.0	70.4	2.0	1.0	2.00	0		0	
Pool	237.0	72.2	12.8	5.0	64.01	2			
Riffle	258.0	78.6	6.4	8.0	51.21	NS			
SDPool	273.0	83.2	3.0	2.0	6.00	0			
SDPool	280.0	85.3	2.0	1.0	2.00	0		0	
Pool	289.0	88.1	9.4	5.0	47.24	1			
Riffle	300.0	91.4	3.4	7.0	23.47	NS			
SDPool	305.0	93.0	3.0	2.0	6.00	1			
SDPool	318.0	96.9	2.0	2.0	4.00	0		0	
SDPool	324.0	98.8	2.0	2.0	4.00	NS			
Riffle	335.0	102.1	10.7	4.0	42.67	0			
SDPool	337.0	102.7	4.0	3.0	12.00	2		3	
Riffle	353.0	107.6	5.5	6.0	32.92	NS			
SDPool	372.0	113.4	3.0	2.0	6.00	1		2	
SDPool	376.0	114.6	3.0	2.0	6.00	0			
Pool	396.0	120.7	13.1	8.0	104.85	46		50	
Cascade	462.0	140.8	20.1	6.0	120.70	NS			
Pool	482.0	146.9	6.1	6.0	48.77	3		4	
Riffle	530.0	161.5	14.6	8.0	14.63	NS			
SDPool	538.0	164.0	1.0	1.0	1.00	NS			
SDPool	544.0	165.8	1.0	1.0	7.00	NS			
Riffle	555.0	169.2	7.6	7.0	15.24	0			
SDPool	582.0	177.4	3.0	2.0	9.00	NS			

Middle Johnson cont.

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
SDPool	582.0	177.4	3.0	3.0	3.00	0		0	
SDPool	592.0	180.4	3.0	1.0	15.00	NS			
Pool	592.0	180.4	10.0	5.0	50.00	7		7	
Pool	608.0	185.3	4.9	5.0	24.38	9			
Cascade	633.0	192.9	5.0	3.0	15.00	NS			
SDPool	636.0	193.9	2.5	1.0	2.50	NS			
Riffle	647.0	197.2	4.3	4.0	17.07	NS			
SDPool	650.0	198.1	2.0	1.0	2.00	0		0	
SDPool	664.0	202.4	1.0	1.0	1.00	NS			
SDPool	672.0	204.8	2.0	1.0	2.00	NS			
SDPool	680.0	207.3	2.0	2.0	4.00	0		0	
SDPool	680.0	207.3	3.0	3.0	9.00	3			
Pool	703.0	214.3	17.1	6.0	102.41	13			
Cascade	727.0	221.6	7.3	8.0	58.52	NS			
SDPool	735.0	224.0	3.0	3.0	9.00	1			
SDPool	743.0	226.5	3.0	3.0	9.00	1			
Pool	758.0	231.0	9.4	4.0	37.80	0			
Pool	768.0	234.1	3.0	4.0	12.19	NS			
Cascade	779.0	237.4	3.4	7.0	23.47	NS			
SDPool	784.0	239.0	3.0	3.0	9.00	1			
SDPool	794.0	242.0	2.0	2.0	4.00	1			
SDPool	800.0	243.8	5.0	5.0	25.00	6			
Riffle	814.0	248.1	10.7	7.0	74.68	0			
Pool	831.0	253.3	5.2	5.0	25.91	8			
Cascade	849.0	258.8	5.5	4.0	21.95	NS			
SDPool	859.0	261.8	2.0	2.0	4.00	NS			
Pool	873.0	266.1	7.3	4.0	29.26	NS			
SDPool	891.0	271.6	3.0	3.0	9.00	NS			
Riffle	896.0	273.1	3.0	3.0	9.00	NS			
SDPool	899.0	274.0	4.0	3.0	12.00	2			
Pool	907.0	276.5	3.4	6.0	20.12	7			
Riffle	922.0	281.0	7.0	6.0	42.06	NS			
SDPool	930.0	283.5	3.0	3.0	9.00	1			
SDPool	957.0	291.7	3.0	2.0	6.00	0			
SDPool	974.0	296.9	2.0	2.0	4.00	NS			
SDPool	981.0	299.0	2.0	2.0	4.00	0			
Pool	987.0	300.8	19.8	6.5	128.78	9			
Pool	1003.0	305.7	4.9	5.0	24.38	12			
Pool	1026.0	312.7	7.0	3.0	21.03	NS			
Cascade	1032.0	314.6	1.8	7.0	12.80	NS			
SDPool	1056.0	321.9	2.0	2.0	4.00	1			
Riffle	1067.0	325.2	10.7	9.0	96.01	NS			
SDPool	1070.0	326.1	2.0	1.0	2.00	NS			
SDPool	1074.0	327.4	4.0	2.0	8.00	2			
SDPool	1081.0	329.5	4.0	4.0	16.00	13			
SDPool	1083.0	330.1	4.0	3.0	12.00	2			
Riffle	1101.0	335.6	10.4	6.0	62.18	NS			
SDPool	1133.0	345.3	2.0	2.0	4.00	NS			
Pool	1144.0	348.7	13.1	5.0	65.53	0			

Upper Johnson

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
Pool	0.0	0.0	8.8	3.0	26.52	0			
Riffle	29.0	8.8	2.1	3.0	6.40	0			
Riffle	36.0	11.0	0.0	3.0	0.00	NS			
SDPool	36.0	11.0	1.0	1.0	1.00	0		0	
Riffle	41.0	12.5	1.5	3.5	5.33	0			
Pool	62.0	18.9	7.9	2.5	19.81	0		0	
Glide	73.0	22.3	9.8	3.0	29.26	0			
Pool	84.0	25.6	6.7	4.0	26.82	0		0	
Glide	101.0	30.8	8.5	3.0	25.60	0		0	
SDPool	105.0	32.0	1.2	1.0	1.22	NS			
SDPool	114.0	34.7	1.0	2.0	2.00	NS			
Glide	115.0	35.1	4.3	3.0	12.80	1		1	
SDPool	127.0	38.7	3.0	2.0	6.00	0			
Glide	130.0	39.6	4.6	3.0	13.72	0			
Pool	139.0	42.4	3.7	4.0	14.63	0		0	
Riffle	172.0	52.4	12.8	2.0	25.60	NS			
SDPool	180.0	54.9	8.0	1.0	8.00	NS			
SDPool	188.0	57.3	15.0	1.0	15.00	0			
Pool	203.0	61.9	9.4	25.0	236.22	1		2	
Pool	248.0	75.6	13.7	4.0	54.86	0		2	
Pool	296.0	90.2	14.6	4.0	58.52	0		2	
Pool	316.0	96.3	6.1	7.0	42.67	0			
Pool	348.0	106.1	9.8	5.0	48.77	2		2	
Pool	383.0	116.7	10.7	4.0	42.67	0			
Pool	398.0	121.3	4.6	15.0	68.58	8			
Pool	455.0	138.7	17.4	8.0	138.99	0		0	
Pool	464.0	141.4	2.7	4.0	10.97	0			
Riffle	490.0	149.4	7.9	4.0	31.70	0		1	
SDPool	500.0	152.4	3.0	3.0	9.00	0			
Pool	519.0	158.2	8.8	5.0	44.20	2		2	
Riffle	537.0	163.7	3.0	6.0	18.00	0		1	
Pool	540.0	164.6	6.4	4.0	25.60	1			
Riffle	550.0	167.6	3.0	8.0	24.38	0		0	
SDPool	550.0	167.6	3.0	2.0	6.00	4		4	
Riffle	556.0	169.5	1.8	5.0	9.14	1		1	
SDPool	582.0	177.4	4.0	3.0	12.00	0			
Pool	590.0	179.8	10.4	3.0	31.09	3		3	
Riffle	620.0	189.0	9.1	4.5	41.15	NS			
Riffle	669.0	203.9	14.9	4.5	67.21	0		0	
SDPool	693.0	211.2	1.5	1.5	2.25	1		1	
SDPool	717.0	218.5	2.0	1.0	2.00	0			
Riffle	719.0	219.2	15.2	5.0	76.20	NS			
SDPool	738.0	224.9	2.0	1.0	2.00	0		0	
SDPool	745.0	227.1	1.5	1.5	2.25	0			
SDPool	755.0	230.1	2.0	1.0	2.00	0		0	
Riffle	771.0	235.0	15.8	5.0	79.25	2		2	
SDPool	798.0	243.2	3.0	2.0	6.00	2		2	
Riffle	813.0	247.8	12.8	5.0	64.01	0		0	
SDPool	822.0	250.5	2.0	1.0	2.00	0			
SDPool	853.0	260.0	2.0	1.0	2.00	0		0	
Cascade	864.0	263.3	15.5	4.0	62.18	NS			
SDPool	888.0	270.7	2.0	2.0	4.00	0			
SDTrib	901.0	274.6	5.0	3.0	15.00	NS			
Riffle	906.0	276.1	12.8	5.0	64.01	0		0	
SDPool	936.0	285.3	3.0	2.0	6.00	0			
Riffle	948.0	289.0	12.8	3.0	38.40	NS			
SDPool	960.0	292.6	4.0	3.0	12.00	0		0	
Pool	970.0	295.7	6.7	5.0	33.53	0			
Cascade	984.0	299.9	4.3	5.0	21.34	NS			
Pool	989.0	301.4	1.5	6.0	9.14	1			
Cascade	1010.0	307.8	6.4	3.0	19.20	NS			
Pool	1025.0	312.4	4.6	4.0	18.29	NS			
Cascade	1071.0	326.4	14.0	1.0	14.02	ns			
Riffle	1100.0	335.3	8.8	1.0	8.84	0			
SDPool	1108.0	337.7	3.0	4.0	12.00	NS			
SDPool	1145.0	349.0	4.0	4.0	16.00	0			
Riffle	1180.0	359.7	24.4	4.0	97.54	NS			

Lower Slate

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel			E-fisher		
						Dv	Ct	Co	Dv	Ct	Co
Glide	0.0	0.0	13.7	8.0	109.80	0	0	20			
SDPool	45.0	13.7	2.0	2.0	4.00	0	0	30			
Pool	70.0	21.4	7.6	4.0	30.50	0	4	30	0	5	
Glide	71.0	21.7	7.9	5.0	39.65			20			
Riffle	92.0	28.1	6.4	2.0	12.81	0	3		0	3	
SDPool	134.0	40.9	1.5	1.5	2.25			0			
Glide	135.0	41.2	13.1	5.0	65.58	0	2		0	2	
Riffle	148.0	45.1	4.0	6.0	23.79	NS	NS	NS			
SDPool	158.0	48.2	1.5	1.5	2.25	0	1				
Glide	176.0	53.7	8.5	3.0	25.62	0	1		0	1	
Riffle	192.0	58.6	4.9	4.5	21.96	0	2				
Glide	204.0	62.2	3.7	4.0	14.64	0	0				
SDPool	220.0	67.1	2.0	1.5	3.00	0	3	4	0	4	
SDPool	227.0	69.2	2.0	7.0	14.00	0	0	0			
SDPool	230.0	70.2	1.0	1.0	1.00	0	0	0			
Pool	240.0	73.2	11.0	7.0	76.86	0	0	0			
Riffle	270.0	82.4	6.0	4.0	24.00	0	4	30			
SDPool	280.0	85.4	2.0	6.0	12.00			0			
Riffle	280.0	85.4	3.1	6.0	18.30	0	2	5			
Pool	302.0	92.1	6.7	8.0	53.68			NS			
Cascade	306.0	93.3	2.0	1.0	2.00			NS			
Riffle	328.0	100.0	6.7	7.0	46.97	0	0	0	0	0	
SDPool	338.0	103.1	1.0	1.0	1.00	0	1	0			
SDPool	348.0	106.1	2.0	5.0	10.00	0	1		0	2	
Pool	366.0	111.6	11.6	1.0	11.59			NS			
Cascade	380.0	115.9	1.0	1.0	1.00		ns				
Riffle	388.0	118.3	2.4	1.0	2.44	0	1		0	1	
Riffle	396.0	120.8	2.4	7.0	17.08	0	1		0	1	
Glide	434.0	132.4	11.6	3.5	40.57		NS				
Riffle	434.0	132.4	11.6	4.0	46.36		NS				
SDPool	453.0	138.2	1.5	1.5	2.25		NS				
SDPool	470.0	143.4	1.5	1.5	2.25	0	1				
Pool	475.0	144.9	12.5	6.0	75.03	0	1	5			
Riffle	490.0	149.5	4.6	3.5	16.01	0	3	25			
Riffle	527.0	160.7	11.3	4.0	45.14	0	1	2			
SDPool	535.0	163.2	1.0	1.0	1.00			0			
SDPool	548.0	167.1	2.0	2.0	4.00	0	2		0	2	
Glide	552.0	168.4	7.6	5.0	38.13	0	1	1	0	2	
Pool	563.0	171.7	3.4	5.0	16.78	0	6				
Riffle	570.0	173.9	2.1	5.0	10.68	0	0	0	0	0	
Glide	600.0	183.0	9.2	3.0	27.45	0	1	6			
Pool	616.0	187.9	3.0	2.0	6.00	0	2	10	0	2	
Riffle	629.0	191.8	4.0	3.0	11.90	0	0	0	0	0	
Glide	629.0	191.8	4.0	3.5	13.88			0			
Pool	632.0	192.8	1.5	1.5	2.25	0	3		0	3	
Riffle	639.0	194.9	2.1	3.5	7.47		NS				
Glide	650.0	198.3	3.4	4.0	13.42	1	1	2	1	1	
SDPool	661.0	201.6	2.0	2.0	4.00			2			
SDPool	676.0	206.2	3.0	2.0	6.00			NS			
SDPool	681.0	207.7	3.0	2.0	6.00	0	6	6			
Glide	700.0	213.5	15.3	1.0	15.25	0	1	1			
Riffle	700.0	213.5	15.3	3.0	45.75	0	2				
Pool	729.0	222.3	4.0	6.0	24.00	0	6	8			
Riffle	750.0	228.8	6.4	2.0	12.81			NS			
SDPool	752.0	229.4	1.0	1.0	1.00	0	1				
Riffle	750.0	228.8	6.4	2.0	12.81	0	0	0			
Pool	778.0	237.3	2.0	2.0	4.00	0	5				
Pool	787.0	240.0	3.0	3.0	9.00	0	2		0	2	
Pool	786.0	239.7	3.0	2.0	6.00		NS				
Glide	805.0	245.5	5.8	3.0	17.39	0	5	6			
Riffle	836.0	255.0	9.5	3.0	28.37			NS			
Glide	840.0	256.2	1.2	3.0	3.66		5	2			
Riffle	868.0	264.7	8.5	3.0	25.62	0	1	1			
SDPool	909.0	277.2	1.5	1.5	2.25	0	1				
Glide	913.0	278.5	13.7	4.0	54.90	0	0				
SDPool	921.0	280.9	4.0	3.0	12.00	0	5	2			
Riffle	949.0	289.4	11.0	3.5	38.43			NS			
Glide	975.0	297.4	7.9	3.5	27.76	0	3	2	0	3	
Pool	977.0	298.0	3.0	3.0	9.00	0	2				
Riffle	1000.0	305.0	7.0	4.0	28.06		NS				
Pool	1050.0	320.3	4.0	3.0	12.00	0	6	2			
SDPool	1086.0	331.2	1.5	1.5	2.25			0			
Riffle	1086.0	331.2	11.0	3.0	32.94	0	0	0			
Pool	1111.0	338.9	1.5	1.5	2.25	1	0		1	0	
Pool	1122.0	342.2	1.5	1.5	2.25			NS			
Riffle	1125.0	343.1	0.9	3.0	2.75	0	1				
Glide	1140.0	347.7	4.6	6.0	27.45	0	1	1			
Pool	1157.0	352.9	2.0	2.0	4.00	0	3	3			
Glide	1172.0	357.5	4.6	5.0	22.87	0	3	1			
Riffle	1181.0	360.2	2.7	3.0	8.24			NS			

Middle Slate

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
SDPool	8.0	2.4	1.5	1.5	2.25	0		0	
SDPool	9.0	2.7	1.0	1.0	1.00	ns			
SDPool	17.0	5.2	1.0	1.0	1.00	0		0	
Cascade	21.0	6.4	1.2	1.0	1.22	NS			
Riffle	26.0	7.9	1.5	1.0	1.53	0		0	
Pool	37.0	11.3	2.0	2.0	4.00	0		0	
Riffle	43.0	13.1	1.8	3.0	5.49	0			
SDPool	55.0	16.8	1.0	1.0	1.00	0			
Glide	57.0	17.4	4.3	1.5	6.41	0			
Pool	77.0	23.5	3.0	2.5	7.50	0		0	
Cascade	92.0	28.1	4.6	2.0	9.15	NS			
SDPool	107.0	32.6	1.5	2.0	3.00	0			
Cascade	112.0	34.2	6.1	1.0	6.10	NS			
Riffle	125.0	38.1	4.0	2.0	7.93	0		0	
SDPool	129.0	39.3	1.0	1.0	1.00	0		0	
Riffle	144.0	43.9	5.8	2.0	11.59	0			
SDPool	152.0	46.4	1.0	1.0	1.00	0			
SDPool	163.0	49.7	1.0	1.0	1.00	0		0	
Riffle	172.0	52.5	8.5	1.0	8.54	0		0	
Glide	193.0	58.9	6.4	1.5	9.61	0			
SDPool	200.0	61.0	1.0	1.0	1.00	0		0	
Pool	210.0	64.1	1.5	1.5	2.25	ns			
Pool	218.0	66.5	7.0	2.0	14.00	0		0	
Riffle	245.0	74.7	8.2	4.0	32.94	NS			
Glide	270.0	82.4	7.6	4.0	30.50	0			
SDPool	300.0	91.5	1.0	1.0	1.00	0		0	
Riffle	305.0	93.0	10.7	2.5	26.69	0		0	
Riffle	322.0	98.2	5.2	3.0	15.56	0			
SDPool	330.0	100.7	1.0	1.0	1.00	NS			
Riffle	342.0	104.3	6.1	3.0	18.30	0			
SDPool	370.0	112.9	1.0	1.0	1.00	0		0	
Cascade	371.0	113.2	0.3	2.5	0.76	NS			
Riffle	381.0	116.2	3.4	2.0	6.71	0		0	
Pool	387.0	118.0	2.0	2.0	4.00	0		0	
SDPool	398.0	121.4	1.0	1.0	1.00	0			
SDPool	407.0	124.1	1.5	1.5	2.25	0		0	
Cascade	411.0	125.4	1.2	2.0	2.44	NS			
Pool	423.0	129.0	2.0	1.0	2.00	0		0	

Middle Slate cont.

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
Glide	438.0	133.6	4.6	2.5	11.44	1			
Riffle	460.0	140.3	6.7	2.0	13.42	0		0	
Pool	470.0	143.4	3.0	1.0	3.00	0		0	
Cascade	477.0	145.5	2.1	1.0	2.13	NS			
Pool	495.0	151.0	1.0	1.0	1.00	0		1	
Riffle	496.0	151.3	0.3	1.0	0.31	0		0	
SDPool	505.0	154.0	0.5	0.5	0.25	0		0	
Riffle	506.0	154.3	3.0	3.0	9.15	0			
SDPool	516.0	157.4	1.0	1.0	1.00	0		0	
SDPool	522.0	159.2	3.0	2.0	6.00	0			
Riffle	523.0	159.5	5.2	2.5	12.96	0		0	
Glide	540.0	164.7	5.2	3.0	15.56	0			
Cascade	554.0	169.0	4.3	1.0	4.27	NS			
Riffle	582.0	177.5	8.5	1.0	8.54	NS			
SDPool	583.0	177.8	1.0	1.0	1.00	0		0	
SDPool	591.0	180.3	1.0	1.0	1.00	0			
Riffle	592.0	180.6	3.1	1.5	4.58	NS			
SDPool	606.0	184.8	1.0	1.0	1.00	0		0	
Cascade	611.0	186.4	5.8	3.0	17.39	NS			
Pool	615.0	187.6	5.0	3.0	15.00	1		1	
Glide	628.0	191.5	4.0	3.5	13.88	2		2	
Down Tree	640.0	195.2			0.00	NS			
Glide	700.0	213.5	22.0	3.0	65.88	0			
SDPool	704.0	214.7	1.5	1.5	2.25	1		1	
Riffle	708.0	215.9	2.4	1.5	3.66	0		0	
SDPool	726.0	221.4	1.0	1.0	1.00	0		0	
Cascade	730.0	222.7	1.2	1.5	1.83	NS			
Pool	738.0	225.1	3.0	5.0	15.00	4		4	
Cascade	752.0	229.4	4.3	2.0	8.54	NS			
Glide	765.0	233.3	4.0	3.0	11.90	0			
Glide	788.0	240.3	7.0	4.0	28.06	4		4	
Riffle	806.0	245.8	5.5	2.0	10.98	NS			
Down Tree	816.0	248.9			0.00	NS			
Riffle	825.0	251.6	5.8	1.0	5.80	2		2	
Down Tree	838.0	255.6			0.00	NS			
Glide	878.0	267.8	16.2	5.0	80.83	1		1	
Riffle	915.0	279.1	11.3	2.0	22.57	1		1	
Glide	930.0	283.7	4.6	3.0	13.73	3		3	
Down Tree	939.0	286.4			0.00	NS			
Glide	1012.0	308.7	25.0	3.0	75.03	3			
Riffle	1033.0	315.1	6.4	3.0	19.22	NS			
Glide	1059.0	323.0	7.9	4.0	31.72	NS			
SDPool	1080.0	329.4	1.0	1.0	1.00	1		1	
Pool	1096.0	334.3	3.0	2.0	6.00	2		2	
Glide	1107.0	337.6	3.4	5.0	16.78	6			
Glide	1170.0	356.9	19.2	4.0	76.86	3			

Upper Slate

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
Pool	0.0	0.0		1.0	0.00	3		3	
Riffle	8.0	2.4	2.4	2.0	4.88	0			
Pool	16.0	4.9	2.4	1.5	3.66	0		0	
Riffle	18.0	5.5	0.6	3.0	1.83	0		0	
SDPool	30.0	9.2	3.7	2.0	7.32	1		1	
Riffle	34.0	10.4	1.2	2.5	3.05	NS			
SDPool	43.0	13.1	2.7	0.5	1.37	2		2	
Riffle	46.0	14.0	0.9	3.0	2.75	NS			
Riffle	62.0	18.9	4.9	4.0	19.52	NS			
SDPool	68.0	20.7	1.8	3.5	6.40	1		1	
Glide	74.0	22.6	1.8	3.0	5.49	7			
Pool	85.0	25.9	3.4	2.0	6.71	3		3	
Riffle	100.0	30.5	4.6	2.0	9.15	2		2	
SDPool	114.0	34.8	4.3	0.5	2.14	3		3	
SDPool	121.0	36.9	2.1	0.5	1.07	3		3	
Riffle	123.0	37.5	0.6	1.0	0.61	0			
Riffle	133.0	40.6	3.1	1.0	3.05	1		1	
Pool	140.0	42.7	2.1	0.5	1.07	NS			
Riffle	143.0	43.6	0.9	1.0	0.92	0			
Pool	154.0	47.0	3.4	1.5	5.03	NS			
Riffle	172.0	52.5	5.5	2.0	10.98	1			
SDPool	172.0	52.5	0.0	1.0	0.00	0		0	
Riffle	183.0	55.8	3.4	1.5	5.03	NS			
Pool	187.0	57.0	1.2	1.5	1.83	0			
Riffle	191.0	58.3	1.2	1.5	1.83	5			
Riffle	204.0	62.2	4.0	2.0	7.93	NS			
Glide	216.0	65.9	3.7	2.0	7.32	NS			
Pool	221.0	67.4	1.5	1.5	2.29	0		0	
Riffle	230.0	70.2	2.7	1.5	4.12	4			
Pool	237.0	72.3	2.1	1.0	2.14	NS			
Riffle	239.0	72.9	0.6	1.5	0.91	NS			
Pool	245.0	74.7	1.8	2.5	4.58	NS			
Riffle	258.0	78.7	4.0	1.0	3.97	5			
SDPool	261.0	79.6	0.9	0.5	0.46	NS			
Riffle	268.0	81.7	2.1	2.0	4.27	3		1	
Pool	284.0	86.6	4.9	2.5	12.20	NS			
Riffle	290.0	88.5	1.8	1.0	1.83	2		2	
Glide	301.0	91.8	3.4	1.0	3.35	NS			
Riffle	307.0	93.6	1.8	1.0	1.83	2		2	
Riffle	316.0	96.4	2.7	1.5	4.12	NS			
SDPool	330.0	100.7	4.3	0.5	2.14	0		0	
Glide	342.0	104.3	3.7	1.0	3.66	2		2	
Pool	348.0	106.1	1.8	1.5	2.75	NS			
Riffle	352.0	107.4	1.2	1.5	1.83	0			
Glide	372.0	113.5	6.1	1.0	6.10	0		0	
Riffle	387.0	118.0	4.6	1.5	6.86	2		2	
Riffle	406.0	123.8	5.8	1.0	5.80	NS			
SDPool	415.0	126.6	2.7	0.5	1.37	2		2	
Pool	420.0	128.1	1.5	3.5	5.34	NS			
Riffle	429.0	130.8	2.7	1.0	2.75	2		2	
Glide	434.0	132.4	1.5	1.5	2.29	NS			
Pool	435.0	132.7	0.3	3.0	0.91	NS			
Pool	447.0	136.3	3.7	2.0	7.32	9			
Riffle	454.0	138.5	2.1	2.0	4.27	NS			
Pool	462.0	140.9	2.4	1.5	3.66	2		2	
Riffle	472.0	144.0	3.1	1.0	3.05	0			
Pool	478.0	145.8	1.8	2.0	3.66	0		0	
Riffle	493.0	150.4	4.6	1.5	6.86	NS			

Upper Slate cont.

Habitat Type	Distance (ft)	Distance (m)	Length (m)	Width (m)	Area (m²)	Snorkel		E-fisher	
						Dv	Ct	Dv	Ct
Pool	499.0	152.2	1.8	2.0	3.66	0			
Riffle	524.0	159.8	7.6	2.0	15.25	NS			
Pool	536.0	163.5	3.7	2.0	7.32	2		2	
Pool	542.0	165.3	1.8	1.5	2.75	NS			
Riffle	552.0	168.4	3.0	1.5	4.57	7			
Pool	560.0	170.8	2.4	3.0	7.32	NS			
Riffle	588.0	179.3	8.5	3.5	29.89	NS			
SDPool	596.0	181.8	2.4	1.5	3.66	3			
Riffle	596.0	181.8	0.0	1.5	0.00	NS			
SDPool	601.0	183.3	1.5	1.0	1.53	0			
Pool	613.0	187.0	3.7	3.0	10.98	NS			
Riffle	617.0	188.2	1.2	1.5	1.83	1			
Pool	620.0	189.1	0.9	2.5	2.29	1			
Riffle	629.0	191.8	2.7	1.5	4.12	NS			
Riffle	636.0	194.0	2.1	1.5	3.20	1			
Pool	645.0	196.7	2.7	3.0	8.24	NS			
Riffle	651.0	198.6	1.8	2.5	4.58	6			
Riffle	664.0	202.5	4.0	2.5	9.91	0			
Pool	685.0	208.9	6.4	1.5	9.61	NS			
Riffle	696.0	212.3	3.4	1.5	5.03	4			
Pool	703.0	214.4	2.1	1.5	3.20	NS			
Riffle	710.0	216.6	2.1	2.0	4.27	1			
Pool	722.0	220.2	3.7	2.0	7.32	NS			
Riffle	737.0	224.8	4.6	1.5	6.86	2			
Riffle	759.0	231.5	6.7	2.0	13.42	NS			
Riffle	767.0	233.9	2.4	1.5	3.66	1			
Riffle	771.0	235.2	1.2	1.0	1.22	NS			
SDPool	791.0	241.3	6.1	1.0	6.10	NS			
Pool	798.0	243.4	2.1	1.0	2.13	1			
Riffle	803.0	244.9	1.5	2.0	3.05	1			
Pool	815.0	248.6	3.7	0.5	1.83	NS			
Riffle	826.0	251.9	3.4	1.5	5.03	1			
Pool	836.0	255.0	3.0	2.0	6.10	NS			
Riffle	848.0	258.6	3.7	1.5	5.49	4			
Pool	862.0	262.9	4.3	1.0	4.27	NS			
Riffle	849.0	258.9	-4.0	2.0	-7.93	0			
Riffle	882.0	269.0	10.1	2.0	20.13	NS			
SDPool	890.0	271.5	2.4	1.0	2.44	0			
Riffle	895.0	273.0	1.5	2.0	3.05	1			
SDPool	905.0	276.0	3.1	1.5	4.58	NS			
Riffle	928.0	283.0	7.0	1.0	7.02	0			
Pool	937.0	285.8	2.7	2.0	5.49	0			
Riffle	942.0	287.3	1.5	1.0	1.53	0			
Riffle	964.0	294.0	6.7	2.0	13.42	0			
SDPool	966.0	294.6	0.6	1.0	0.61	NS			
Riffle	980.0	298.9	4.3	1.5	6.40	NS			
Pool	990.0	302.0	3.1	1.5	4.58	NS			
Riffle	996.0	303.8	1.8	0.5	0.91	2			
Pool	1000.0	305.0	1.2	2.0	2.44	NS			
Riffle	1006.0	306.8	1.8	1.0	1.83	1			
SDPool	1007.0	307.1	0.3	2.0	0.61	NS			
Pool	1009.0	307.7	0.6	1.5	0.92	0			
Riffle	1017.0	310.2	2.4	2.0	4.88	1			
SDPool	1017.0	310.2	0.0	0.5	0.00	NS			
Pool	1023.0	312.0	1.8	1.0	1.83	NS			
Riffle	1030.0	314.2	2.1	2.0	4.27	0			
SDPool	1037.0	316.3	2.1	0.5	1.07	NS			
SDPool	1040.0	317.2	0.9	1.5	1.37	0			
Pool	1045.0	318.7	1.5	2.0	3.05	0			
Riffle	1050.0	320.3	1.5	0.5	0.76	1			

APPENDIX 3D: FISH LENGTH & WEIGHT DATA

Appendix 3d: Total length, weight and condition factor (K) for resident fish in 2009

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Lower Sherman	7/15/2009						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
0-50 m	122	15.4	1815848	8.48E-06	0.848	mean	0.859
	117	12.4	1601613	7.74E-06	0.774	ST dev	0.074417
	89	5.5	704969	7.8E-06	0.780	n	8
	75	4.0	421875	9.48E-06	0.948	95% CI	0.051569
50-110 m	120	13.9	1728000	8.04E-06	0.804		
	148	27.1	3241792	8.36E-06	0.836		
	95	8.0	857375	9.33E-06	0.933		
Cutthroat	154	34.7	3652264	9.5E-06	0.950		

Middle Sherman	8/5/09						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
0-20m	99	10.1	970299	1.04E-05	1.041	mean	0.954
	109	12.5	1295029	9.65E-06	0.965	ST dev	0.083578
	77	3.8	456533	8.32E-06	0.832	n	10
	144	27.8	2985984	9.31E-06	0.931	95% CI	0.051802
20-60m	200	81.7	8000000	1.02E-05	1.021		
	158	39.7	3944312	1.01E-05	1.007		
	125	20.2	1953125	1.03E-05	1.034		
	105	11.7	1157625	1.01E-05	1.011		
60-100m	152	29.9	3511808	8.51E-06	0.851		
150m	187	55.1	6539203	8.43E-06	0.843		

Appendix 3d cont.

Upper Sherman 8/11/09

Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
Electro-Fish	119	15.9	1685159	9.44E-06	0.944	mean	1.022
50-75 m	111	11.4	1367631	8.34E-06	0.834	ST dev	0.430512
	107	11.6	1225043	9.47E-06	0.947	n	25
	114	12.8	1481544	8.64E-06	0.864	95% CI	0.168761
	111	11.7	1367631	8.55E-06	0.855		
	133	17.6	2352637	7.48E-06	0.748		
	67	2.6	300763	8.64E-06	0.864		
	105	9.4	1157625	8.12E-06	0.812		
75-100 m	92	7.5	778688	9.63E-06	0.963		
	122	16.4	1815848	9.03E-06	0.903		
	70	3.2	343000	9.33E-06	0.933		
	151	34.9	3442951	1.01E-05	1.014		
	161	40.4	4173281	9.68E-06	0.968		
	149	34.4	3307949	1.04E-05	1.040		
	139	23.3	2685619	8.68E-06	0.868		
	129	18.8	2146689	8.76E-06	0.876		
	97	8.7	912673	9.53E-06	0.953		
	101	9.8	1030301	9.51E-06	0.951		
	90	7.4	729000	1.02E-05	1.015		
65-125m	31	0.2	29791	6.71E-06	0.671		
	39	0.6	59319	1.01E-05	1.011		
	66	2.5	287496	8.7E-06	0.870		
	28	0.6	21952	2.73E-05	2.733		
	78	4.2	474552	8.85E-06	0.885		
	34	0.8	39304	2.04E-05	2.035		
	37.0	0.6	50653.0	1.18E-05	1.18453		
	108.0	12.0	1259712.0	9.53E-06	0.952599		
	35.0	0.4	42875.0	9.33E-06	0.932945		
	35.0	0.9	42875.0	2.1E-05	2.099125		
	144.0	23.9	2985984.0	8E-06	0.800406		
	33.0	0.7	35937.0	1.95E-05	1.947853		
	61.0	1.8	226981.0	7.93E-06	0.793018		
Minnow-Trap	132.0	20.9	2299968.0	9.09E-06	0.908708		
100-150 m	141.0	26.2	2803221.0	9.35E-06	0.934639		
	154.0	32.6	3652264.0	8.93E-06	0.892597		
	77.0	4.0	456533.0	8.76E-06	0.876169		
	78.0	3.8	474552	8.01E-06	0.800755		
	131.0	20.9	2248091	9.3E-06	0.929678		
	143.0	25.2	2924207	8.62E-06	0.861772		
	166.0	41.8	4574296	9.14E-06	0.913802		
	166.0	38.1	4574296	8.33E-06	0.832915		
	112.0	14.1	1404928	1E-05	1.00361		
	151.0	31.4	3442951	9.12E-06	0.912008		
	112.0	11.7	1404928.0	8.33E-06	0.832783		
	72.0	3.0	373248.0	8.04E-06	0.803755		
	136.0	21.1	2515456.0	8.39E-06	0.838814		

Appendix 3d cont.

Lower Johnson	7/14/2009						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
Trap # 1	70	2.9	343000	8.45E-06	0.845	mean	0.716
Trap # 2	98	6.8	941192	7.22E-06	0.722	ST dev	0.076391
	67	2.4	300763	7.98E-06	0.798	n	25
Trap # 3	116	11.1	1560896	7.11E-06	0.711	95% CI	0.029945
Trap # 4	192	45.7	7077888	6.46E-06	0.646		
	111	10.9	1367631	7.97E-06	0.797		
Trap # 5	312	237.3	30371328	7.81E-06	0.781		
	334	257.4	37259704	6.91E-06	0.691		
	289	167.4	24137569	6.94E-06	0.694		
	253	109.1	16194277	6.74E-06	0.674		
	203	59.5	8365427	7.11E-06	0.711		
	181	41.1	5929741	6.93E-06	0.693		
	232	86.7	12487168	6.94E-06	0.694		
	239	89.5	13651919	6.56E-06	0.656		
	200	53.3	8000000	6.66E-06	0.666		
	154	28.7	3652264	7.86E-06	0.786		
	210	70.5	9261000	7.61E-06	0.761		
	184	40.8	6229504	6.55E-06	0.655		
	234	86.8	12812904	6.77E-06	0.677		
	203	63.8	8365427	7.63E-06	0.763		
	187	45.1	6539203	6.9E-06	0.690		
	207	56.8	8869743	6.4E-06	0.640		
	199	51.6	7880599	6.55E-06	0.655		
	182	46.9	6028568	7.78E-06	0.778		
	187	42.8	6539203	6.55E-06	0.655		
	172	36.3	5088448	7.13E-06	0.713		
	105	8.1	1157625	7E-06	0.700		
	105	11.6	1157625	1E-05	1.002		
	114	10.2	1481544	6.88E-06	0.688		
	114	10.7	1481544	7.22E-06	0.722		
	170	39.0	4913000	7.94E-06	0.794		
	183	42.8	6128487	6.98E-06	0.698		
	164	30.7	4410944	6.96E-06	0.696		
	130	16.9	2197000	7.69E-06	0.769		
	113	12.4	1442897	8.59E-06	0.859		
	153	25.5	3581577	7.12E-06	0.712		
	98	6.6	941192	7.01E-06	0.701		
	170	34.6	4913000	7.04E-06	0.704		
	144	18.6	2985984	6.23E-06	0.623		
	130	14.0	2197000	6.37E-06	0.637		
	123	14.6	1860867	7.85E-06	0.785		
	131	15.7	2248091	6.98E-06	0.698		
Trap # 6	119	13.5	1685159	8.01E-06	0.801		

Appendix 3d cont.

Middle Johnson	8/6/2009						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
Trap # 1	123	13.4	1860867	7.2E-06	0.720	mean	1.282
	104	8.8	1124864	7.82E-06	0.782	ST dev	1.566928
	188	48.5	6644672	7.3E-06	0.730	n	20
	158	32.6	3944312	8.27E-06	0.827	95% CI	0.686736
	124	15.7	1906624	8.23E-06	0.823		
	115	12.3	1520875	8.09E-06	0.809		
	105	8.9	1157625	7.69E-06	0.769		
	124	15.3	1906624	8.02E-06	0.802		
	115	90.2	1520875	5.93E-05	5.931		
	105	12.0	1157625	1.04E-05	1.037		
	124	7.4	1906624	3.88E-06	0.388		
	230	16.6	12167000	1.36E-06	0.136		
	116	66.7	1560896	4.27E-05	4.273		
	97	38.1	912673	4.17E-05	4.175		
	131	11.2	2248091	4.98E-06	0.498		
	202	79.3	8242408	9.62E-06	0.962		
	168	11.5	4741632	2.43E-06	0.243		
	115	12.8	1520875	8.42E-06	0.842		
	216	16.1	10077696	1.6E-06	0.160		
	116	11.5	1560896	7.37E-06	0.737		
	117	12.8	1601613	7.99E-06	0.799		
	129	16.1	2146689	7.5E-06	0.750		
	95	7.6	857375	8.86E-06	0.886		
	121	14.3	1771561	8.07E-06	0.807		
	161	30.4	4173281	7.28E-06	0.728		
	179	46.0	5735339	8.02E-06	0.802		
	199	61.7	7880599	7.83E-06	0.783		
	131	17.7	2248091	7.87E-06	0.787		
	105	8.6	1157625	7.43E-06	0.743		
	108	12.9	1259712	1.02E-05	1.024		
	174	41.2	5268024	7.82E-06	0.782		
	173	43.1	5177717	8.32E-06	0.832		
	165	37.2	4492125	8.28E-06	0.828		
	119	14.5	1685159	8.6E-06	0.860		
	109	11.1	1295029	8.57E-06	0.857		
	144	23.1	2985984	7.74E-06	0.774		
	124	15.4	1906624	8.08E-06	0.808		
	111	11.9	1367631	8.7E-06	0.870		
	117	12.5	1601613	7.8E-06	0.780		
	109	10.9	1295029	8.42E-06	0.842		
	103	18.4	1092727	1.68E-05	1.684		
	104	11.8	1124864	1.05E-05	1.049		
	104	11.9	1124864	1.06E-05	1.058		
	111	11.9	1367631	8.7E-06	0.870		
	122	14.8	1815848	8.15E-06	0.815		
	101	8.9	1030301	8.64E-06	0.864		
	102	8.2	1061208	7.73E-06	0.773		

Appendix 3d cont.

Middle Johnson cont.	8/6/2009				
Dolly Varden					
Location	Length (mm)	Weight (g)	L power 3		k
Trap # 2	146	26.7	3112136	8.58E-06	0.858
	125	17.1	1953125	8.76E-06	0.876
	118	12.5	1643032	7.61E-06	0.761
	120	15.0	1728000	8.68E-06	0.868
	112	8.7	1404928	6.19E-06	0.619
	109	9.7	1295029	7.49E-06	0.749
	102	9.4	1061208	8.86E-06	0.886
	182	54.7	6028568	9.07E-06	0.907
	143	26.4	2924207	9.03E-06	0.903
	112	12.6	1404928	8.97E-06	0.897
	122	15.6	1815848	8.59E-06	0.859
	109	10.5	1295029	8.11E-06	0.811
	109	8.6	1295029	6.64E-06	0.664
Trap # 3	201	75.5	8120601	9.3E-06	0.930
	197	65.9	7645373	8.62E-06	0.862
	158	33.4	3944312	8.47E-06	0.847
	111	12.3	1367631	8.99E-06	0.899
	123	16.0	1860867	8.6E-06	0.860
	171	43.0	5000211	8.6E-06	0.860
	170	38.1	4913000	7.75E-06	0.775
	111	10.8	1367631	7.9E-06	0.790
	143	23.3	2924207	7.97E-06	0.797
	144	29.2	2985984	9.78E-06	0.978
	111	11.2	1367631	8.19E-06	0.819

Upper Johnson	8/12/09						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
	202	69.7	8242408	8.46E-06	0.846	mean	0.901
	202	68.5	8242408	8.31E-06	0.831	ST dev	0.093822
	193	66.8	7189057	9.29E-06	0.929	n	21
	164	37.7	4410944	8.55E-06	0.855	95% CI	0.040128
	174	41.4	5268024	7.86E-06	0.786		
	152	27.3	3511808	7.77E-06	0.777		
	181	67.5	5929741	1.14E-05	1.138		
	167	50.3	4657463	1.08E-05	1.080		
	138	25.2	2628072	9.59E-06	0.959		
	186	62.4	6434856	9.7E-06	0.970		
	229	104.8	12008989	8.73E-06	0.873		
	186	55.9	6434856	8.69E-06	0.869		
	221	96.5	10793861	8.94E-06	0.894		
	178	54.1	5639752	9.59E-06	0.959		
	205	84.5	8615125	9.81E-06	0.981		
	198	71.1	7762392	9.16E-06	0.916		
	213	84.0	9663597	8.69E-06	0.869		
	184	50.9	6229504	8.17E-06	0.817		
	190	52.7	6859000	7.68E-06	0.768		
	175	46.3	5359375	8.64E-06	0.864		
	175	50.2	5359375	9.37E-06	0.937		

Appendix 3d cont.

Lower Slate							
Cutthroat 7/21/2009							
Location	Length (mm)	Weight (g)	L power 3		k		
0-50 m	80	3.9	512000	7.62E-06	0.762	mean	0.804
	143	23.9	2924207	8.17E-06	0.817	ST dev	0.058741
	78	4.2	474552	8.85E-06	0.885	n	13
	77	3.5	456533	7.67E-06	0.767	95% CI	0.031932
	89	5.6	704969	7.94E-06	0.794		
	81	4.9	531441	9.22E-06	0.922		
100-200 m	76	3.5	438976	7.97E-06	0.797		
	78	3.6	474552	7.59E-06	0.759		
	76	3.7	438976	8.43E-06	0.843		
	132	17.7	2299968	7.7E-06	0.770		
	77	3.6	456533	7.89E-06	0.789		
	76	3.7	438976	8.43E-06	0.843		
	83	4.0	571787	7E-06	0.700		

Middle Slate	8/28/2009						
Dolly Varden							
Location	Length (mm)	Weight (g)	L power 3		k		
150-250 m	49	9.0	117649	7.65E-05	7.650	mean	1.265
	97	8.9	912673	9.75E-06	0.975	ST dev	1.598304
	53	1.9	148877	1.28E-05	1.276	n	18
	91	7.5	753571	9.95E-06	0.995	95% CI	0.738379
	101.0	9.7	1030301	9.41E-06	0.941		
	187.0	47.2	6539203	7.22E-06	0.722		
275 m	50.0	1.1	125000	8.8E-06	0.880		
	52.0	1.3	140608	9.25E-06	0.925		
	45.0	0.8	91125	8.78E-06	0.878		
	46.0	0.7	97336	7.19E-06	0.719		
	48.0	1.0	110592	9.04E-06	0.904		
	47.0	0.9	103823	8.67E-06	0.867		
	46.0	0.8	97336	8.22E-06	0.822		
	46.0	0.9	97336	9.25E-06	0.925		
	37.0	0.4	50653	7.9E-06	0.790		
	43	0.6	79507	7.55E-06	0.755		
	59.0	1.9	205379	9.25E-06	0.925		
	51.0	1.1	132651	8.29E-06	0.829		

Appendix 3d cont.

Upper Slate

Dolly Varden	8/27/2009						
Location	Length (mm)	Weight (g)	L power 3		k		
E-Fishing	33	0.1	35937	2.78E-06	0.278	mean	0.950
30-60 m	32	0.3	32768	9.16E-06	0.916	ST dev	0.49921
	81	4.8	531441	9.03E-06	0.903	n	17
	62	2.2	238328	9.23E-06	0.923	95% CI	0.237309
	34	0.6	39304	1.53E-05	1.527		
	35	0.3	42875	7E-06	0.700		
	30	0.7	27000	2.59E-05	2.593		
	34	0.5	39304	1.27E-05	1.272		
	33	0.2	35937	5.57E-06	0.557		
	33	0.3	35937	8.35E-06	0.835		
	69	2.9	328509	8.83E-06	0.883		
	54	1.4	157464	8.89E-06	0.889		
	65	2.2	274625	8.01E-06	0.801		
	68	2.6	314432	8.27E-06	0.827		
	78	3.4	474552	7.16E-06	0.716		
	67	2.4	300763	7.98E-06	0.798		
	60	1.6	216000	7.41E-06	0.741		

APPENDIX 4A: ADFG FISH RESOURCE PERMIT (SF2009-059; fry counts)

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME

P.O. BOX 115525
JUNEAU, ALASKA 99811-5525

Permit #: SF2009-59

Expires: 6/30/2009

Collections Report Due: 7/30/2009

FISH RESOURCE PERMIT
(For Scientific/Educational Purposes)

This permit authorizes Liz Flory *(whose signature is required on page 2 for permit validation)*
person

of Aquatic Sciences (for Coeur Alaska) **at** 3031 Clinton Drive, Suite 202, Juneau, Alaska 99801
agency or organization *address*

to conduct the following activities **from** April 1, 2008 **to** June 30, 2008 in accordance with AS 16.05.930:

Purpose: To estimate the number of out-migrating pink salmon fry in creeks designated by an EPA issued NPDES permit for the Kensington Mine.

Location: *Lynn Canal*-Sherman/Sweeny Creeks *Berners Bay*-Slate/Johnson Creeks

Species Collected: Pink/chum/coho salmon, Dolly Varden, cutthroat trout, eulachon, and coast-range sculpin

Method of Capture: Fyke nets with adjustable wings or inclined plane traps **(see Permit Stipulations #2/3)**

Final Disposition: All fish must be released alive back into the system they were captured.
No more than the following numbers of mostly juvenile fish may be handled;
≤450K pink salmon *≤20K chum salmon* *≤ 500 coho salmon* *≤50 Dolly Varden* *≤50 cutthroat trout* *≤500 eulachon* *≤1K sculpin*
≤12,000 pink salmon smolts in total (≈150 per test) may be marked with Bismarck Brown dye and released above trap so as to determine smolt trap catch efficiency.

-Continued on Back-

REPORT DUE July 30, 2009. The collections report, using a template furnished by ADF&G), shall include **ALL** 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. *It must also include the date/time the local biologist was contacted prior to initiating collection activities.* A completion report (abstract, background, methods, data, analysis), if not submitted with the collection report described above, must be submitted to the department by; ***January/2010***. 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 Pawlowski
Fish Resource Permit Coordinator
Division of Sport Fish

Robert Begtz
for Director
Division of Sport Fish

3-6-09
Date

Authorized Personnel: The following persons may perform collecting activities under terms of this permit:

Eric Chadwell, Brian Flory, Elizabeth Flory, Charmagne Gutierrez, Brent McEwan, Jill Michalak,

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@alaska.gov) Juneau, must be notified **prior** to you engaging in any collecting activities. ***The time/date of this contact must be included in your collections report (using the "data submission form" furnished by ADF&G.*** This biologist has the right to specify methods for collecting, as well as limiting the collections, of any species by number, time and location.
2) **At a minimum, smolt traps must be checked on a daily basis prior to 10 am.** However it is recommended they be checked twice daily between 8 - 11 am and between 9pm - midnight. **Each time a 10% or greater mortality event occurs at a smolt trap, you are required to call the AMB (*see Stipulation #1*) to discuss strategies for reducing future high mortality rates.**
3) The stream channel may not be blocking by capture gear. Fyke nets and inclined plane traps must be operated in such a manner as to allow cutthroat trout and Dolly Varden to migrate freely up and down stream.
4) All unattended sampling gear must be; 1) labeled with the permittee's name, telephone number, and permit number, 2) securely tied to substrate, 3) located with GPS coordinates, and 4) accounted for/removed at the conclusion of sampling.
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@alaska.gov
6) **Atlantic salmon** and other **non-native invasive aquatic species** encountered should be killed. The nearest ADF&G office (**see Stipulation # 1**) must be contacted immediately with species identification or description, capture or sighting location, number captured, size, and sex. Preserve/turn in the whole specimen to the nearest ADF&G office.
7) *A Title 41 Permit may be required from Division of Habitat to place structures (weir, etc.) in streams.*
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; Robert.Piorkowski@alaska.gov), 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), 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**.

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 Fish, Juneau
Randy Bachman, Division of Commercial Fisheries, Haines
Jackie Timothy, Division of Habitat, Juneau
Fish and Wildlife Protection, Juneau

APPENDIX 4B: ADNR FISH HABITAT PERMIT
(for fry counts)

STATE OF ALASKA

FRANK H. MURKOWSKI, GOVERNOR

400 WILLOUGHBY AVENUE, 4th FLOOR
PO BOX 111050
JUNEAU, ALASKA 99801-1050
PHONE: (907) 465-4105
FAX: (907) 465-4759

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HABITAT MANAGEMENT AND PERMITTING
JUNEAU AREA OFFICE

FISH HABITAT PERMITS
FH06-I-0024, FH06-I-0025, and FH06-I-0026

ISSUED: March 23, 2006
EXPIRES: December 31, 2011

Ms. Liz Flory
Coeur Alaska, Inc.
3031 Clinton Drive
Juneau, AK 99801

RE: Installation of Temporary Fish Weirs
Sherman Creek (Stream #115-31-10330)
Slate Creek (Stream #115-20-10030)
Johnson Creek (Stream #115-20-10070)
T. 35 S., R. 62 E., C.R.M. (Juneau D-4)

Dear Ms. Flory:

Pursuant to AS 41.14.870(b), the Alaska Department of Natural Resources (DNR) Office of Habitat Management and Permitting (OHMP) has reviewed your proposal to install temporary fish weirs in Sherman Creek, Slate Creek and Johnson Creek to monitor out-migrating salmon fry. Weirs will be in place from early April until fish numbers diminish in late May or early June.

Anadromous Fish Act and Coastal Consistency Requirements

Sherman Creek (Stream #115-31-10330), Slate Creek (Stream #115-20-10030), and Johnson Creek (Stream #115-20-10070) have been specified as being important for the spawning, rearing, or migration of anadromous fish pursuant to AS 41.14.870(a). Pink salmon are present in Sherman Creek; coho, pink and chum salmon are present in Slate Creek and Johnson Creek. Installation of temporary fish weirs is consistent with the Standards of the Alaska Coastal Management Program under Generally Consistent Determination GCD-6, *Temporary Fish Research and Management Facilities*, provided you conduct the project as described above and adopt the standard alternative measures. I have attached GCD 6 for your information.

In accordance with AS 41.14.870(d) and 11 AAC 110, your project is approved according to the project description, standard alternative measures, and the terms of this permit.

FH06-I-0024 authorizes placement of a weir in Sherman Creek
FH06-I-0025 authorizes placement of a weir in Slate Creek
FH06-I-0026 authorizes placement of a weir in Johnson Creek

You are responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved project. For any activity that significantly deviates from the approved plan, you shall notify OHMP and obtain written approval in the form of a permit amendment before beginning the activity. Any action that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the OHMP. Therefore, it is recommended you consult OHMP immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 41.14.870. This permit must be retained on site during construction. Please be advised that this determination applies only to activities regulated by OHMP; other divisions with ADNR also may have jurisdiction under their respective authorities. This determination does not relieve you of your responsibility to secure other permits; state, federal, or local. You are still required to comply with all other applicable laws.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to correct disruption to fish created by the project which was a direct result of failure to comply with this permit or any applicable law.

You shall indemnify, save harmless, and defend the department, its agents, and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or your performance under this permit. However, this provision has no effect if, and only if, the sole proximate cause of the injury is the department's negligence.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330-630.

If you have any questions, please contact Carl Schrader at (907) 465-4287 or email carl_schrader@dnr.state.ak.us.

Sincerely,

Edmund J. Fogels
Acting Deputy Commissioner

Timothy

By Jackie Timothy
Office of Habitat Management and Permitting
Department of Natural Resources

Email cc:

Al Ott, OHMP, Fairbanks
Carl Schrader, OHMP, Juneau
Joe Donohue, OPMP, Juneau
Tom Crafford, OPMP, Anchorage
Brian Glynn, ADF&G-SF, Juneau
Randy Bachman, ADF&G-CF, Haines
Mark Fink, ADF&G-SF, Anchorage

GENERALLY CONSISTENT DETERMINATION GCD-6

TEMPORARY FISH RESEARCH AND MANAGEMENT FACILITIES

The following activity is consistent with the Alaska Coastal Management Program per 11 AAC 110.730 when conducted according to the standard alternative measures listed below. This approval does not relieve the applicant from obtaining required permits and approvals from local, State, and federal individual agencies.

For activities subject to this generally consistent determination, the applicant is not automatically required to complete a CPQ. DFG may require a CPQ for project proposals where it is uncertain whether other State and federal authorizations may be required.

DESCRIPTION OF THE ACTIVITY

Seasonal construction, maintenance, operation, and removal of temporary fish weirs, counting towers, sonar arrays, holding pens, and other sampling or research facilities for the purpose of fisheries research, management, or enhancement. Camp facilities are excluded from this generally consistent determination, but may qualify for approval under generally consistent determination GCD-23.

Authority: AS 41.14.840
AS 41.14.870
AS 16.20
AS 38.05.850
5 AAC 95

Permits: Fish Habitat Permit (OHMP)
Special Area Permit (DFG)
Land Use Permit (DNR)

Region: Statewide

STANDARD ALTERNATIVE MEASURES

1. Streambanks shall not be disturbed. If streambanks are inadvertently disturbed by activities attributable to this project, they shall be immediately stabilized to prevent erosion and the resultant sedimentation of streams which could occur both during and after operations.

2. Facilities shall be operated and maintained as required by DFG and OHMP to prevent unnecessary sampling mortality and ensure that fish mortality caused by delays in migration do not occur.

APPENDIX 5: WEEKLY SALMON COUNTS

Appendix 5: Weekly salmon counts for Sherman, Johnson and Slate in 2009.

Sherman Creek Adult Pink Salmon Count

	7/15/2009		7/22/2009		7/27/2009		8/4/2009	
Reach	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
intertidal	0	0	0	0	1	1	88	10
0-50	0	0	3	1	3	0	100	
50-100	0	0	0	0	0	0	52	
100-150	0	0	1	1	4	0	75	1
150-200	0	0	2	0	1	0	106	1
200-250	0	0	0	0	0	0	80	
250-300	0	0	3	0	0	1	56	3
300-350	0	0	0	0	4	0	64	
falls pool	0	0	0	0	6	0	30	
Total	0	0	9	2	19	2	651	15

	8/10/2009		8/19/2009		8/26/2009		9/1/2009	
Reach	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
Intertidal	56	5	93	2	80	3		
0-50	110	3	67		130		100	2
50-100	20	2	22		50		40	
100-150	130	3	73		78		136	
150-200	320	5	67		80		110	2
200-250	92	2	53		125		94	2
250-300	98	3	55	2	72		58	3
300-350	63	4	54	1	75		64	
falls pool	32	0	28		6		10	
Total	921	27	512	5	696	3	612	9

	9/8/2009		9/14/2009		9/20/2009		9/28/2009	
Reach	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
Intertidal			0		0		0	
0-50	50		25		18		0	
50-100	80		30		4		0	
100-150	38		20		15		0	
150-200	65		35		8		0	
200-250	54		25		2		0	
250-300	75		40		2		0	
300-350	36		15		3		0	
falls pool	6		3		0		0	
Total	404	0	193		52	0	0	0

Appendix 5 cont.

Johnson Creek Adult Pink Salmon Count

	7/14/2009		7/21/2009		7/27/2009		8/6/2009		8/12/2009	
	# Live	# Dead	# pink	# Dead	# pink	# Dead	# pink	# Dead	# Live	# Dead
Lace Trib.	0	0	0		500	0	620		550	
John Mouth	0	0	30		30	0	200		400	
Trap Site	0	0			50	0	100		300	
Marker 4	0	0	50		100	0	200		200	
Marker 7	0	0	10		50	3	600		40	
Marker 8	0	0				0	10		1100	
Marker 10	0	0				0	600		600	
Marker 12	0	0				0	80		400	
Powerhouse	0	0				0	100		300	
Marker 15	0	0				0	50		360	
Falls Pool							20		20	
Total	0	0	90		730	3	2580	0	4270	0

	8/18/2009		8/27/2009		9/3/2009		9/9/2009		9/16/2009	
	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead	# Live	# Dead
Lace Trib.	0		85	31	10		15		0	
John Mouth	200		200	50	30		20		2	
Trap Site	100		350	150	25		48		2	
Marker 4	50		100	50	90		59		13	
Marker 7	600		400	150	165		0		2	
Marker 8	100		10	40			24		0	
Marker 10	400		200	50	55				3	
Marker 12	300		40		28					
Powerhouse	100		20		20				2	
Marker 15	200		20		7					
Falls Pool	20		6		0					
Total	2070	0	1431	521	430	0	151	0	24	0

Appendix 5 cont.

Slate Creek Adult Pink Salmon Count

Reach	7/21/2009 # Live	7/21/2009 # Dead	7/27/2009 # Live	7/27/2009 # Dead	8/3/2009 # Live	8/3/2009 # Dead	8/10/2009 # Live	8/10/2009 # Dead
intertidal1	0	0	0	0	65	1	179	1
intertidal2	0	0	0	0	0		2	0
0-100	1	0	0	0	12		16	1
100-200	4	0	5	0	0		0	
200-300	0	0	0	0	0		0	
300-400	0	0	0	0	0		nc	
400-500	0	0	0	0	NC		nc	
500-600	0	0	0	0	NC		nc	
600-700	0	0	0	0	NC		nc	
700-800	NC	NC	NC	NC	NC		nc	
800-900	NC	NC	NC	NC	NC		nc	
Total	5	0	5	0	77	1	197	2

Reach	8/18/2009 # Live	8/18/2009 # Dead	8/26/2009 # Live	8/26/2009 # Dead	8/31/2009 # Live	8/31/2009 # Dead	9/9/2009 # Live	9/9/2009 # Dead
intertidal1	49		40	4	8			
intertidal2	220		130		45	2	3	
0-100	140		105		50		11	
100-200	46		50		28		2	
200-300	122		55		30		0	
300-400	129		22		13		nc	
400-500	37		12		9			
500-600	12		12		19			
600-700	nc		0		1			
700-800	nc		0		0			
800-900	nc		nc		0			
Total	755	0	426	4	203	2	16	0