

The SeaCrest Group

An Environmental Services Company

April 10, 2006

Mrs. Elizabeth Russell
Left Hand Watershed Oversight Group
P.O. Box 1074
Niwot, Colorado 80544-1074

Dear Mrs. Russell:

Enclosed is the document summarizing the data generated from acute sediment toxicity tests and physical characterizations of sediments located within the Left Hand Watershed (LHWS) of Boulder County, Colorado. These tests were implemented in support of the Left Hand Watershed Oversight Group (LWOG) and performed by The SeaCrest Group, an environmental services laboratory located in Louisville, Colorado.

If you have any questions or concerns, please do not hesitate to contact me at (303) 661-9324.

Best regards,



Shannon Phelps

Lab Manager

Enclosure(s): Report
Invoice

The SeaCrest Group

An Environmental Services Company

COPY

March 30, 2005

Ms. Elizabeth Russell
Lefthand Watershed Oversight Group
3114 Belljive
Boulder, Colorado 80301

RE: The Collection and Analysis of Sediment Samples for Lefthand Watershed Oversight Group Matching Funds


Dear Ms. Russell:

As previously agreed, The SeaCrest Group is looking forward to assisting the Lefthand Watershed Oversight Group (LWOG) in collecting and analyzing sediment samples to provide long-term indicators of intermittent sources in order to better understand the impacts of toxic metals in the basin.

The SeaCrest Group will be matching funds from the LWOG in the amount of \$4,000.00. This work should begin approximately the second or third quarter of 2005.

If you have any questions or concerns, please do not hesitate to contact me at (303) 661-9324.

Best regards,



Shannon Phelps
Senior Scientist

**RESULTS OF ACUTE SEDIMENT TOXICITY TESTS
CONDUCTED FOR THE
LEFT HAND WATERSHED OVERSIGHT GROUP
ON THE
LEFT HAND WATERSHED SITES**

Prepared for:

Mrs. Elizabeth Russell
Left Hand Watershed Oversight Group
P.O. Box 1074
Niwot, Colorado 80544-1074

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April 10, 2006

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INTRODUCTION

This document summarizes the data generated from acute sediment toxicity tests and physical characterizations of sediments located within the Left Hand Watershed (LHWS) of Boulder County, Colorado (Figure 1, Appendix 3). These tests were implemented in support of the Left Hand Watershed Oversight Group (LWOG) and performed by The SeaCrest Group, an environmental services laboratory located in Louisville, Colorado.

Analyses conducted on sediments included a physical characterization of seven sampling sites each corresponding to a 10-day whole-sediment toxicity test using the amphipod *Hyaella azteca*. All seven sites were sampled on two separate events selected to represent an early season high run-off flow regime and a late season low flow regime.

The Sample Collection and Handling Plan for the overall project outlines the procedures used to identify sampling stations and to collect sediment samples. The sediment sampling strategy provided both broad geographic coverage of the watershed and also focused on specific areas of concern. All sites were selected on the basis of current metals loading data and proximity to acidic, metal laden mines and waste rock piles located within the watershed.

Historical mining in the LHWS, outside of Boulder, Colorado, has impacted the water quality of the surrounding ecosystem. Acidic, metal laden water emanating from inactive mines and waste rock piles presently pose acute and chronic risks for aquatic organisms (USEPA, 2002). Metals including manganese, aluminum, beryllium, cadmium, cobalt, copper, iron, lead, magnesium, nickel, and zinc have been identified in sediment and surface water samples taken from the Left Hand Creek and several of its tributaries. These metals, associated with the Captain Jack Mill and the Golden Age Mining District sites, have created a more acidic water system resulting in documented fish kills within the drainage (NACCHO, 2005; Woods et al., 2005).

Sediment is a major repository for many of the most persistent chemicals that are introduced into surface waters and provides habitat for many aquatic organisms. In aquatic environments, most anthropogenic chemicals and waste materials including toxic organics and inorganic chemicals eventually accumulate in sediment. Mounting evidence exists of environmental degradation in areas where United States Environmental Protection Agency (USEPA) water quality criteria are not exceeded, yet organisms in or near sediments are adversely affected (ASTM 2000a, USEPA 2000b). Although certain chemicals are highly sorbed to sediments, many compounds may still be directly toxic to aquatic life or can be a source of contaminants for bioaccumulation in the food chain.

The research conducted by The SeaCrest Group is part of a cooperative effort to characterize the impacts of historical mining activities within LHWS. Recent surveys conducted in the watershed have identified concerns that continued acid mine drainage would permanently impair aquatic health and that aquatic biomonitoring would provide another useful tool in interpreting the continued impacts associated with acid mine drainage and sediment loading.

Aquatic biomonitoring has provided an effective means by which the toxicity of discharges from mining operations can be tested. These tests typically used standardized, surrogate freshwater invertebrates to measure the aggregate toxic effects of the water and sediment matrices (Grothe et al. 1995). Those selected biological species, notably *Hyalella azteca*, are among several indicator species most sensitive to metals and organics.

The primary objectives of this research was designed to provide information needed to develop site-specific linkages between sediment and water chemistry data provided from 2004-2005 analyses and current biological effects characterized within the study area. Additionally, the biological toxicity data would provide critical information used to directly assess the mobility and bioavailability of mine wastes, as well as, the success of mine reclamation processes occurring within the watershed.

METHODS

Sample Collection and Handling

Sampling locations were determined using the site priority list provided by the LWOG Watershed Plan (Woods et al., 2005). Samples were distributed in a manner that provides broad geographical coverage of the watershed, as well as, a focus on specific sites characterized by high metal loading data.

Preliminary field assessments were conducted on June 2005 to determine the severity of acid mine drainage and to identify convergent tributary loading into the Little James and Left Hand Creeks. Also, two reference-sampling sites were established in the watershed. One, on the Little James Creek west (upstream) of the Argo Mine input and a second reference site located in the Left Hand Creek west of the Peak to Peak Highway (Hwy. 119). These reference sample sites are used as an indicator of localized sediment conditions exclusive of the specific pollutant inputs of concern (USEPA, 2000). Reference sites are considered non-impacted waters and serve as second controls for the investigation.

Seven individual sites were selected along Left Hand Creek and Little James Creek for sediment sampling. Selected sites upstream and downstream of potential impacted areas were chosen to bracket toxicity entering from tributaries, as well as, emanating from streamside waste rock piles or subsidence pits associated with the historical mining practices. All sites and sediments were characterized in the field and are further described in the Characterization of Sediments and Sampling Sites Plan.

Sediments were collected in July and October 2005 to characterize high and low flow water regimes within the watershed. Total volume of sediment collected from each site ranged from one to two liters depending on availability. Sampling equipment was cleaned between sampling sites by scraping off excess sediment and rinsing the equipment in site water. Sediments for each station were brought back to the lab in sterilized, high density polypropylene containers collected in an iced cooler. Samples were received chilled to the SeaCrest laboratory where they were held at 4°C in a dark refrigerator. Chain of custody forms showing sample collection and laboratory arrival times are included in Appendix I.

Sediment grain size

Hyalella azteca are found in many fresh water sediments and are tolerant of variable grain size. Although sediment grain sizes were not established prior to testing, observations of the sampled sediments suggest a mix of silts and sands with no one sediment characterized as a purely sandy or purely silty sample.

Sieving and Homogenization

The sediment did not require sieving but were thoroughly stirred and all large particles (i.e. branches, stones) were removed manually. Each of the sediments was visually inspected for indigenous organisms but none were observed prior to test initiation. All sample sediments were treated in the same manner in regards to processing and addition to the test containers

Pore water quality

Total ammonia, temperature and pH of pore water from surrogate containers were taken on days -1 and 10. Interstitial water was collected by centrifuging 50 ml of each homogenized sample for 30-45 minutes at 4,000 rpm. The pore water chemistry results are located in Appendix 2.

Overlying Water

Laboratory reconstituted water was used as the initial and renewal water source for the tests. Reconstituted water was matched to pH, hardness and alkalinities identified in past water analyses of the watershed and was created by adding sodium bicarbonate, calcium sulfate, magnesium sulfate and potassium chloride to deionized water.

Sampling Site Characterization

Sampling sites are located in the Left Hand (LHC) and Little James Creeks (LJC) (Figure1). Site characterization, physical descriptions, and sample identifications are presented in Appendix 3

Test Organisms

The tests were conducted with the benthic amphipod *Hyalella azteca*. The amphipods used in the sediment tests were age selected using methods as prescribed by the USEPA (USEPA, 2000). Reference toxicant tests using potassium chloride were conducted to insure test organism health and test acceptability. One set of forty animals per sampling event was randomly selected and weighed to compare against growth endpoints for the 10-day tests.

Test Procedures

The tests followed USEPA (2000b) procedures outlined in EPA/600/R-99/064. The first set of tests was started on July 20, 2005 (Day -1) with the addition of water over the sediments. Pore water total ammonia, temperature and pH were also measured on Day -1 and are included in Appendix 2. Ten animals were added to each test container on July 21, 2005 (Day 0). The test ran for 10-days, ending on July 31, 2005. A second pore water quality reading was also taken on this day.

The second set of *Hyalella azteca* tests were started on October 9, 2005 (Day-1) with the addition of water over the sediments. Pore water total ammonia, temperature and pH were also measured on Day-1 and are included in Appendix 2. Ten animals were added to each test container on October 1, 2005 (Day 0). The test ran for 10-days, ending on October 20, 2005. A second pore water quality reading was also taken on this day.

Test containers were 300 ml lipless glass beakers with a 6 cm inner diameter to which 100 ml of the homogenized sediments were added. To this was added 175 ml of reconstituted water. . Eight replicates were used for each sediment sample. A negative control was run for each sampling event. The control used clean, uncontaminated sediment created with medium-to-fine grain sand mixed with sediment purchased from Aquatic Research Organisms.

Daily change outs replaced approximately 100 ml of water once per day in each test container. The test containers were monitored for temperature and dissolved oxygen before and after the water change outs. Water used for the change outs was kept at 4°C and warmed in the incubator to test temperature each day. The data sheets documenting the water batch preparations are located in Appendix 4.

Test animals were fed 1.0 ml of Tetramin daily after each water change out. Observations of mortality, feeding regimes and/or effects were made at water change outs (Appendix 5).

The water over each sediment sample was measured for dissolved oxygen, temperature, pH, alkalinity, hardness, ammonia and conductivity at the beginning and at the end of the tests. The data sheets containing the daily readings of temperature and dissolved oxygen, and the water quality readings taken at the beginning and end of the tests are located in Appendix 6. The tests were held at $23 \pm 1^\circ\text{C}$ in an incubator at a 16-hours light/8-hours dark cycle under a wide spectrum florescent light bank at 700 lux illumination. The daily temperature readings for the incubator are located in Appendix 7.

Dissolved oxygen levels were maintained above 2.5 mg/L in overlying water, as per the sediment toxicity test guidelines. All sediments in both tests were aerated from the beginning of the tests due to low initial dissolved oxygen levels.

At the end of the *Hyalella azteca* tests, water from each replicate was composited for final water quality readings. Each sediment replicate was sieved into a clean plastic pan and searched thoroughly for live animals. Diligent effort was made to account for every test organism, either by retrieving them live or finding a body. The live organisms were euthanized and placed in a drying oven at 70°C for 24 hours. The organisms were then weighed on a four-place analytical balance to determine average dry weights. The data sheets containing the dry weight determinations and the number of surviving *Hyalella azteca* are presented in Appendix 8.

Data Analysis

LC50's were calculated using EPA's TOXDAT Multi-Method Program according to the binomial, probit or moving average methods. Data from the sediment test(s) were analyzed using the TOXSTAT package developed at the University of Wyoming by West, Inc. Test acceptability was determined using control survival and growth criteria (USEPA).

RESULTS

Pore water quality

Pore water characteristics were generally similar among collected sediments. Initial ammonia readings were less than 1.0 mg/L in all sediments. Final ammonia readings ranged up to 4.0 mg/L. The sediment pH levels ranged from 6.5-8.0 in initial and final sediments. Overlying water used during test initiation and change outs had a pH of 8.0.

Hyaella azteca Test

Mean control survival for the July 2005 test was 86% and measurable growth was documented (Table 1). Therefore, these tests met the acceptability criteria recommended in USEPA (2000b). Statistically significant mortality was measured in the LJC-02, LJC-03, LHC-01, LHC-02 and LHC-04 sediment samples when compared with the control.

Table 1. Comparison of test parameters for *Hyaella azteca* in exposures from sediments collected in July 2005.

Sample ID #	Survival Range (%)	Average Survival (%)	Weight Range (mg)	Average Weight per animal (mg)	Significance	
					Surv.	Growth
Control	70-100	86	0.08-0.20	0.14		
LJC-R01	60-100	80	0.13-0.40	0.27		
LJC-02	0-10	3	0.00-0.10	0.03	*	*
LJC-03	0-10	1	0.00-0.10	0.01	*	*
LHC-01	20-60	36	0.15-0.55	0.33	*	
LHC-02	20-70	40	0.12-0.35	0.21	*	
LHC-R03	50-90	70	0.10-0.34	0.25		
LHC-04	0-30	4	0.00-0.10	0.01	*	*

Average weights of individual amphipods ranged from 0.01 mg per individual in the LJC-03 and LHC-04 samples to 0.33 mg per individual in the LHC-01 sample. Control average weights were 0.14 mg per individual. Statistically significant differences for growth were measured in the LJC-02, LJC-03 and LHC-04 sediment samples when compared with the control.

Mean control survival for the October 2005 test was 81% and measurable growth was documented (Table 2). Therefore, these tests also met the acceptability criteria recommended in USEPA (2000b). Overall survival in these sediments was better than that measured in the July tests. Nevertheless, statistically significant mortality was measured in the LHC-01, LHC-02 and LHC-04 sediment samples when compared with the control.

Table 2. Comparison of test parameters for *Hyalella azteca* in exposures from sediments collected in October 2005.

Sample ID #	Survival Range (%)	Average Survival (%)	Weight Range (mg)	Average Weight per animal (mg)	Significance	
					Surv.	Growth
Control	70-100	81	0.24-0.43	0.34		
LJC-R01	60-90	70	0.17-0.34	0.26		
LJC-02	50-80	65	0.17-0.42	0.28		
LJC-03	40-100	73	0.02-0.15	0.08		*
LHC-01	50-90	63	0.17-0.36	0.26	*	
LHC-02	20-80	54	0.05-0.25	0.12	*	*
LHC-R03	80-100	83	0.16-0.37	0.23		
LHC-04	0-20	6	0.00-0.50	0.17	*	*

As with survival, overall growth was higher than that observed in September. Average weights of individual amphipods ranged from 0.08 mg per individual in the LJC-03 sample to 0.28 mg per individual in the LJC-02 sample. Control average weights were 0.34 mg per individual. Statistically significant differences for growth were measured in the LJC-03, LHC-02 and LHC-04 sediment samples when compared with the control.

REFERENCE TOXICANT TEST RESULTS

Hyalella azteca

The test organism history sheets from the supplier, Aquatic Research Organisms and reference toxicity test bench sheets are located in Appendix 9 (QA/QC). Measured LC50s were 185.6 ppb potassium chloride for both reference toxicant tests using the Probit Statistical Method. Control survival did not meet 90% in the July retox and should be considered when characterizing the July testing data.

DISCUSSION

The objectives of this research was designed to provide information needed to develop site-specific linkages between sediment and water chemistry data and provide critical information used to directly assess the mobility and bioavailability of mine wastes, as well as, the success of mine reclamation processes occurring within the watershed.

Hard rock mine produced waters tend to have high dissolved metals which have been implicated in the cause of toxicity for numerous discharges of this type and tend to accumulate in associated sediments downstream from the mining operations. *Hyalella azteca* generally show sensitivities to dissolved metals, given the right hardness, at concentrations in the parts per billion (ppb) ranges and have been shown to be a particularly good indicator of sediment contamination (USEPA, 2000b).

Sediment test results suggest that water quality conditions found within particular reaches of the Little James Creek and the Left Hand Creek have the potential to impact the aquatic environment. Sediment toxicity was most obvious in areas downstream from the Captain Jack Mill and the Golden Age Mining District sites, more specifically locations below the Burlington Mine Reclamation and Captain Jack Mine sites. This is suggestive of the potential for bioavailability and mobility of contaminants emanating from or around those inactive mine operations.

While it is known that metals and other contaminants reside within sediments the bioavailability of those contaminants to aquatic and terrestrial species is less understood. The seasonal toxicity observed in the sediment tests corresponds with toxicity patterns observed in the overlying waters in the watershed. This is based on data collected by the SeaCrest Group in the spring to fall periods in 2004. These toxicity patterns correlate with periods of high flows (i.e. high toxicity) and low flows (i.e. low toxicity). This may suggest that toxicity may be more a function of overlying water quality as opposed to a sink of contaminants attached to the sediments. Secondly, toxicity could be attributed to porewater contaminant concentrations. Porewater in the sediments has been shown to be an important source of toxicity in contaminated sediments (USEPA 1993; Di Toro et al. 1991; Adams et al. 1985). Information is needed to demonstrate how contaminant levels in the sediments, and particularly the porewaters, fluctuate with periods of high and low flows and the overlying water quality. This could be an important contribution to understanding the fate of contaminants in the sediments and in being able to predict rates of recovery when the sources of contamination are eliminated.

REFERENCES

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USEPA. 2000b. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment Associated Contaminants with Freshwater Invertebrates, second edition*. EPA/600/R-99/064, Washington, DC.

USEPA, 2002. United States Environmental Protection Agency. HRS Documentation Record for the Captain Jack Mine. August 1, 2002.

Woods, A. R., Russell, E. A., 2005. Watershed management plan for the Upper Lefthand Creek watershed, Boulder County, Colorado. Available online at <http://www.LWOG.org>.

APPENDIX 1 – CHAIN OF CUSTODY



1341 Cannon Street • Louisville, Colorado 80027
 303-661-9324 • FAX 303-661-9325

Chain of Custody Record

(enclose with each shipping container)

Purchase Order Number _____
 Project Number (lab use only)
305-1761-7

Client: The SeaCrest Group Contact: _____ Address: _____
 Program/Site: Left hand watershed # Phone: _____

Collected by: Shannon Phelps & Holly Garrett

Sample ID	Sample Identification (Effluent, Receiving, Sediment, list other)	Date Sampled	Time	Sample Type (composite, grab)	Acute			Chronic			Sediment Other Test	Total Units	Total Volume		
					Cerit	FH Minnow	Accelerated	Cerit	FH Minnow	Accelerated					
1	JJC - R01	7/19/05	10:30	Grab											
2	LJC - 02	7/19	1050	"											
3	LJC - 03	7/19	1110	"											
4	LHC - 01	7/19	1130	"											
5	LHC - 02	7/19	1150	"											
6	LHC - R03	7/19	1210	"											
7	LHC - 04	7/19	1230	"											
8															
9															
10															

These fields may be used for field test results

Comments and special testing instructions: _____

Relinquished by: Holly Garrett Representing: SeaCrest Group To Whom: SeaCrest Group Date/Time: 7/19/05 1400
 Relinquished by: SRP Representing: _____ To Whom: _____ Date/Time: _____
 Next recipient: _____ Relinquished by: Holly Garrett Rec'd by: Holly Garrett Date/Time: 7/19/05 1400

WHITE COPY: Accompanies samples

CANARY COPY: Client



1341 Cannon Street • Louisville, Colorado 80027
303-661-9324 • FAX 303-661-9325

Chain of Custody Record

(enclose with each shipping container)

Purchase Order Number _____

Project Number (lab use only)

305292 (1-7)

Client: The SeaCrest Group Address: _____

Contact: _____

Program/Site: LHWS SAMPLING #2 Phone: _____

Collected by: _____

Sample ID	Sample Identification (Effluent, Receiving, Sediment, list other)	Date Sampled	Time	Sample Type (composite, grab)	Acute			Chronic			TRE	Serials Other 6-Day Kysl	Total Units	Total Volume
					Cerio	FH Minnow	Accelerated	Cerio	FH Minnow	Accelerated				
1	LHC - R03 - 2	100605	1155	G								X		
2	LHC - 04 - 2	100605	1220	G								X		
3	LHC - 02 - 2	100605	1245	G								X		
4	LHC - 01 - 2	100605	1250	G								X		
5	LJC - R01 - 2	100605	1310	G								X		
6	LJC - 02 - 2	100605	1325	G								X		
7	LJC - 03 - 2	100605	1330	G								X		
8														
9														
10														

These fields may be used for field test results

Comments and special testing instructions:

*LJC Dry

Relinquished by: _____ Representing: _____ To Whom: _____ Date/Time: _____
 Relinquished by: _____ Representing: _____ To Whom: _____ Date/Time: _____
 Next recipient: _____ Relinquished by: _____ Rec'd by: [Signature] Date/Time: 100605-1510

APPENDIX 2 – PORE WATER CHEMISTRIES

Sediment Pore Water Chemistry for October 2005

Project Name: LHWS

Project Number: 305292

Test Day: -1

Test Type: Sediment

Bulk Sample (ID #)	Pore Water Total Ammonia (mg/L)	Temperature (Degree C)	pH (S.I. units)
LJC-R01	0.04	5.5	6.9
LJC-02	0.04	5.5	6.9
LJC-03	0.22	5.1	6.5
LHC-01	0.89	5.7	7.1
LHC-02	0.99	5.9	6.9
LHC-R03	0.78	5.6	6.9
LHC-04	0.85	6.0	6.9
Control	0.73	5.4	8.0

Recorder: SP

Project Name: LHWS

Project Number: 305292

Test Day: 10

Test Type: Sediment

Bulk Sample (ID #)	Pore Water Total Ammonia (mg/L)	Temperature (Degree C)	pH (S.I. units)
LJC-R01	2.77	23.0	6.9
LJC-02	2.77	22.4	6.6
LJC-03	3.99	22.3	6.8
LJC-04	2.77	22.4	6.6
LHC-02	2.27	22.5	7.1
LHC-03	2.27	22.5	7.1
LHC-04	2.62	22.8	7.0
Control	0.98	22.7	7.9

Recorder: SP

Sediment Pore Water Chemistry for July 2005

Project Name: LHWS

Project Number: 305176

Test Day: -1

Test Type: Sediment

Bulk Sample (ID #)	Pore Water Total Ammonia (mg/L)	Temperature (Degree C)	pH (S.I. units)
LJC-R01	0.02	6.0	6.8
LJC-02	0.08	5.8	6.9
LJC-03	0.02	5.7	6.6
LHC-01	0.92	6.2	7.3
LHC-02	0.84	6.4	7.1
LHC-R03	0.43	5.8	6.9
LHC-04	0.39	5.6	6.9
Control	0.98	5.9	6.0

Recorder: SP

Project Name: LHWS

Project Number: 305176

Test Day: 10

Test Type: Sediment

Bulk Sample (ID #)	Pore Water Total Ammonia (mg/L)	Temperature (Degree C)	pH (S.I. units)
LJC-R01	2.99	22.4	7.3
LJC-02	3.38	22.3	7.3
LJC-03	3.98	24.5	7.2
LHC-01	3.66	23.8	7.6
LHC-02	2.99	25.3	7.5
LHC-R03	2.88	24.6	7.3
LHC-04	3.98	25.0	7.0
Control	0.98	25.5	7.7

Recorder: SP

APPENDIX 3 – SAMPLING SITE CHARACTERIZATION

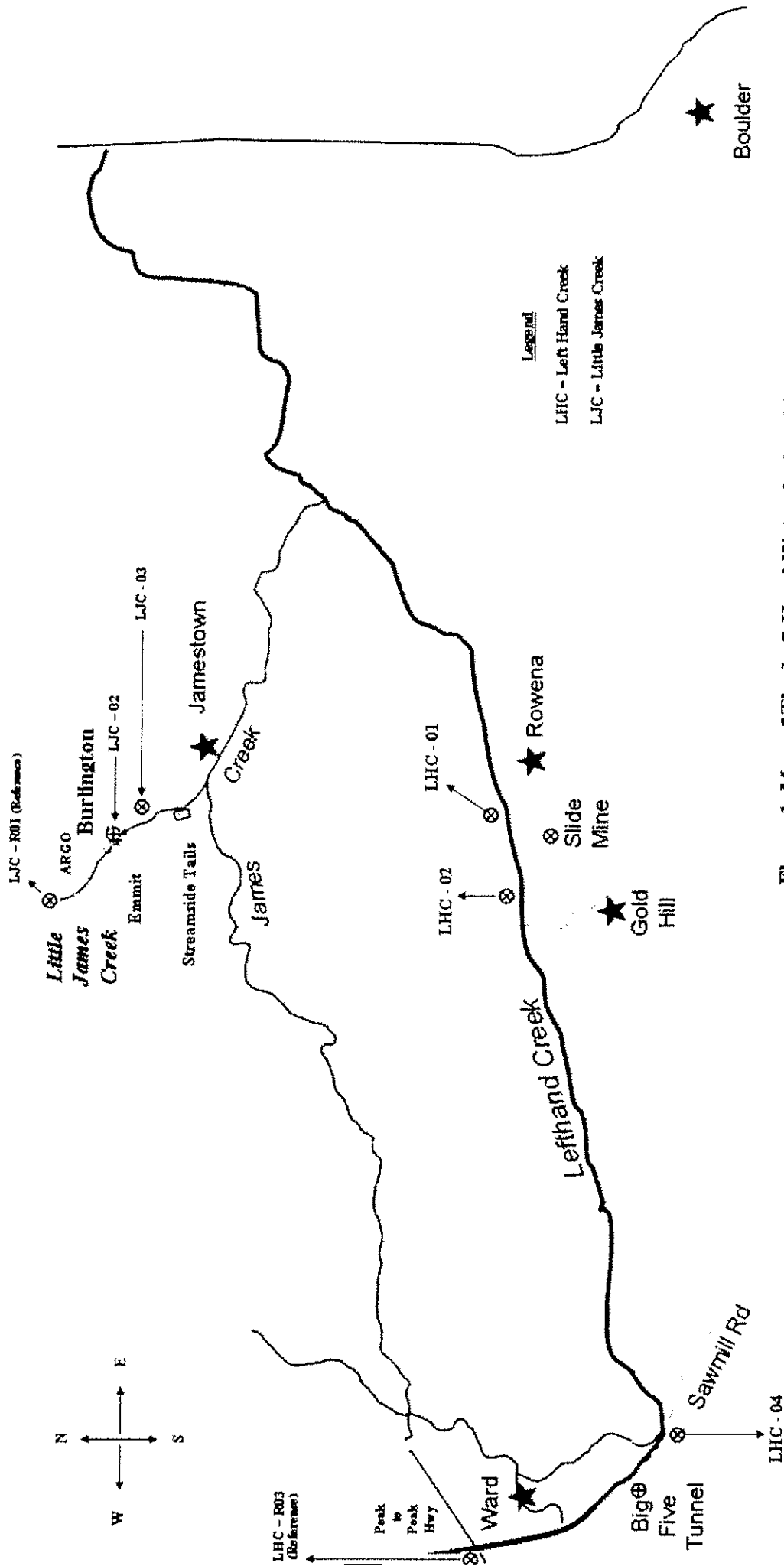


Figure 1. Map of The Left Hand Watershed and Sampling Sites

Characterization and Physical Description of LHWS Sampling Sites

Samples taken on 07/19/2005

- Site Description
 - Little James Creek
 - LJC-R01 (reference point above Argo mine)-Medium, clear flow in creek. Sandy soils and light colored sediment. Limited sediment in stream.
 - Little James Creek:
 - LJC-02 (sample of Balarat Creek below the reclamation pond before meeting with LJC)-Low flow in creek. Yellow-orange precipitate (crust) on sediment surface and in water. Sandy sediment.
 - LJC-03 (sample of convergence of Balarat Creek and LJC)-Medium flow in creek. Orange precipitate persistent with this sample. Sandy sediment.
 - Left Hand Creek
 - LHC-01 (downstream of Slide mine runoff)-High, clear flow in creek. Silty-sandy sediment.
 - LHC-02 (upstream from the Slide mine runoff)-High, clear flow in creek. Silty-sandy sediment.
 - LHC-R03 (reference point on LHC located above the Peak to Peak highway)-Medium, clear flow in creek. Very rocky streambed and dark sediments.
 - LHC-04 (sample of convergence of LHC and Independence creek below Captain Jack mill)-High, clear flow in creek. Rocky streambed and dark, organic sediment.

Samples taken on 10/06/2005

- Site Description
 - Little James Creek
 - LJC-R01 (reference point above Argo mine)-No flow in creek. Sandy, dry soils and light colored sediment. Limited sediment in stream.

- Little James Creek:
 - LJC-02 (sample of Balarat creek below the reclamation pond before meeting with LJC)-No flow in creek. Yellow-orange precipitate (crust) on sediment surface and in pooled waters. Sandy, dry sediment.
 - LJC-03 (sample of convergence of Balarat creek and LJC)-No flow in creek. Orange precipitate persistent with this sample. Sandy, dry sediment.

- Left Hand Creek
 - LHC-01 (downstream of Slide mine runoff)-Medium, clear flow in creek. Silty-sandy sediment.
 - LHC-02 (upstream from the Slide mine runoff)-Medium, clear flow in creek. Silty-sandy sediment.
 - LHC-R03 (reference point on LHC located above the Peak to Peak highway)-Medium, clear flow in creek. Very rocky streambed and dark sediments.
 - LHC-04 (sample of convergence of LHC and Independence creek below Captain Jack mill)-Medium, clear flow in creek. Rocky streambed and dark, organic sediment.

APPENDIX 4 – ANALYTICAL DATA

Vertebrate Reconstituted Freshwater Preparation Log

Batch #	Water quantity	Grams CaSO ₄	Grams NaHCO ₃	Grams KCl	Grams MgSO ₄	Date	Initials	Hardness*	Alkalinity*	Conductivity†	Date	Initials
05024	50 gal	11.4	18.25	0.76	11.4	05025	HL	94	67	306	05025	HL
05025	50 gal	11.4	18.25	0.76	11.4	05105	HL	89	66	298	05105	HL
05026	50 gal	11.4	18.25	0.76	11.4	05185	HL	96	41/62	300	05195	HL
05027	50 gal	11.4	18.25	0.76	11.4	05235	HL	56/82	66	314	05245	HL
05028	50 gal	11.4	18.25	0.76	11.4	05315	HL	94	63	305	060105	HL
05029	50 gal	11.4	18.25	0.76	11.4	06075	HL	97	60	282	06075	HL
05030	50 gal	11.4	18.25	0.76	11.4	06165	HL	95	62	256	06165	HL
05031	50 gal	11.4	18.25	0.76	11.4	06225	HL	81	62/64	279	06225	HL
05032	50 gal	11.4	18.25	0.76	11.4	07015	HL	91	64	305	0702	HL
05033	50 gal	11.4	18.25	0.76	11.4	07105	HL	80	66	276	0711	HL
05034	50 gal	11.4	18.25	0.76	11.4	07165	HL	97	61	319	07175	HL
05035	50 gal	11.4	18.25	0.76	11.4	07205	HL	95	69	313	07225	HL
05036	50 gal	11.4	18.25	0.76	11.4	07305	HL	95	69	295	07305	HL
05037	50 gal	11.4	18.25	0.76	11.4	07405	HL	96	63	307	07405	HL
05038	50 gal	11.4	18.25	0.76	11.4	08065	HL	81	63	309	08065	HL
05039	50 gal	11.4	18.25	0.76	11.4	08105	HL	91	62	273	08105	HL
05040	50 gal	11.4	18.25	0.76	11.4	08165	HL	95	62	308	08165	HL
05041	50 gal	11.4	18.25	0.76	11.4	08205	HL	93	60	316	08205	HL
05042	50 gal	11.4	18.25	0.76	11.4	08245	HL	93	63	294	08245	HL
05043	50 gal	11.4	18.25	0.76	11.4	08305	HL	90	61	297	08305	HL
05044	50 gal	11.4	18.25	0.76	11.4	08345	HL	96	67	302	08345	HL
05045	50 gal	11.4	18.25	0.76	11.4	08385	HL	97	65	307	08385	HL
05046	50 gal	11.4	18.25	0.76	11.4	10045	HL	90	63	311	1005	AC
05047	50 gal	11.4	18.25	0.76	11.4	10065	HL	97	67	304	1008	AC

Add
1.133
NaHCO₃

* Measured in milligrams/liter (mg/L) as CaCO₃
† Measured in micromhos/centimeter (µmhos/cm)

hardness=80-100
alkalinity=60-70

JS
W

**APPENDIX 5 – OBSERVATIONS OF MORTALITY, FEEDING REGIMES AND/OR
EFFECTS**

Lab #: LJC-R01

Day 0

Date 07/21/05

Initials 

Fed:

Day 1

Date 07/22/05

Initials 

Seds settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 2

Date 07/23/05

Initials HG

Seds settled
H₂O clear
Live worms present + swimming around
NO visible hyaella

Fed: 1.0 mL

Day 3

Date 07/24/05

Initials 

Seds settled
H₂O clear
NO visible org.

Fed:

Day 4

Date 07/25/05

Initials TM

Sed settled
H₂O clear
No vis org.

Fed: 1.0 mL

Lab #: LJC-R01

Day 5 Date 07/26/05 Initials TM

Sed. settled
H₂O clear
No visible spp

Fed: 1.0 ml

Day 6 Date 07/27/05 Initials TM

H₂O settled
H₂O clear
No visible spp

Fed: 1.0 ml

Day 7 Date 07/28/05 Initials TM

H₂O settled
H₂O clear
No visible spp

Fed: 1.5 ml

Day 8 Date 07/28/05 Initials TM

No visible spp
H₂O clear

Fed: 1.0 ml

Day 9 Date 07/30/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 ml

Lab #: WC-02

Day 0 Date 7/22/05 Initials _____

Fed:

Day 1 Date 07/22/05 Initials TM

sed settled
H₂O settled cloudy
No visible spp

Fed: 1.0 ml

Day 2 Date 07/23/05 Initials HG

H₂O clear
No visible species

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials D

H₂O clear
sed settled
NO visible org.

Fed: 1.0 mL

Day 4 Date 07/25/05 Initials D

H₂O clear
sed settled
NO visible org.

Fed: 1.0

Lab #: 305-176-6 (LJC-02)

Day 5 Date 07/26/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 6 Date 07/27/05 Initials TM

H₂O clear
No visible spp.

Fed: 1.5 mL

Day 7 Date 07/28/05 Initials TM

H₂O clear
No visible sp

Fed: 1.0

Day 8 Date 07/29/05 Initials h

H₂O clear
No visible spp.

Fed: 1.5 mL

Day 9 Date 07/30/05 Initials h

H₂O clear
no visible spp

Fed: 1.0 mL

Lab #: WC-03

Day 0 Date 07/21/05 Initials _____

Fed: _____

Day 1 Date 07/22/05 Initials TM

sed settled
H₂O cloudy
NO visible spp

Fed: 1.0 ml

Day 2 Date 07/23/05 Initials HG

H₂O clear
No visible species

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials D

H₂O clear
sed settled
NO visible org

Fed: 1.0 ml

Day 4 Date 07/25/05 Initials D

H₂O clear
sed. settled
No visible org.

Fed: 1.0 ml

Lab #: 305-176-5 (LJC-03)

Day 5 Date 07/26/05 Initials HG

H₂O clear
NO visible spp.

Fed: 1.0 ml

Day 6 Date 07/27/05 Initials TM

H₂O clear
No visible spp

Fed: 1.0 ml

Day 7 Date 07/28/05 Initials TM

H₂O clear
No visible spp

Fed:

Day 8 Date 07/29/05 Initials [Signature]

H₂O clear
No visible spp

Fed: 1.0 ml

Day 9 Date 07/30/05 Initials [Signature]

H₂O clear
No visible spp

Fed: 1.0 ml

Lab #: 305-176-4 (LHC-01)

Day 0 Date 07/21/05 Initials _____

Fed: _____

Day 1 Date 07/22/05 Initials TM

Sed settled
H₂O cloudy
No visible spp

Fed: 1.0 ml

Day 2 Date 07/23/05 Initials HG

Sediment settled
H₂O clear; some film on surface of some reps
No visible species

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials D

Sed settles
H₂O clear
No vis org.

Fed: 1.0 mL

Day 4 Date 07/25/05 Initials D

Sed. Settles
H₂O Clear
No Vis org.

Fed: ~~1.0~~ 1.0 mL

DSC

Lab #: 305-167-4 (LHC-01)

Day 5 Date 07/26/05 Initials HG
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 6 Date 07/27/05 Initials TM
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 7 Date 07/28/05 Initials TM
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 8 Date 07/29/05 Initials L
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 9 Date 07/30/05 Initials L
H₂O clear
No visible spp.

Fed: 1.0 mL

Lab #: 305-17b-7 (LHC-02)

Day 0 Date 07/21/05 Initials h

Species introduced
Aeration started

Fed:

Day 1 Date 07/22/05 Initials h

sed settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 2 Date 07/23/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials TM

visible spp. on some reps
H₂O clear
seeds settled

Fed: 1.0 mL

Day 4 Date 07/25/05 Initials TM

no vis spp
H₂O clear
Seed Settled

Fed: 1.0 mL

Lab #: 305-176-7 (LHC-02)

Day 5 Date 07/26/05 Initials HG
H₂O clear
No visible species

Fed: 1.0 mL

Day 6 Date 07/27/05 Initials HG
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 7 Date 07/28/05 Initials h
sed settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 8 Date 07/29/05 Initials TM
sed settled
H₂O clear
No visible spp

Fed: 1.0 mL

Day 9 Date 07/30/05 Initials HG
H₂O clear
Seds settled
No visible spp.

Fed: 1.0 mL

Lab #: LHC-R03

Day 0 Date 07/21/05 Initials _____

Fed: _____

Day 1 Date 07/22/05 Initials h

sed settled
H₂O clear
no visible spp.

Fed: 1.0 mL

Day 2 Date 07/23/05 Initials H

H₂O clear
lots of OM on top
No visible spp.

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials D

sed settled
H₂O clear
No vis. spp.

Fed: 1.0 mL

Day 4 Date 07/25/05 Initials TM

sed settled
H₂O clear
No vis spp

Fed: 1.0 mL

Lab #: LHC-R03

Day 5 Date 07/26/05 Initials TM

No visible spp
H₂O clear
sed settled

Fed: L0

Day 6 Date 07/27/05 Initials TM

No visible spp
H₂O clear
sed settled

Fed: 1.0 ml

Day 7 Date 07/28/05 Initials TM

No visible spp
H₂O clear

Fed: 1.0 ml

Day 8 Date 07/29/05 Initials l

H₂O clear
no visible spp.

Fed: 1.0 ml

Day 9 Date 07/30/05 Initials l

H₂O clear
No visible spp

Fed: 1.0 ml

Lab #: LHC-04

Day 0

Date 07/21/05

Initials _____

Fed: _____

Day 1

Date 07/22/05

Initials h

Sed settled
H₂O cloudy
No visible spp.

Fed: 1.0 mL

Day 2

Date 07/23/05

Initials HG

H₂O slightly cloudy
No visible spp.

Fed: 1.0 mL

Day 3

Date 07/24/05

Initials D

Sed. settled
H₂O Clear
No visible org.

Fed: 1.0 mL

Day 4

Date 07/25/05

Initials TM

Sed settled
H₂O clear slightly cloudy
No visible org

Fed: 1.0 mL

Lab #: LHC-04

Day 5

Date 07/26/05

Initials TM

sed settled
no visible spp
H₂O clear

Fed: 1.0 ml

Day 6

Date 07/27/05

Initials TM

H₂O clear
No visible spp

Fed: 1.0 ml

Day 7

Date 07/28/05

Initials TM

H₂O clear
No visible spp

Fed: 1.0 ml

Day 8

Date 07/29/05

Initials TM

H₂O clear
No visible spp

Fed: 1.0 ml

Day 9

Date 07/30/05

Initials HG

H₂O clear
No visible spp

Fed: 1.0 ml

Lab #: 305-176-8 (Control)

Day 0 Date 07/21/05 Initials [Signature]

species introduced
Accretion started.

Fed: 1.0 mL

Day 1 Date 07/22/05 Initials [Signature]

Seds Settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 2 Date 07/23/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 3 Date 07/24/05 Initials [Signature]

No visible spp.
H₂O clear w/ red tint most likely Iron oxide
Seds Settled

Fed: 1.0 mL

Day 4 Date 07/25/05 Initials [Signature]

No vis spp
H₂O clear
seed Settled

Fed: 1.0 mL

Lab #: 305-176-8 (Control)

Day 5 Date 07/26/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 ml

Day 6 Date 07/27/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 ml

Day 7 Date 07/28/05 Initials l

sed. settled
H₂O clear
No visible spp.

Fed: 1.0 ml

Day 8 Date 07/29/05 Initials JM

sed. settled
H₂O clear
No visible spp
Reddish color to sediment

Fed: 1.0 ml

Day 9 Date 07/30/05 Initials HG

H₂O slightly cloudy in some cups
No visible spp.

Fed: 1.0 ml

Lab #: 305-292-3 (LC-R01-02)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 ml

Day 1 Date 10/11/05 Initials HG

Sed settled
H₂O clear
No visible spp.

Fed: 1.0 ml

Day 2 Date 10/12/05 Initials HG

Seds settled
No visible spp.
H₂O clear

Fed: 1.0 ml

Day 3 Date 10/13/05 Initials HG

No visible orgs.
H₂O clear

Fed: 1.0 ml

Day 4 Date 10/14/05 Initials CW

No spp. visible
H₂O clear

Fed: 1.0 ml

Lab #: 365-292-3 (JC-R01-02)

Day 5 Date 10/15/05 Initials HG

H₂O clear
No spp. visible

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials D

H₂O clear
No vis. org.

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
No visible spp

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear, sed. settled. no visible spp.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials Ad

H₂O clear, sed settled, no visible spp

Fed: 1.0 mL

Lab #: 305-292-2 (WL-02-02)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediment settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HG

Seds settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HG

No visible spp.
H₂O clear

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials CW

H₂O clear
No spp. visible

Fed: 1.0 mL

Lab #: 305-292-2 (WJC-02-02)

Day 5 Date 10/15/05 Initials HG

H₂O clear
No visible spp.
Sed. settled

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials D

H₂O
Clear
No Vis. Org.
Sed. Settled

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
Sed. settled
No visible spp

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HLV

H₂O clear, no visible spp, sed. settled.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

no visible spp, H₂O clear, sed. settled

Fed: 1.0 mL

Lab #: 305-292-1 (LIC-03-02)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediment settled
No visible spp.
H₂O clear

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HG

Sed. settled
No visible species
H₂O clear

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HG

H₂O clear
no visible spp.

Fed: HG

Day 4 Date 10/14/05 Initials HG

H₂O clear
No visible spp.

Fed: HG

Lab #: 305-292-1 (LJC-03-02)

Day 5 Date 10/15/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials D

H₂O clear
no vis org.
Sed settled

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
No visible spp
Sed settled

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear
sed settled
no visible spp

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

sed settled, H₂O clear, no visible spp

Fed: 1.0 mL

Lab #: 305-292-4 (LHC-01-02)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediment settled
H₂O clear
No visible spp.

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HG

Seds settled
H₂O clear
NO visible spp.

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HG

No visible spp.
H₂O clear

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials AC

No visible spp.
H₂O Clear

Fed: 1.0 mL

Lab #: 305-292-4 (LHC-01-02)

Day 5 Date 10/15/05 Initials HG

H₂O clear.
No visible spp.

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials ✓

H₂O clear
No VT org

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear, sed settled, no spp visible.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

no visible spp, H₂O clear, sed settled

Fed: 1.0 mL

Lab #: 305-292-5 (LHC-02-02)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediments settled
No visible spp.
H₂O clear

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HG

Seds settled
NO visible spp.
H₂O clear

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HG

No visible spp.
H₂O clear

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials AC

No visible spp.
H₂O clear

Fed: 1.0 mL

Lab #: 305-292-5 (LHC-0202)

Day 5 Date 10/15/05 Initials HG

H₂O clear
NO visible spp.

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials D

H₂O clear
No vis org

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
No visible spp

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear, sed. settled, no visible spp.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

sed settled, no spp visible, H₂O clear

Fed: 1.0 mL

Lab #: 305-292-7 (LHC-R0302)

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediment settled
H₂O clear
No visible spp.

Fed:

Day 2 Date 10/12/05 Initials HG

H₂O clear
No visible spp.

Fed:

Day 3 Date 10/13/05 Initials HG

NO visible spp.
H₂O clear

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials AC

No visible spp.
H₂O clear

Fed: 1.0 mL

Lab #: 305-292-7 (LHC - R03-02)

Day 5 Date 10/15/05 Initials HG

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials D

H₂O clear
No visible spp.

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
no visible spp.

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear, no visible spp.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

H₂O clear, sed settled, no spp visible

Fed: 1.0 mL

Lab #: 305-292-6 (LHC-0402)

Day 0 Date 10/10/05 Initials HB

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HB

Sediment settled
No visible spp.
H₂O clear

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HB

H₂O clear
NO visible orgs.

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HB

No visible spp.
H₂O clear

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials AC

No visible spp.
H₂O clear

Fed: 1.0 mL

Lab #: 305-292-6 (LHC-0402)

Day 5 Date 10/15/05 Initials HG

H₂O clear
No spp. visible

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials Ⓣ

H₂O clear
No vis. org

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O clear
No visible spp

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O clear, sed. settled. No visible spp.

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

H₂O clear, sed settled, no visible spp

Fed: 1.0 mL

Lab #: 305-292-C

Day 0 Date 10/10/05 Initials HG

Hyallela introduced

Fed: 1.0 mL

Day 1 Date 10/11/05 Initials HG

Sediment settled
No visible spp.
H₂O clear

Fed: 1.0 mL

Day 2 Date 10/12/05 Initials HG

Sediment settled
No spp. visible
H₂O clear

Fed: 1.0 mL

Day 3 Date 10/13/05 Initials HG

H₂O slightly murky
No visible spp.

Fed: 1.0 mL

Day 4 Date 10/14/05 Initials CW

H₂O slightly murky
No spp. visible

Fed: 1.0 mL

Lab #: 305-292-C

Day 5 Date 10/15/05 Initials HW

H₂O murky
No visible spp.

Fed: 1.0 mL

Day 6 Date 10/16/05 Initials _____

H₂O has fm (not clear)
No V, or G
sed settled

Fed: 1.0 mL

Day 7 Date 10/17/05 Initials HW

H₂O murky, no visible spp.

Fed: 1.0 mL

Day 8 Date 10/18/05 Initials HW

H₂O murky, sed. settled, no visible spp

Fed: 1.0 mL

Day 9 Date 10/19/05 Initials AC

sed settled, H₂O slightly murky, no visible spp

Fed: 1.0 mL

APPENDIX 6 – WATER QUALITY READINGS

Client LHWS Site L. James Creek - Ref 01 Lab # 305-176-1
 H₂O FHM MH Sample Date 071905 Species Info 072105 - ABS H. azteca (7-10)
 Test Setup 072005 Hyalella introduced 072105-1615 Test End _____
 Test Conditions _____

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	E		F		A		B		C		D	
DO	2.8	4.1	4.3	5.5	6.8	6.5	6.4	6.5	7.4	7.4	6.3	6.7
Temp °C	23.8	22.9	23.7	22.8	23.1	23.7	23.0	23.3	22.9	22.8	24.0	23.3
pH	6.9											
alkalinity	62											
hardness	89											
ammonia	0.269											
conductivity	328											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G 5.5		H 5.8		a		b		C		D	
DO	5.5	6.4	6.4	5.8	6.7	6.7	6.8	6.6	6.9	6.0	6.7	6.7
Temp °C	23.8	23.7	23.7	23.0	22.5	23.4	23.4	22.4	24.3	22.1	24.1	22.1
	Obs 23.1				21.9							

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	6.6	6.7	6.1	6.4	7.3	7.2	7.2	7.2	7.0	6.9	7.2	7.1
Temp °C	22.5	22.3	23.2	22.3	23.7	22.5	22.8	22.3	23.0	24.2	22.0	23.9
	23.0 FETM				23.2							

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep	C 7.2		D		G		H	
DO	7.1	6.9	6.9	6.9	5.8	/	6.1	/
Temp °C	22.2	22.4	22.5	22.9	24.1	/	24.8	/
					pH 7.2 alkalinity 105 hardness 89 ammonia 2.52 conductivity 318			

Client LHWS Site Little James Creek - 02 Lab # 305-176-6
 H₂O EHM MH Sample Date 071905 Species Info 072105 - ABS H. azteca (7-10d)
 Test Setup 072005 Hyalella introduced 072105 - 1500 Test End _____
 Test Conditions _____

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.1	5.6	5.1	5.6	7.0	6.5	6.8	6.7	7.2	7.3	7.0	7.1
Temp °C	24.2	24.2	24.2	24.2	24.1	23.2	23.3	23.7	23.4	24.2	22.5	24.0
pH	7.0											
alkalinity	53											
hardness	123											
ammonia	0.00											
conductivity	463											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G		M		A		B		C		D	
DO	6.4	6.8	6.6	7.0	6.2	7.1	6.5	7.7	2.5	5.7	5.3	6.5
Temp °C	23.9	22.7	24.2	22.9	24.9	24.0	25.0	24.0	24.3	24.0	24.7	24.1

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	2.8	5.4	5.9	6.3	7.7	7.5	7.7	7.5	7.8	7.4	6.9	6.5
Temp °C	23.3	22.3	22.8	22.1	23.3	23.2	23.6	23.3	22.6	24.0	24.5	24.6

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep					E		F	
DO	7.2	7.4	7.5	7.4	7.4	7.7	7.4	7.4
Temp °C	22.7	22.5	21.6	22.7	23.6	23.6	23.5	22.9
					pH		7.3	
					alkalinity		88	
					hardness		98	
					ammonia		3.28	
					conductivity		451	

Client LHWS Site Little James Creek - 03 Lab # 305-176-5
 H₂O FHM MH Sample Date 071905 Species Info 072105 - ABS H. azteca (7-10d)
 Test Setup 072005 Hyalella introduced 072105 - 1500 Test End _____
 Test Conditions _____

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.7	5.5	5.7	5.5	4.0	5.5	6.5	6.7	3.3	6.2	4.5	6.5
Temp °C	24.0	24.0	24.0	24.0	24.0	23.4	23.2	23.8	23.9	24.6	22.9	24.3
pH	6.7											
alkalinity	22											
hardness	121											
ammonia	0.00											
conductivity	466											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	6.5	6.7	6.8	7.0	6.6	7.0	6.5	7.1	6.1	6.4	4.5	6.1
Temp °C	23.4	22.8	24.1	22.9	24.9	24.1	24.8	24.1	24.4	24.4	24.1	24.4

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	6.4	6.5	6.2	6.5	7.8	7.5	7.6	7.4	6.9	6.4	7.4	7.3
Temp °C	23.5	22.3	23.4	22.3	22.7	22.9	23.3	23.1	24.4	24.2	23.7	23.9

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep					E		F	
DO	7.4	6.5	6.9	6.7	7.6	7.4	7.7	7.6
Temp °C	22.9	23.4	24.0	23.6	23.4	23.6	24.5	24.6
							pH	
							7.1	
							alkalinity	
							78	
							hardness	
							86	
							ammonia	
							3.87	
							conductivity	
							437	

Client LHWS Site Lefthand Creek-Ref-03 Lab # 305-176-3
 H₂O FHM MH Sample Date 071905 Species Info 072105-ABS H. azteca (7-10d)
 Test Setup 072005 Hyalella introduced 072105 - 1545 Test End _____
 Test Conditions _____

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	A		B E		C		D		E		F	
DO	0.7	2.9	0.8	3.2	6.0	5.5	5.1	5.1	6.6	6.8	5.8	6.2
Temp °C	24.0	23.3	24.0	23.1	22.0	24.0	24.2	24.0	23.3	22.8	23.5	22.9
pH	6.9											
alkalinity	64											
hardness	83											
ammonia	0.34											
conductivity	337											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G Dec		H Dec		A		B		C		D	
DO	5.7	2.63	5.9	2.76	6.5	6.0	2.2	3.8	6.3	6.0	6.5	6.0
Temp °C	24.6	23.2	24.7	22.2	22.1	21.3	23.2	21.6	22.0	22.4	22.8	21.8

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		G IP		H		A		B	
DO	6.7	5.3	3.1	4.6	7.7	7.4	7.6	7.4	7.5	6.7	7.4	5.4
Temp °C	24.0	23.7	24.4	23.5	21.9	22.7	22.0	22.8	22.3	22.6	22.9	22.6

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	7.0	6.6	6.8	5.9	6.9	7.2	6.2	7.0
Temp °C	22.2	22.4	22.5	23.5	23.8	24.0	23.6	23.9
							pH	7.2
							alkalinity	128
							hardness	89
							ammonia	26.50
							conductivity	330

Client LHWS Site Left Hand Creek - 04 Lab # 305-176-2
 H₂O FHM MH Sample Date 071905 Species Info 072105 - ABS H. azteca (7-10)
 Test Setup 072005 Hyalella introduced 072105-1600 Test End _____
 Test Conditions _____

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	4.5	5.4	4.5	5.6	6.4	6.6	2.0	4.5	4.8	7.1	4.6	7.0
Temp °C	24.0	23.3	24.0	23.1	22.7	23.3	24.2	24.1	22.9	22.8	22.5	22.7
pH	6.9											
alkalinity	62.48		EE									
hardness	89.71		HG									
ammonia	0.156											
conductivity	300											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	2.9	4.6	2.2	4.7	3.8	4.8	6.4	6.6	6.5	6.5	6.6	6.5
Temp °C	23.9	23.2	23.2	23.3	23.9	22.2	23.5	22.4	23.5	22.0	23.9	22.1

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	6.7	6.7	6.5	6.7	7.3	7.3	7.2	7.2	7.0	7.1	7.0	7.2
Temp °C	24.3	23.1	24.4	23.1	24.2	22.7 22.8	24.9	22.8 23.1	24.4	24.9	24.4	24.9

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep	C		D		E		H	
DO	6.9	6.8	5.5	6.6	5.9	/	5.2	/
Temp °C	23.4	23.8	24.0	23.8	24.6	/	25.0	/
							pH	7.1
							alkalinity	72
							hardness	70
							ammonia	3.59
							conductivity	305

Client LHWS Site Control Lab # 305-176-8
 H₂O FHM MH Sample Date 072005 Species Info 072105-ABS H. azteca (7-10d)
 Test Setup 072005 Hyalella introduced _____ Test End _____
 Test Conditions Potting soil w/ overlying sand layer

	0				1				2			
Day	Thursday				Friday				Saturday			
Date	072105				072205				072305			
a/b rep	a		b		a		b		a		b	
rep	2		3		C		D		E		F	
DO	5.5	6.2	6.0	6.4	6.7	6.7	6.7	6.7	7.4	7.3	7.3	7.3
Temp °C	23.5	22.0	22.2	22.9	22.9	22.9	24.2	24.0	23.7	23.6	23.6	23.6
pH	8.1											
alkalinity	79											
hardness	103											
ammonia	0.171											
conductivity	608											

	3				4				5			
Day	Sunday				Monday				Tuesday			
Date	072405				072505				072605			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	7.0	7.0	7.1	7.2	6.7	7.0	6.8	7.1	7.3	7.5	7.3	7.3
Temp °C	23.9	23.4	24.1	23.9	21.7	21.7	22.6	22.1	22.9	23.8	23.3	24.1

	6				7				8			
Day	Wednesday				Thursday				Friday			
Date	072705				072805				072905			
a/b rep	a		b		a		b		a		b	
rep	E		F		A		B		A		B	
DO	7.2	7.5	7.2	7.5	6.8	6.7	6.7	6.7	7.4	7.2	7.4	7.3
Temp °C	23.5	24.2	23.2	24.1	23.3	24.3	23.7	24.3	23.7	24.1	24.1	24.3

	9				10			
Day	Saturday				Sunday			
Date	073005				073105			
a/b rep	a		b		a		b	
rep	C		D		F		H	
DO	7.2	7.0	6.7	6.7	6.8	/	6.2	/
Temp °C	23.0	22.3	24.0	22.7	25.1	/	25.3	/
						pH	7.9	
						alkalinity	154	
						hardness	106	
						ammonia	0.743	
						conductivity	595	

10-day Hyalella Benchsheet

Client CR LWS Site LJC-RO1-2 Lab # 305292
 H₂O Mac Hard Sample Date 100605 Species Info Hyalella
 Test Setup 100905 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2							
Day	Monday								Tuesday				Wednesday			
Date	100905 101005								101005 101105				101205			
a/b rep	a		b		a		b		a		b		a		b	
rep	A		B		C		D		E		F					
DO	4.4	6.7	4.0	6.6	6.6	7.3	6.5	7.3	7.0	7.1	22.4	7.1				
Temp °C	23.3	23.3	23.7	23.2	22.3	22.6	22.2	22.5	22.6	22.4	22.4	22.3				
pH	7.0															
alkalinity	89 65 65															
hardness	102															
ammonia	2.0															
conductivity	315															

	3				4				5							
Day	Thursday								Friday				Saturday			
Date	101305								101405				101505			
a/b rep	a		b		a		b		a		b		a		b	
rep	G		H		A		B		C		D					
DO	7.0	7.1	7.1	6.9	7.3	6.3	7.3	6.6	6.6	5.6	6.8	5.7				
Temp °C	22.7	22.4	22.3	22.3	22.5	22.4	22.4	22.1	22.4	22.4	22.0	22.2				

	6				7				8							
Day	Sunday								Monday				Tuesday			
Date	101605								101705				101805			
a/b rep	a		b		a		b		a		b		a		b	
rep	E		F		G		H		A		B					
DO	6.9	5.4	6.9	5.4	4.3	5.8	6.3	6.1	6.8	5.3	6.6	5.5				
Temp °C	22.3	22.5	22.4	22.5	22.6	22.3	22.4	22.4	22.4	22.4	22.4	22.6	22.6			

	9				10							
Day	Sunday Wednesday								Monday Thursday			
Date	101905								102005			
a/b rep	a		b		a		b		a		b	
rep	C		D		E		F					
DO	6.6	5.7	6.3	5.7	7.3		7.3					
Temp °C	23.0	22.9	23.3	22.6	22.9		22.7					
pH	7.0											
alkalinity	98											
hardness	120											
ammonia	2.17											
conductivity	299											

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The SeaCrest Group
Louisville, CO

10-day Hyalella Benchsheet

Form #: 110a
Effective: November 2002

Client ~~UHS~~ UHS Site LJC-02-2 Lab # 305292
 H₂O Mod. Hard Sample Date 100905 Species Info Hyal. a.
 Test Setup 100905 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2			
Day	Monday				Tuesday				Wednesday			
Date	100905 101005				101005 101105				101205			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.6	6.9	5.6	6.8	6.6	7.1	6.7	7.2	7.0	6.9	7.0	6.8
Temp °C	23.6	23.5	23.4	23.3	22.4	22.6	22.2	22.7	22.8	22.1	22.6	22.1
pH	7.1											
alkalinity	62											
hardness	93											
ammonia	4.0											
conductivity	452											

	3				4				5			
Day	Thursday				Friday				Saturday			
Date	101305				101405				101505			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	6.9	6.9	6.9	6.8	7.1	6.6	7.1	6.7	6.1	6.1	6.0	5.9
Temp °C	22.0	22.3	22.1	22.4	22.2	22.6	22.3	22.8	22.1	22.1	22.3	22.1

	6				7				8			
Day	Sunday				Monday				Tuesday			
Date	101605				101705				101805			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	6.4	6.4	6.4	6.1	6.7	6.1	6.6	6.1	6.5	6.2	6.6	5.8
Temp °C	22.2	22.3	22.3	22.8	22.1	22.7	22.0	22.7	22.4	22.2	23.9	22.7

22.8

	9				10			
Day	Wednesday				Thursday			
Date	101905				102005			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	6.8	6.4	6.1	6.2	6.9	/		6.6
Temp °C	22.8	22.8	22.5	22.4	22.4	/		22.1

pH	7.2
alkalinity	93
hardness	120
ammonia	2.17
conductivity	398

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10-day Hyalella Benchsheet

Client LHWS Site LJC-03-2 Lab # 305292
 H₂O Moore Hard Sample Date 100605 Species Info Hyalella
 Test Setup 100905 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2							
Day	Monday								Tuesday				Wednesday			
Date	100905 101005								101005 101105				101205			
a/b rep	a		b		a		b		a		b		a		b	
rep	A		B		C		D		E		F					
DO	5.0	6.8	5.4	6.9	6.7	7.0	6.7	7.0	6.9	7.0	7.0	6.8				
Temp °C	23.5	23.4	23.4	23.3	23.0	22.3	22.7	22.6	22.6	22.1	22.7	22.0				
pH	6.6															
alkalinity	60															
hardness	95															
ammonia	11.0															
conductivity	448															

	3				4				5							
Day	Thursday								Friday				Saturday			
Date	101305								101405				101505			
a/b rep	a		b		a		b		a		b		a		b	
rep	G		H		A		B		C		D					
DO	6.6	6.4	6.8	6.4	7.0	6.4	6.9	6.5	4.8	6.0	4.2	4.8				
Temp °C	22.2	22.0	22.5	22.1	22.1	23.0	23.1	22.4	22.1	22.2	22.0	22.0				

	6				7				8							
Day	Sunday								Monday				Tuesday			
Date	101605								101705				101805			
a/b rep	a		b		a		b		a		b		a		b	
rep	E		F		G		H		A		B					
DO	6.7	5.9	4.2	4.8	6.2	5.8	5.9	5.8	6.5	6.2	6.1	6.0				
Temp °C	22.6	22.9	22.2	22.7	22.7	22.5	22.9	22.6	22.1	22.1	22.7	22.4				

	9				10									
Day	Wednesday								Thursday					
Date	101905								102005					
a/b rep	a		b		a		b		a		b			
rep	C		D		E		F							
DO	6.6	6.2	5.5	5.8	6.7			6.8						
Temp °C	23.0	22.2	22.5	22.7	22.1			22.2						
pH	6.9													
alkalinity	92													
hardness	112													
ammonia	3.69													
conductivity	437													

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Client COR LHWS Site LHC-01-2 Lab # 305292
H₂O Mar Hard Sample Date 100605 Species Info Hyalella
Test Setup 100905 Hyalella introduced 101005 Test End _____
Test Conditions _____

	0				1				2			
Day	Monday				Tuesday				Wednesday			
Date	100905 101005				101005-101105				101205			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.4	6.7	5.1	6.7	6.5	7.1	6.6	7.2	6.9	7.1	7.0	7.1
Temp °C	23.3	23.4	22.9	23.2	23.0	22.8	23.0	22.9	22.7	22.4	22.4	22.3
pH	7.2											
alkalinity	48											
hardness	118											
ammonia	<1.0											
conductivity	206											

	3				4				5			
Day	Thursday				Friday				Saturday			
Date	101305				101405				101505			
a/b rep	a		b		a		b		a		b	
rep	G		H 7.0 ^{ppm}		A		B		C		D	
DO	5.6	6.6	7.0	6.9	7.5	6.9	7.4	6.7	6.9	6.4	7.0	6.3
Temp °C	22.7	22.2	22.5	22.4	21.8	23.0	22.1	23.0	22.6	22.4	23.3	23.0

	6				7				8			
Day	Sunday				Monday				Tuesday			
Date	101605				101705				101805			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	7.2	6.2	7.2	6.4	7.1	6.0	7.0	6.2	7.0	6.0	6.8	5.3
Temp °C	23.0	23.0	23.4	23.2	22.5	22.4	22.4	22.3	22.3	22.1	22.3	22.0

	9				10			
Day	Wednesday				Thursday			
Date	101905				102005			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	6.7	5.6	6.8	6.0	7.0	/	7.3	/
Temp °C	22.5	22.9	22.5	22.9	22.9	/	23.0	/

pH	7.0
alkalinity	78
hardness	112
ammonia	2.05
conductivity	263

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The SeaCrest Group
Louisville, CO

10-day Hyalella Benchsheet

Form #: 110a
Effective: November 2002

Client GEEB LHWIS Site LHC-02-2 Lab # 305292
 H₂O Mod. Hard Sample Date 100605 Species Info Hyal. a
 Test Setup 100905 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2			
Day	Monday								Tuesday			
Date	100905 101005								101005 101105			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.8	6.7	5.5	6.6	6.6	7.2	6.4	7.1	7.1	7.1	7.3	7.0
Temp °C	23.7	23.4	23.4	23.4	23.0	23.0	23.0	23.1	22.6	22.2	22.4	22.3
pH	7.0											
alkalinity	58											
hardness	97											
ammonia	41.0											
conductivity	305											

	3				4				5			
Day	Thursday								Friday			
Date	101305								101405			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	7.0	6.7	6.9	6.6	7.6	6.8	7.6	6.8	7.0	6.5	7.2	6.6
Temp °C	22.3	22.5	22.7	22.7	21.5	22.9	22.2	22.7	22.6	22.1	22.9	22.4

	6				7				8			
Day	Sunday								Monday			
Date	101605								101705			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	6.5	6.1	6.8	6.0	6.9	6.1	6.9	6.3	7.2	6.1	6.6	6.0
Temp °C	22.5	22.6	22.7	22.6	22.4	22.1	22.6	21.3	22.0	22.1	22.6	22.2

	9				10							
Day	Wednesday								Thursday			
Date	101905								102005			
a/b rep	a		b		a		b		a		b	
rep	C		D		E		F		G		H	
DO	6.6	6.1	6.7	6.2	6.1	7.2	7.2	7.2	6.6	6.6	6.0	6.0
Temp °C	22.7	22.2	22.7	23.1	22.6	22.6	22.2	22.2	22.6	22.6	22.2	22.2
pH	7.1											
alkalinity	76											
hardness	98											
ammonia	2.18											
conductivity	292											

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10-day Hyalella Benchsheet

Client UHS Site LHC-R03-2 Lab # 305292
H₂O Mod. Harp Sample Date 10/05 Species Info Hyalella
Test Setup 100905 Hyalella introduced 10/05 Test End _____
Test Conditions _____

	0				1				2			
Day	Monday				Tuesday				Wednesday			
Date	100905 10/10/05				101005 10/11/05				10/12/05			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	6.1	6.8	6.8	6.9	6.8	7.1	6.8	7.3	7.1	7.0	7.1	7.1
Temp °C	22.7	23.0	22.9	23.2	22.8	23.1	23.0	22.9	22.4	22.0	22.4	22.1
pH	6.9											
alkalinity	34											
hardness	115											
ammonia	41.6											
conductivity	318											

	3				4				5			
Day	Thursday				Friday				Saturday			
Date	10/13/05				10/14/05				10/15/05			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	6.7	6.7	6.9	6.8	7.1	6.7	7.1	6.8	6.7	6.5	6.7	6.4
Temp °C	22.4	22.5	22.7	22.4	21.9	22.8	21.9	22.7	22.5	22.4	22.6	22.8

	6				7				8			
Day	Sunday				Monday				Tuesday			
Date	10/16/05				10/17/05				10/18/05			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	7.1	6.3	7.1	6.3	6.7	6.4	6.4	6.4	7.1	5.7	7.1	5.9
Temp °C	22.5	22.3	22.7	22.3	22.9	22.6	22.8	22.7	22.4	22.2	22.5	22.3

	9				10			
Day	Wednesday				Thursday			
Date	10/19/05				10/20/05			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	6.9	6.1	6.9	6.4	7.2		7.2	
Temp °C	23.0	22.7	22.8	22.3	22.7		23.1	

pH	7.1
alkalinity	54
hardness	117
ammonia	2.31
conductivity	298

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The SeaCrest Group
Louisville, CO

10-day Hyalella Benchsheet

Form #: 110a
Effective: November 2002

Client CBR LIWS Site LHC-04-2 Lab # 305292
 H₂O Mod. Hard Sample Date 100605 Species Info Hyal. a.
 Test Setup 100905 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2			
Day	Monday				Tuesday				Wednesday			
Date	100905 101005				101005 101105				101205			
a/b rep	a		b		a		b		a		b	
rep					C		D		E		F	
DO	6.0	6.9	6.1	6.9	6.8	7.0	6.7	7.0	7.0	7.2	6.9	6.9
Temp °C	22.9	23.1	23.2	23.3	22.8	23.0	22.9	22.7	22.3	22.1	22.2	22.0
pH	7.0											
alkalinity	76											
hardness	132											
ammonia	41.0											
conductivity	319											

	3				4				5			
Day	Thursday				Friday				Saturday			
Date	101305				101405				101505			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	6.7	6.5	6.8	6.7	7.3	6.7	7.0	6.2	6.7	6.6	6.8	6.5
Temp °C	22.4	22.4	22.2	22.4	22.8	22.7	22.9	22.8	22.4	22.6	22.6	22.6

	6				7				8			
Day	Sunday				Monday				Tuesday			
Date	101605				101705				101805			
a/b rep	a		b		a		b		a		b	
rep	F		F		G		H		A		b	
DO	5.4	6.2	6.4	5.9	6.5	6.3	7.0	6.5	6.6	5.8	5.3	4.5
Temp °C	22.5	22.6	22.6	22.7	23.1	22.8	23.0	22.8	22.1	22.3	22.5	22.5

	9				10			
Day	Wednesday				Thursday			
Date	101905				102005			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	6.4	5.9	6.5	6.1	7.1	/	7.1	/
Temp °C	23.3	22.4	23.2	22.4	22.6	/	22.8	/
pH	7.0							
alkalinity	41							
hardness	119							
ammonia	2.53							
conductivity	295							

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10-day Hyalella Benchsheet

Client CO2 LHS Site Control Lab # 305292
 H₂O Map Hard Sample Date 101005 Species Info Hyalella
 Test Setup 10005 Hyalella introduced 101005 Test End _____
 Test Conditions _____

	0				1				2			
Day	Monday				Tuesday				Wednesday			
Date	EEHQ 100905 101005				101105				101205			
a/b rep	a		b		a		b		a		b	
rep	A		B		C		D		E		F	
DO	5.4	6.6	5.6	6.8	6.4	7.1	6.7	6.9	7.0	6.8	6.7	6.9
Temp °C	23.7	23.5	23.4	23.5	22.1	22.4	22.2	22.3	22.4	22.0	22.6	22.0
pH	8.0											
alkalinity	89											
hardness	111											
ammonia	41.0											
conductivity	556											

	3				4				5			
Day	Thursday				Friday				Saturday			
Date	101305				101405				101505			
a/b rep	a		b		a		b		a		b	
rep	G		H		A		B		C		D	
DO	5.6	6.3	6.7	6.4	7.2	6.6	6.9	6.6	6.8	6.9	6.7	6.8
Temp °C	22.2	22.3	22.1	22.3	22.3	22.2	23.5	22.7	23.2	23.0	22.8	22.6

	6				7				8			
Day	Sunday				Monday				Tuesday			
Date	101605				101705				101805			
a/b rep	a		b		a		b		a		b	
rep	E		F		G		H		A		B	
DO	7.1	6.3	6.7	6.3	4.0	5.2	4.9	6.2	4.8	6.4	7.0	6.5
Temp °C	22.9	23.0	23.1	23.1	22.8	22.4	23.1	22.6	22.8	22.2	22.2	22.3

	9				10			
Day	Wednesday				Thursday			
Date	101905				102005			
a/b rep	a		b		a		b	
rep	C		D		E		F	
DO	6.6	6.1	6.7	6.3	7.3		7.4	
Temp °C	22.4	23.0	22.8	22.3	22.1		22.4	
pH	7.9							
alkalinity	163							
hardness	136							
ammonia	41.0							
conductivity	533							

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APPENDIX 7 – TEMPERATURE READINGS

Incubator 1 Temperature Record

Incubator #: 1		Incubator Make: Dept. of Ag		Incubator Model: PC678	
Acceptable Temperature Range: 24-26°C		Acceptable Light Range: 50-100 foot candles			
NIST Correction:		Date of NIST Correction:			
Date:		Initials:		Light Meter Reading Top:	
Light Meter Reading Middle:		Light Meter Reading Bottom:			
Date	Temperature	Initials	Maintenance	Notes	
062005	25.3	HG			
062105	24.9	HG			
062205	25.0	HG			
062305	24.5	HG			
062405	24.8	HG			
062505	24.6	D			
062605	25.5	D			
062705	25.6	rpm			
062805	25.7	HG			
062905	25.7	HG			
063005	25.4	HG			
070105	25.3	HG			
070205	25.5	HG			
070305	25.3	D			
070405	25.7	rpm	TURNED DOWN		
070505	23.0	D	TURNED UP		
070605	23.3	HG			
070705	22.9	rpm	TURNED UP	REPLACED ALL BULBS	
070805	25.7	HG			
070905	25.6	HG			
071005	25.4	D			
071105	25.5	rpm			
071205	25.5	HG			
071305	25.5	rpm			
071405	25.6	HG			
071505	25.6	HG			
071605	25.3	HG			
071705	25.5	D			
071805	25.8	rpm			
071905	25.7	rpm			

Incubator 1 Temperature Record

Incubator #: 1				
Incubator Make: Dept. of Ag			Incubator Model: PC678	
Acceptable Temperature Range: 24-26°C			Acceptable Light Range: 50-100 foot candles	
NIST Correction:			Date of NIST Correction:	
Date:		Initials:	Light Meter Reading Top:	
Light Meter Reading Middle:			Light Meter Reading Bottom:	
Date	Temperature	Initials	Maintenance	Notes
072005	25.5	HG		
072105	25.2	HG		
072205	25.0	HG		
072305	25.2	HG		
072405	25.4	SP		
072505	25.7	D		
072605	25.9	D	turned ↓	
072805	25.0	D		
073005	25.4	HG		
073105	25.3	SP		
073205	25.0	D		
080205	25.6	HG		
080305	25.7	HG		
080405	25.4	HG		
080505	25.4	HG		
080605	25.7	HG		
080705	25.6	SP		
080805	25.7	SP		
080905	25.4	HG		
081005	25.7	HG		
081105	25.4	HG		
081205	25.2	TM		
081305	25.5	HG		
081405	25.3	D		
081505	25.3	TM		
081605	26.9	HG		
081705	26.6	HG		
081805	26.8	HG	turned down	
081905	26.6	HG		
082005	24.5	HG		

073105
DS

Incubator 1 Temperature Record

Incubator #: 1				
Incubator Make: Dept. of Ag			Incubator Model: PC678	
Acceptable Temperature Range: 24-26°C			Acceptable Light Range: 50-100 foot candles	
NIST Correction:			Date of NIST Correction:	
Date:		Initials:	Light Meter Reading Top:	
Light Meter Reading Middle:			Light Meter Reading Bottom:	
Date	Temperature	Initials	Maintenance	Notes
092005	24.3	HW		
092105	24.7	HW		
092205	24.6	TM		
092305	24.6	HW		
092405	25.1	∅		
092505	24.3	HW		
092505	24.5	HW		
092705	24.8	HW		
092805	24.5	HW		
092905	24.3	HW		
093005	24.8	HG		
100105	24.3	AC		
100205	24.4	HW		
100305	24.4	HW		
100405	24.4	HW		
100505	24.3	HW		(switched to acute)
100605	20.1	HW		
100705	19.1	AC		
100805	20.1	HG		
100905	19.3	HW		
101005	19.2	HW		
101105	19.0	HW		
101205	19.4	HW		
101305	19.3	HW		
101405	19.9	HG		
101505	19.6	AC		
101605	19.3	HW		
101705	19.4	HW		
101805	19.3	HW		
101905	19.4	HW		

Incubator 2 Temperature Record

Incubator #: 2		Incubator Make: Precision Scientific Inc			Incubator Model: 818	
Acceptable Temperature Range: 24-26°C		Acceptable Light Range: 50-100 foot candles				
NIST Correction:			Date of NIST Correction:			
Date:		Initials:		Light Meter Reading Top:		
Light Meter Reading Middle:			Light Meter Reading Bottom:			
Date	Temperature	Initials	Maintenance	Notes		
121804	25.0	rpm				
121904	25.1	SP				
122004	25.0	SP				
122104	25.0	rpm				
122204	25.5	SP				
122304	25.7	SP				
122404	25.2	rpm				
122604	25.3	rpm				
122704	25.1	SP				
122804	25.3	SP				
122904	25.3	SP				
12304	25.2	rpm				
123104	25.4	rpm				
010104	24.5	SP				
010204	24.7	SP				
010304	24.5	SP				
010405	24.6	rpm				
010505	24.6	rpm				
010605	25.0	AD				
010705	25.2	rpm				
010805	25.0	rpm				
010905	25.4	AD				
011005	25.6	AD				
011105	26.8	rpm				
011205	25.2	rpm				
011305	25.2	rpm				
011405	25.4	rpm				
011505	25.0	rpm				
011605	25.1	AD				
011705	25.2	AD				
011805	25.5	rpm				
011905	25.7	rpm				
012005	25.1	rpm				

APPENDIX 8 – DRY WEIGHT DETERMINATIONS AND STATISTICS

Date of water sampling: 07/19/2005

Species: *Hyalolella azteca*

Facility: SeaCrest Group

Test: 10 Day

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-R01	a	8	1.1320	1.1339	1.9000	0.24
	b	7	1.1365	1.1390	2.5000	0.36
	c	6	1.1371	1.1395	2.4000	0.40
	d	10	1.1349	1.1362	1.3000	0.13
	e	8	1.1612	1.1630	1.8000	0.23
	f	8	1.1333	1.1352	1.9000	0.24
	g	10	1.1655	1.1674	1.9000	0.19
	h	7	1.1475	1.1498	2.3000	0.33
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-02	a	0				
	b	1	1.1409	1.1410	0.10	0.10
	c	0				
	d	0				
	e	1	1.1378	1.1379	0.10	0.10
	f	0				
	g	0				
	h	0				
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-03	a	0				
	b	0				
	c	0				
	d	0				
	e	0				
	f	0				
	g	1	1.1326	1.1327	0.10	0.10
	h	0				

Date of water sampling: 07/19/2005

Species: *Hyalalea azteca*

Facility: SeaCrest Group

Test: 10 Day

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-01	a	4	1.1387	1.1393	0.60	0.15
	b	4	1.1377	1.1385	0.80	0.20
	c	4	1.1376	1.1390	1.40	0.35
	d	3	1.1345	1.1358	1.30	0.43
	e	4	1.1368	1.1382	1.40	0.35
	f	2	1.1354	1.1360	0.60	0.30
	g	6	1.1398	1.1416	1.80	0.30
	h	2	1.1429	1.1440	1.10	0.55
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-02	a	2	1.1440	1.1444	0.40	0.20
	b	4	1.1352	1.1361	0.90	0.23
	c	3	1.1438	1.1445	0.70	0.23
	d	5	1.1647	1.1657	1.00	0.20
	e	5	1.1413	1.1422	0.90	0.18
	f	2	1.1402	1.1409	0.70	0.35
	g	4	1.1354	1.1359	0.50	0.12
	h	7	1.1348	1.1358	1.00	0.14
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-R03	a	6	1.1327	1.1341	1.4000	0.23
	b	7	1.1331	1.1355	2.4000	0.34
	c	6	1.1430	1.1447	1.7000	0.28
	d	9	1.1324	1.1333	0.9000	0.10
	e	7	1.1482	1.1499	1.7000	0.24
	f	5	1.1465	1.1479	1.4000	0.28
	g	8	1.1450	1.1477	2.7000	0.34
	h	8	1.1587	1.1599	1.2000	0.15

Date of water sampling: 07/19/2005						
Species: <i>Hyalloëla azteca</i>						
Facility: SeaCrest Group						
Test: 10 Day						
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-04	a	0				
	b	0				
	c	0				
	d	0				
	e	3	1.1327	1.1330	0.30	0.10
	f	0				
	g	0				
	h	0				
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
Sediment Control	a	9	1.1543	1.1555	1.20	0.13
	b	8	1.1666	1.1678	1.20	0.15
	c	10	1.1597	1.1610	1.30	0.13
	d	8	1.1456	1.1466	1.00	0.13
	e	7	1.1337	1.1348	1.10	0.16
	f	10	1.1494	1.1502	0.80	0.08
	g	10	1.1358	1.1369	1.10	0.11
	h	7	1.1498	1.1512	1.40	0.20
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
Pre-Treated	X	40	1.1517	1.1547	3.00	0.08

Title: LWTS-071905

File: LWTS0705SURV

Transform:

NO TRANSFORMATION

Anderson - Darling Test for Normality

A = 1.1980 (p-value < 0.005)
A* = 1.2126

Critical A* = 1.035 (alpha = 0.01 , N = 64)
A* = 0.752 (alpha = 0.05 , N = 64)

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: LWTS-071905

File: LWTS0705SURV

Transform:

NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 20.0417

(p-value = 0.0055)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

Critical B = 18.4753 (alpha = 0.01, df = 7)

= 14.0671 (alpha = 0.05, df = 7)

Title: LWTS-071905

File: LWTS0705SURV

Transform:

NO TRANSFORMATION

Steel's Many-One Rank Test

-

Ho: Control < Treatment

GROUP	IDENTIFICATION	MEAN IN ORIGINAL UNITS	RANK SUM	CRIT. VALUE	DF	SIG 0.05
1	control	0.8625				
2	LJC-R01	0.8000	60.00	45.00	8.00	
3	LJC-02	0.0250	36.00	45.00	8.00	*
4	LJC-03	0.0125	36.00	45.00	8.00	*
5	LHC-01	0.3625	36.00	45.00	8.00	*
6	LHC-02	0.4000	37.00	45.00	8.00	*
7	LHC-R03	0.7000	48.50	45.00	8.00	
8	LHC-04	0.0375	36.00	45.00	8.00	*

Critical values are 1 tailed (k = 7)

Title: LHWS-SEDIMENT-071905 ~~Growth~~
File: SEDIMENT0705 Transform: NO TRANSFORMATION

Anderson - Darling Test for Normality

A = 2.3688 (p-value < 0.005)
A* = 2.3979

Critical A* = 1.035 (alpha = 0.01 , N = 64)
A* = 0.752 (alpha = 0.05 , N = 64)

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: LHWS-SEDIMENT-071905

File: SEDIMENT0705

Transform:

NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 22.6114

(p-value = 0.0020)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

Critical B = 18.4753 (alpha = 0.01, df = 7)

= 14.0671 (alpha = 0.05, df = 7)

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	8	0.0800	0.2000	0.1363
2	LJC-R01	8	0.1300	0.4000	0.2650
3	LJC-02	8	0.0000	0.1000	0.0250
4	LJC-03	8	0.0000	0.1000	0.0125
5	LHC-01	8	0.1500	0.5500	0.3288
6	LHC-02	8	0.1200	0.3500	0.2063
7	LHC-R03	8	0.1000	0.3400	0.2450
8	LHC-04	8	0.0000	0.1000	0.0125

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	0.0013	0.0354	0.0125	26.0044
2	LJC-R01	0.0083	0.0909	0.0321	34.2901
3	LJC-02	0.0021	0.0463	0.0164	185.1640
4	LJC-03	0.0013	0.0354	0.0125	282.8427
5	LHC-01	0.0158	0.1255	0.0444	38.1811
6	LHC-02	0.0049	0.0701	0.0248	33.9827
7	LHC-R03	0.0073	0.0852	0.0301	34.7710
8	LHC-04	0.0013	0.0354	0.0125	282.8427

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

Transform:

NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	7	0.8870	0.1267	24.0889
Within (Error)	56	0.2946	0.0053	
Total	63	1.1815		

(p-value = 0.0000)

Critical F = 2.9768 (alpha = 0.01, df = 7,56)

= 2.1782 (alpha = 0.05, df = 7,56)

Since $F > \text{Critical F}$ REJECT H_0 : All equal (alpha = 0.05)

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

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
1	CONTROL	0.1363	0.1363		
2	LJC-R01	0.2650	0.2650	-3.5504	
3	LJC-02	0.0250	0.0250	3.0679	*
4	LJC-03	0.0125	0.0125	3.4126	*
5	LHC-01	0.3288	0.3288	-5.3084	
6	LHC-02	0.2063	0.2063	-1.9303	
7	LHC-R03	0.2450	0.2450	-2.9989	
8	LHC-04	0.0125	0.0125	3.4126	*

Dunnett critical value = 2.4200 (1 Tailed, alpha = 0.05, df [used] = 7,40)
(Actual df = 7,56)

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

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	CONTROL	8			
2	LJC-R01	8	0.0878	64.4	-0.1288
3	LJC-02	8	0.0878	64.4	0.1113
4	LJC-03	8	0.0878	64.4	0.1238
5	LHC-01	8	0.0878	64.4	-0.1925
6	LHC-02	8	0.0878	64.4	-0.0700
7	LHC-R03	8	0.0878	64.4	-0.1088
8	LHC-04	8	0.0878	64.4	0.1238

Title: LHWS-SEDIMENT-071905

File: SEDIMENT0705

Transform:

NO TRANSFORMATION

Steel's Many-One Rank Test

-

Ho: Control < Treatment

GROUP	IDENTIFICATION	MEAN IN ORIGINAL UNITS	RANK SUM	CRIT. VALUE	DF	SIG 0.05
1	CONTROL	0.1363				
2	LJC-R01	0.2650	94.50	45.00	8.00	
3	LJC-02	0.0250	38.00	45.00	8.00	*
4	LJC-03	0.0125	37.00	45.00	8.00	*
5	LHC-01	0.3288	97.00	45.00	8.00	
6	LHC-02	0.2063	89.00	45.00	8.00	
7	LHC-R03	0.2450	90.50	45.00	8.00	
8	LHC-04	0.0125	37.00	45.00	8.00	*

Critical values are 1 tailed (k = 7)

Date of water sampling: 4/06/2005

Species: *Hyalloa azteca*

Facility: SeaCrest Group

Test: 10 Day

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-R01-02	a	6	1.1358	1.1369	1.1000	0.18
	b	6	1.1378	1.1393	1.5000	0.25
	c	7	1.1372	1.1389	1.7000	0.24
	d	9	1.1397	1.1412	1.5000	0.17
	e	6	1.1485	1.1498	1.3000	0.22
	f	6	1.1301	1.1321	2.0000	0.33
	g	8	1.1341	1.1368	2.7000	0.34
	h	8	1.1432	1.1458	2.6000	0.32

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-02-2	a	8	1.1442	1.1456	1.40	0.17
	b	5	1.1505	1.1522	1.70	0.34
	c	8	1.1539	1.1553	1.40	0.18
	d	5	1.1417	1.1436	1.90	0.38
	e	7	1.1371	1.1392	2.10	0.30
	f	8	1.1483	1.1499	1.60	0.20
	g	6	1.1275	1.1292	1.70	0.28
	h	5	1.1358	1.1379	2.10	0.42

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LJC-03-2	a	8	1.1357	1.1360	0.30	0.04
	b	8	1.1531	1.1533	0.20	0.02
	c	7	1.1459	1.1463	0.40	0.06
	d	6	1.1471	1.1473	0.20	0.03
	e	10	1.1296	1.1303	0.70	0.07
	f	6	1.1369	1.1378	0.90	0.15
	g	9	1.1436	1.1445	0.90	0.10
	h	4	1.1412	1.1418	0.60	0.15

Date of water sampling: 10/06/2005

Species: *Hyallolela azteca*

Facility: SeaCrest Group

Test: 10 Day

Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-01-2	a	9	1.1299	1.1314	1.50	0.17
	b	5	1.1381	1.1399	1.80	0.36
	c	6	1.1433	1.1452	1.90	0.32
	d	5	1.1443	1.1459	1.60	0.32
	e	5	1.1409	1.1422	1.30	0.26
	f	6	1.1239	1.1253	1.40	0.23
	g	7	1.1315	1.1330	1.50	0.21
	h	7	1.1276	1.1290	1.40	0.20
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-02-2	a	8	1.1453	1.1457	0.40	0.05
	b	5	1.1438	1.1442	0.40	0.08
	c	2	1.1394	1.1399	0.50	0.25
	d	6	1.1359	1.1365	0.60	0.10
	e	5	1.1464	1.1470	0.60	0.12
	f	3	1.1483	1.1488	0.50	0.17
	g	6	1.1436	1.1441	0.50	0.08
	h	8	1.1434	1.1440	0.60	0.07
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-R03-2	a	8	1.1358	1.1375	1.7000	0.21
	b	8	1.1396	1.1409	1.3000	0.16
	c	7	1.1402	1.1428	2.6000	0.37
	d	9	1.1377	1.1394	1.7000	0.19
	e	10	1.1398	1.1421	2.3000	0.23
	f	8	1.1500	1.1516	1.6000	0.20
	g	8	1.1299	1.1318	1.9000	0.24
	h	8	1.1366	1.1383	1.7000	0.21

Date of water sampling: 10/06/2005						
Species: <i>Hyalloea azteca</i>						
Facility: SeaCrest Group						
Test: 10 Day						
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
LHC-04-2	a	1	1.1379	1.1383	0.40	0.40
	b	2	1.1426	1.1431	0.50	0.25
	c	0				
	d	0				
	e	1	1.1331	1.1336	0.50	0.50
	f	0				
	g	1	1.1397	1.1399	0.20	0.20
	h	0				
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
Sediment Control	a	8	1.1458	1.1490	3.20	0.40
	b	8	1.1306	1.1338	3.20	0.40
	c	9	1.1454	1.1482	2.80	0.31
	d	8	1.1446	1.1469	2.30	0.29
	e	6	1.1442	1.1468	2.60	0.43
	f	7	1.1403	1.1428	2.50	0.36
	g	9	1.1364	1.1389	2.50	0.28
	h	10	1.1501	1.1525	2.40	0.24
Treatment	Rep	Surviving	Pan Weight(g)	Pan + Larvae(g)	Dry Weight(mg)	
					Total	Individual
Pre-Treated	X	40	1.1419	1.1461	4.20	0.11

Title: LWTS-100605

File: 100605SURV

Transform:

NO TRANSFORMATION

Anderson - Darling Test for Normality

A = 0.4387 (p-value = 0.2885)
A* = 0.4441

Critical A* = 1.035 (alpha = 0.01 , N = 64)
A* = 0.752 (alpha = 0.05 , N = 64)

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

Title: LWTS-100605

File: 100605SURV

Transform:

NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 10.9097

(p-value = 0.1426)

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

Critical B = 18.4753 (alpha = 0.01, df = 7)

= 14.0671 (alpha = 0.05, df = 7)

Title: LWTS-100605
 File: 100605SURV Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	8	0.6000	1.0000	0.8125
2	LJC-R01-02	8	0.6000	0.9000	0.7000
3	LJC-02-2	8	0.5000	0.8000	0.6500
4	LJC-03-2	8	0.4000	1.0000	0.7250
5	LHC-01-2	8	0.5000	0.9000	0.6250
6	LHC-02-2	8	0.2000	0.8000	0.5375
7	LHC-R03-2	8	0.7000	1.0000	0.8250
8	LHC-04-2	8	0.0000	0.2000	0.0625

Title: LWTS-100605
 File: 100605SURV Transform: NO TRANSFORMATION

Summary Statistics on Data TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	0.0155	0.1246	0.0441	15.3406
2	LJC-R01-02	0.0143	0.1195	0.0423	17.0747
3	LJC-02-2	0.0200	0.1414	0.0500	21.7571
4	LJC-03-2	0.0364	0.1909	0.0675	26.3259
5	LHC-01-2	0.0193	0.1389	0.0491	22.2197
6	LHC-02-2	0.0455	0.2134	0.0754	39.7006
7	LHC-R03-2	0.0079	0.0886	0.0313	10.7443
8	LHC-04-2	0.0055	0.0744	0.0263	119.0438

Title: LWTS-100605

File: 100605SURV

Transform:

NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	7	3.3198	0.4743	23.0695
Within (Error)	56	1.1512	0.0206	
Total	63	4.4711		

(p-value = 0.0000)

Critical F = 2.9768 (alpha = 0.01, df = 7,56)
= 2.1782 (alpha = 0.05, df = 7,56)

Since $F > \text{Critical F}$ REJECT H_0 : All equal (alpha = 0.05)

Title: LWTS-100605
 File: 100605SURV ~~Surv~~ Surv 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	CONTROL	0.8125	0.8125		
2	LJC-R01-02	0.7000	0.7000	1.5692	
3	LJC-02-2	0.6500	0.6500	2.2667	
4	LJC-03-2	0.7250	0.7250	1.2205	
5	LHC-01-2	0.6250	0.6250	2.6154	*
6	LHC-02-2	0.5375	0.5375	3.8359	*
7	LHC-R03-2	0.8250	0.8250	-0.1744	
8	LHC-04-2	0.0625	0.0625	10.4617	*

Dunnett critical value = 2.4200 (1 Tailed, alpha = 0.05, df [used] = 7,40)
 (Actual df = 7,56)

Title: LWTS-100605
 File: 100605SURV 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	CONTROL	8			
2	LJC-R01-02	8	0.1735	21.4	0.1125
3	LJC-02-2	8	0.1735	21.4	0.1625
4	LJC-03-2	8	0.1735	21.4	0.0875
5	LHC-01-2	8	0.1735	21.4	0.1875
6	LHC-02-2	8	0.1735	21.4	0.2750
7	LHC-R03-2	8	0.1735	21.4	-0.0125
8	LHC-04-2	8	0.1735	21.4	0.7500

Title: LHWS-SEDIMENT-100605 - Growth
File: SEDIMENT1005 Transform: NO TRANSFORMATION

Anderson - Darling Test for Normality

A = 0.6719 (p-value = 0.0794)
A* = 0.6801

Critical A* = 1.035 (alpha = 0.01 , N = 64)
A* = 0.752 (alpha = 0.05 , N = 64)

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

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

Transform:

NO TRANSFORMATION

Bartlett's Test for Homogeneity of Variance

Calculated B1 statistic = 23.6330

(p-value = 0.0013)

Data FAIL B1 homogeneity test at 0.01 level. Try another transformation.

Critical B = 18.4753 (alpha = 0.01, df = 7)

= 14.0671 (alpha = 0.05, df = 7)

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 1 of 2

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	CONTROL	8	0.2400	0.4300	0.3388
2	LJC-R01-02	8	0.1700	0.3400	0.2562
3	LJC-02-2	8	0.1700	0.4200	0.2838
4	LJC-03-2	8	0.0200	0.1500	0.0775
5	LHC-01-2	8	0.1700	0.3600	0.2588
6	LHC-02-2	8	0.0500	0.2500	0.1150
7	LHC-R03-2	8	0.1600	0.3700	0.2263
8	LHC-04-2	8	0.0000	0.5000	0.1688

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

Transform:

NO TRANSFORMATION

Summary Statistics on Data

TABLE 2 of 2

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	CONTROL	0.0047	0.0683	0.0242	20.1726
2	LJC-R01-02	0.0045	0.0670	0.0237	26.1316
3	LJC-02-2	0.0089	0.0941	0.0333	33.1640
4	LJC-03-2	0.0026	0.0512	0.0181	66.0644
5	LHC-01-2	0.0046	0.0679	0.0240	26.2475
6	LHC-02-2	0.0043	0.0657	0.0232	57.1158
7	LHC-R03-2	0.0040	0.0630	0.0223	27.8476
8	LHC-04-2	0.0407	0.2017	0.0713	119.5065

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

Transform:

NO TRANSFORMATION

ANOVA Table

SOURCE	DF	SS	MS	F
Between	7	0.4386	0.0627	6.7558
Within (Error)	56	0.5194	0.0093	
Total	63	0.9580		

(p-value = 0.0000)

Critical F = 2.9768 (alpha = 0.01, df = 7,56)
= 2.1782 (alpha = 0.05, df = 7,56)

Since $F > \text{Critical F}$ REJECT H_0 : All equal (alpha = 0.05)

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

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	CONTROL	0.3388	0.3388		
2	LJC-R01-02	0.2562	0.2562	1.7133	
3	LJC-02-2	0.2838	0.2838	1.1422	
4	LJC-03-2	0.0775	0.0775	5.4255	*
5	LHC-01-2	0.2588	0.2588	1.6614	
6	LHC-02-2	0.1150	0.1150	4.6467	*
7	LHC-R03-2	0.2263	0.2263	2.3363	
8	LHC-04-2	0.1688	0.1688	3.5305	*

Dunnett critical value = 2.4200 (1 Tailed, alpha = 0.05, df [used] = 7,40)
(Actual df = 7,56)

Title: LHWS-SEDIMENT-100605

File: SEDIMENT1005

Transform:

NO TRANSFORMATION

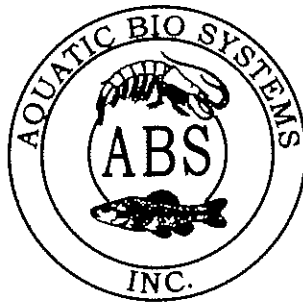
Dunnett's Test - TABLE 2 OF 2

Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	CONTROL	8			
2	LJC-R01-02	8	0.1165	34.4	0.0825
3	LJC-02-2	8	0.1165	34.4	0.0550
4	LJC-03-2	8	0.1165	34.4	0.2613
5	LHC-01-2	8	0.1165	34.4	0.0800
6	LHC-02-2	8	0.1165	34.4	0.2238
7	LHC-R03-2	8	0.1165	34.4	0.1125
8	LHC-04-2	8	0.1165	34.4	0.1700

APPENDIX 9 – QA/QC

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524



Toll Free: 800/331-5916
Tel: 970/484-5091 Fax: 970/484-2514

ORGANISM HISTORY

DATE: 7/21/05

SPECIES: Hyaella azteca

AGE: 7-10 day

LIFE STAGE: Juvenile

HATCH DATE: Variable

BEGAN FEEDING: Immediately

FOOD: Flake slurry

received
07/21/05 - 1115 H₉

DO - 7.0
pH - 7.5
Temp - 24.7°C

Water Chemistry Record:

	Current	Range
TEMPERATURE:	<u>24°C</u>	<u>22-25°C</u>
SALINITY/CONDUCTIVITY:	<u>--</u>	<u>--</u>
TOTAL HARDNESS (as CaCO ₃):	<u>100 mg/l</u>	<u>82-218 mg/l</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>50 mg/l</u>	<u>50-130 mg/l</u>
pH:	<u>7.05</u>	<u>7.02-7.90</u>

Comments:

Facility Supervisor

***** Version 2.5 *****

Results calculated using the Summary Method.

```

Sponsor           :                LHWS
Species           :                H.AZTECA
Study Number      :                072105
Dates of test     :    072105 to    072505
Test Material     :                KCL
Concentration Units :            MG/L
Report run by     :                CW
Date of report    :                04-03-2006
    
```

Concentration (MG/L)	Number Exposed	Number Dead	Percent Dead	Corrected Number Dead	Corrected Percent Dead
500.0	10	10	100.0	10	100.0
250.0	10	6	60.0	6	60.0
125.0	10	3	30.0	2	20.0
62.5	10	2	20.0	1	10.0
31.3	10	0	0.0	0	0.0
Control	10	1	10.0	0	0.0

Method	W	LC50	95% Confidence Limits		Slope
			Lower	Upper	
Results NOT corrected for Spontaneous Mortality					
Binomial		198.98	31.25	500.00	--N/A--
Moving Average		154.42	113.03	222.81	--N/A--
Probit		162.95	112.33	243.26	3.01
Logit		173.83	111.09	358.76	3.93

Results corrected for Spontaneous Mortality					
Binomial		211.66	62.50	500.00	--N/A--
Moving Average		174.69	128.09	259.76	--N/A--
Probit		185.59	132.10	266.22	3.65
Logit		196.30	130.39	371.08	4.64

Note -- In order to produce this summary report, no warning or diagnostic messages were given (if any occurred). An asterisk appearing next to the method indicates that there was a warning associated with the corresponding method. You should run the full report for this method to determine the problem.

Purpose: LHWS Salt Used: 500 mg/L KCl Date Made: 072105
 Dilution Series: 50% Template #: 7 Dilution Water: MH
 Name, age & source: H. AZTECA, 7-10 d, ABS Test Start: 072105-1000 Test End: 072505-1100
 Test Conditions:

	0	24	48	72	96
(C)	/	/	/	/	/
0	/	/	/	0	0
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
DO	7.0	5.3	5.3	4.1	5.8
Temp	24.0	24.0	24.8	25.1	24.1
pH	8.1	7.3	7.2	7.4	7.4
Cond	325				
(1)	/	/	/	/	/
325	/	/	/	/	/
mg/L	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
DO	7.0	6.3	5.4	4.1	4.1
Temp	24.0	24.0	25.0	25.2	23.6
pH	8.1	7.3	7.4	7.4	7.3
Cond	434				
(2)	/	/	0	0	0
625	/	/	/	/	/
mg/L	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
DO	6.9	6.5	5.6	4.5	4.4
Temp	24.0	24.1	25.0	25.0	23.6
pH	8.1	7.6	7.4	7.4	7.4
Cond	552				
Initials	D	HW	D	D	

	0	1	2	3	4
(3)	/	/	/	/	0
125	/	/	/	/	/
mg/L	/	/	/	/	/
	/	/	/	/	/
	/	/	0	0	0
	/	/	/	/	/
	/	/	/	/	/
	/	/	/	/	/
DO	6.9	5.7	5.6	4.2	4.5
Temp	23.9	24.0	24.9	24.7	23.8
pH	8.1	7.5	7.4	7.4	7.5
Cond	787				
(4)	/	/	0	0	0
250	/	/	/	0	0
mg/L	/	/	/	0	0
	/	/	/	/	/
	/	0	0	0	0
	/	0	0	0	0
	/	/	/	/	/
	/	/	/	/	/
DO	6.9	6.3	5.4	4.0	4.2
Temp	23.9	24.0	24.9	24.8	24.0
pH	8.1	7.5	7.4	7.3	7.4
Cond	1076				
(5)	/	0	0	0	0
500	/	0	0	0	0
mg/L	/	0	0	0	0
	/	0	0	0	0
	/	0	0	0	0
	/	0	0	0	0
	/	0	0	0	0
DO	6.8	6.0			
Temp	23.9	24.0			
pH	8.1	7.4			
Cond	1288				
food	Y	-	Y	-	-

	Reftox1	Reftox2	Recon #1	Recon #2
Hardness				
Alkalinity				
Chlorine				
Ammonia				

1. Exposure Chamber
 Total Capacity: 30 ml
 Test Solution Surface Area: cm²
 Test Solution Volume: 15 ml
 Water Depth (constant): cm
 (cyclic): to cm

3. Aeration
 Slow: _____
 Med: _____
 Fast: _____

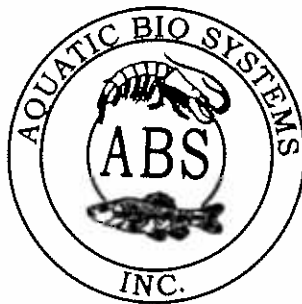
2. Feeding Schedule
 Not fed: _____ Fed Daily: _____
 Fed Irregularly: 0 & 48 hours Food Used: YCT + Flake Slurry

4. Screened Animal Enclosers
 Not Used: X Used: _____ cm diameter

5. Condition/appearance of surviving organisms at end of test (i.e., alive but immobile; loss of orientation; erratic movement; etc.):

6. Comments: _____

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Fort Collins, Colorado 80524



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Tel: 970/484-5091 Fax: 970/484-2514

ORGANISM HISTORY

DATE: 10/11/05
SPECIES: Hyaella azteca
AGE: 7-9 day
LIFE STAGE: Juveniles
HATCH DATE: Variable
BEGAN FEEDING: Immediately
FOOD: Flake slurry

DO: 6.1
pH: 7.3
temp: 22.3

received
10/11/05 - HG

Water Chemistry Record:

	Current	Range
TEMPERATURE:	<u>24°C</u>	<u>22-25°C</u>
SALINITY/CONDUCTIVITY:	<u>-</u>	<u>-</u>
TOTAL HARDNESS (as CaCO ₃):	<u>168 mg/l</u>	<u>82-198 mg/l</u>
TOTAL ALKALINITY (as CaCO ₃):	<u>75 mg/l</u>	<u>45-130 mg/l</u>
pH:	<u>7.36</u>	<u>7.02-7.90</u>

Comments:

Facility Supervisor

***** Version 2.5 *****

Results calculated using the Summary Method.

```

Sponsor           :                LHWS
Species           :                H.AZTECA
Study Number      :                101205
Dates of test     :    101205 to    101605
Test Material     :                KCL
Concentration Units :            MG/L
Report run by     :                CW
Date of report    :                04-03-2006
    
```

Concentration (MG/L)	Number Exposed	Number Dead	Percent Dead	Corrected Number Dead	Corrected Percent Dead
500.0	10	10	100.0	10	100.0
250.0	10	7	70.0	6	60.0
125.0	10	4	40.0	2	20.0
62.5	10	3	30.0	1	10.0
31.3	10	2	20.0	0	0.0
Control	10	2	20.0	0	0.0

Method	W	LC50	95% Confidence Limits		Slope
			Lower	Upper	
Results NOT corrected for Spontaneous Mortality					
Binomial		157.05	62.50	500.00	--N/A--
Moving Average		117.79	71.64	187.47	--N/A--
Probit		112.80	65.89	185.99	2.04
Logit		123.20	67.26	289.37	2.88

Results corrected for Spontaneous Mortality					
Binomial		211.66	62.50	500.00	--N/A--
Moving Average		174.69	128.09	259.76	--N/A--
Probit		185.59	132.10	266.22	3.65
Logit		196.30	130.39	371.08	4.64

Note -- In order to produce this summary report, no warning or diagnostic messages were given (if any occurred). An asterisk appearing next to the method indicates that there was a warning associated with the corresponding method. You should run the full report for this method to determine the problem.

Purpose: LHW S Salt Used: 500 mg/L KCl Date Made: 10/20/05
 Dilution Series: 50% Template #: 8 Dilution Water: HW
 Name, age & source: H. AZTECA, 7-10 D, ABS Test Start: 10/20/05-1245 Test End: 10/20/05-1245
 Test Conditions:

	0	24	48	72	96
(C)					
0			0		
DO	7.1	5.3	5.6	3.9	4.3
Temp	22.6	22.4	22.1	22.3	22.7
pH	8.0	7.4	7.5	7.1	7.5
Cond	331				
(1)					
31.25 mg/L					
				0	
			0		
DO	7.1	5.3	5.6	4.3	4.5
Temp	22.6	22.6	22.6	22.9	23.0
pH	8.0	7.3	7.5	7.3	7.6
Cond	445				
(2)		0			
62.5 mg/L					
					0
			0		
DO	7.0	6.6	6.4	4.1	5.4
Temp	22.6	22.6	22.8	23.2	23.2
pH	8.1	7.5	7.8	7.2	7.6
Cond	556				
Initials	HW	HW	HG	HG	HW

	0	1	2	3	4
(3)					
125 mg/L		0			
			0		
				0	
DO	7.0	5.8	6.0	4.2	5.1
Temp	22.6	22.7	22.8	23.0	23.3
pH	8.0	7.4	7.7	7.3	7.6
Cond	735				
(4)				0	
250 mg/L		0			
		0			
		0			
		0			
		0			
		0			
		0			
DO	6.9	5.9	5.9	5.9	5.2
Temp	22.4	22.8	22.9	22.9	23.4
pH	8.0	7.4	7.6	7.6	7.5
Cond	1028				
(5)		0			
500 mg/L		0			
		0			
		0			
		0			
		0			
		0			
		0			
DO	6.9	6.4			
Temp	22.2	22.8			
pH	8.1	7.5			
Cond	1244				
food	✓	-	✓	-	-

	Reftox1	Reftox2	Recon #1	Recon #2
Hardness				
Alkalinity				
Chlorine				
Ammonia				

1. Exposure Chamber
 Total Capacity: 30 ml
 Test Solution Surface Area: cm²
 Test Solution Volume: 15 ml
 Water Depth (constant): cm
 (cyclic): to cm

3. Aeration
 Slow: _____
 Med: _____
 Fast: _____

2. Feeding Schedule
 Not fed: _____ Fed Daily: _____
 Fed Irregularly: 0 & 48 hours Food Used: YCT, FLAKE SLURRY

4. Screened Animal Enclosures
 Not Used: X Used: _____ cm diameter

5. Condition/appearance of surviving organisms at end of test (i.e., alive but immobile; loss of orientation; erratic movement; etc.):
ALIVE AND mobile in Control - immobile 7.625% dilution 112

6. Comments: _____